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The Service Economy Revisited*

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Abstract

This article, after a critical appraisal of the main definitions of services in economics, proposes a concept of services based on process analysis. The new concept is used for a constructive purpose, to support a negative argument and to point out some directions of research. The constructive application extends the scope of the Leontief- Von Neumann- Sraffa type models. The negative application denies the existence of a correlation between the expansion of the service activities and an increasing dematerialization of the economy associated with knowledge and information. The final section suggests directions for future research on service outsourcing and unbalanced growth.

JEL: B12, D46, D57, E11, G1, L8, L22, L94, O14

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1. Introduction

In economics, like in other theoretical disciplines, a discussion on concepts and definitions usually derives from the interest in some specific phenomenon under investigation. The discussion on the concept of service has been occasionally resumed by interest in the ongoing structural change of capitalist economies. The partially overlapping notions of “service economy”, “tertiary”, “post-industrial”, “new” economy have been used to characterize the latest stage of capitalist development. A widespread view states that 1) the service sector is displacing the sector of material goods, 2) its expansion is associated with that of non-material (often called promiscuously intangible, unobservable, informative) goods and 3) its role has changed, from being driven by the manufacturing sector, to the status of driving sector. Assuming that the relative importance of services is measured by the service sector’s share of total employment, three main hypotheses have been explored to explain this structural shift of employment: 1) the final demand for services grows more rapidly; 2) the growth of labour productivity in the service sector is relatively slow; 3) the growth of the intermediate demand for services is relatively fast. This range of alternative explanations is still a field of research and it does not seem to be getting any narrower. A debate about problems of such a wide scope, if it has to be proved useful, needs a preliminary consensus on the concept of service.

In this article we present (section 2) a critical appraisal of the main definitions of services. We propose (section 3) a revised notion of services based on modern process analysis representing continuity with Adam Smith’s idea of service. We use the revised concept i) for a constructive analytical purpose, ii) to support a negative argument and iii) to point out a direction for future research. The constructive application (section 4) extends the scope of linear models of the Leontief-Von Neumann- Sraffa type, through the explicit recognition of the special logical position of services versus that of goods. Such an extension is reflected by the form of the price equations and will allow us to determine the price of services besides that of goods. The negative application

(section 5) aims to clarify and strengthen the criticism put forward by those economists who deny the existence of a definite correlation between the expansion of the service activities, *as such*, and an increasing dematerialization of the economy associated with more knowledge creation and information diffusion. The final section (section 6) suggests some directions for future research about the outsourcing of service activities and the tendency towards a new economy characterized by services and intangible goods.

2. Services in economics and contiguous disciplines

2.1 Adam Smith

From the Physiocrats, through Adam Smith and up to the transition to marginalism, represented by John Stuart Mill, the concept of services has been a derivative of the notion of unproductive labour. According to Smith, the basic distinction is not between goods and services, but between productive and unproductive labour, inasmuch as the latter consents the isolation of activities, which lead to the increase of the wealth of nations from others, which, from this point of view, are just a waste. It is necessary to start from this perspective so as to interpret the following celebrated passages of *The Wealth of Nations*:

There is one sort of labour, which adds to the value of the subject upon which it is bestowed: there is another, which has no such effect. The former, as it produces a value, may be called productive; the latter, unproductive labour. Thus the labour of a manufacturer adds, generally, to the value of the materials which he works upon, that of his own maintenance, and of his master's profit. The labour of a menial servant, on the contrary, adds to the value of nothing. (Smith, 1937, Book II, p.314).

.....
The labour of the menial servant, on the contrary, does not fix or realise itself in any particular [permanent] subject or vendible commodity. His services generally perish in the very instant of their performance, and seldom leave any trace of value behind them, for which an equal quantity of services could afterwards be procured. (Smith, 1937, Book II, p. 314-315, [permanent] added)

According to many commentators, the concept of services in Smith is not satisfactory because 1) it implies that the service activities are necessarily unproductive and 2) it would reduce the distinction between goods and services to the material or immaterial content of the outcome of the labour process. As a consequence, services should be defined as a residual category, including all non-material goods and services in our terminology.¹

However, the criticisms addressed to Smith on this issue, starting from Marx (1905), rest upon an unduly restrictive interpretation of the expressions *permanent subject or vendible commodity*, used by Smith himself. Marx' criticism and those coming after him seem to share the idea that a commodity is a material good and that a strict equivalence exists between services and immaterial goods. Instead, as Hill (1999) had emphasized on the one hand, a service should not be identified with an immaterial good and, on the other, a good can be intangible. For instance, industrial designs, software, new medicines and therapies, which are the outcome of R & D and are subjected to intellectual property rights, are not services but intangible goods. For this reason, labour can be a source of growth by fixing itself into an immaterial good, besides into non vendible commodities (in particular, the services for education that fix themselves into people). Consequently, not only the Smithian concept of services, but also the criticism addressed to it appears to be blurred owing to the accepted equivalence of services and intangible goods.

Economic thought has taken different routes after Smith, as regards the distinction between “goods” and “services”. Let us cover them briefly.

2.2 Marginalists

The first route, followed by Walras and Irving Fisher, still prevails. It leads to such an extension of the domain of the concept of service, that it becomes doubtful whether the latter remains a useful analytical category. According to this notion, each good has its own price and a

¹ In this article we adopt the following terminology. The term “commodity” includes material and non-material goods and services; “commodity” *tout court* means “vendible commodity”; instead we write “non vendible commodity” if we need to specify the contrary.

distinct price for its service performed during a certain period of time; instead a worker only receives a price for his service. The wage of a worker, the user cost or rental of a machine, the rate of interest on a loan and the rent on a piece of land are all conceived as a price paid for service (from the worker, from the capital good, from financial capital and from land, respectively), in the same way as the payment received by a menial servant.

Despite the simplicity of this distinction, the content of the examples, which are presented to illustrate the neoclassical theory of prices, usually concern material goods. We find typical examples in two dimensions: butter and cannons or food and clothing. Apparently the analyses of those economic activities, which are called “services” in standard statistical classifications, (commerce, transportation, tourism, banking, insurances, telecommunications, public services, personal services and similar), are left to a different level of abstraction. Services are occasionally mentioned in the textbooks to warn us that they are subjected to some particular difficulty of measurement. For instance, a typical question is “How can the output of a bank be measured?”.

Of course, speaking about the price of a service is meaningless if we do not know the physical unit in which it is measured. However, this difficulty has been attributed to services at an exaggerated extent, without noticing similar difficulties of measurement for certain kinds of goods and for labour in general. We need only to say that information about the nature of goods is often highly incomplete and goods are sold on the market jointly with certain rights and local conventions poorly defined. Furthermore the non-material feature cannot be a source of specific difficulty for the measurement of services, because it may impinge upon some goods as well (non-material goods). The problem of measurement is not the main reason for the precarious theoretical status of services in economic theory after Smith. The difficulty is conceptual.

2.3 Sraffians

Sraffa and those Sraffian economists who have resumed and developed the theory of the Classics, have turned to a different route, closer to Smith. In their approach the concepts of

“productive” and “unproductive” are not associated with pure labour anymore, but with the system of production as a whole, in which labour – “assisted” with other means of production – remains the active factor of production. With reference to a matrix of technical coefficients, it has been proved that the same conditions guarantee a “dual” concept of productivity: in terms of a physical surplus *and* in terms of a surplus value. Yet, the Sraffian approach does not seem to apply the distinction between goods and services, after having absorbed both categories within the general notions of heterogeneous commodities and labour, respectively. The examples of production processes, by means of which Sraffa and the Sraffians present their theory of prices, involve material goods, like corn and steel, and labour. Services are never mentioned explicitly. The same remark applies to the Leontief-Von Neumann type models. Section 4 will deal with the explicit existence of heterogeneous services along classical lines, beyond the “reduction” of heterogeneous labour to homogenous labour.

2.4 A pragmatic view of services

The debate on the distinction between goods and services, while gradually fading away in economic theory, is still alive in fields contiguous to the latter and at a more pragmatic level. Contributors in the fields of national accounting and statistics, labour economics, economic geography, urban science, sociology and development economics, occasionally reconsider the meaning of such a distinction. Their main effort aims to criticize or rationalize certain statistical classifications which group together within the same sector (the service sector) the host of activities mentioned above: commerce, transportation, tourism, banking, insurances, telecommunications, public services, personal services, etc.. Yet, when these contributors, finally propose some new definition of services, they end up usually supplying either a too long or a too short cover for the previously mentioned activities. Let us examine two definitions.

2.4.1 Services according to Hill

Hill proposes the following definition, which has been taken as a reference point by many service economists

A service may be defined as a change in the condition of a person, or of a good belonging to some economic unit, which is brought about as the result of the activity of some other economic unit, with the prior agreement of the former person or economic unit. (Hill, 1977, p.318)

This definition, which seems to cover most of the activities currently called services, encounters some difficulties.

The timing of a service activity

Two arguments underlying the above definition concern the timing of the service: we raise a question about the first one and we agree on the second.

Firstly, let us consider, for instance, two alternative prior stipulations. 1) Exchange agreement: I buy a house, which already exists or will be built in a year, for delivery in a year. 2) Contract agreement: I pay a firm, which will build a house for me on a piece of my land for delivery within a year. In both cases a change in the condition of my person (the state of my property) is brought about as the result of the activity of another agent with prior agreement of both². In the first case I buy a good. In the other case, it is not clear whether I buy a service or a composite commodity that includes goods and services.

Secondly, Hill asserts that a service is distinct from a good *at a logical level*. “*Services cannot be put into stock because a stock of changes is a contradiction in terms. Thus, the fact that services cannot be held in stock is not a physical impossibility, but a logical impossibility*” (Hill, 1977, p.179). We agree with this view. For example, a good available within a year is economically different from a good available now, but a dated good has no time dimension; only its production is a flow-variable. Instead, when I buy *an activity* that fixes itself in the house, I buy something, which

² In some cases a person may be “served” without a prior agreement. This is the case of many *public or collective services* which involve a public agency, public servants and citizens.

possesses a time dimension. If a single worker-entrepreneur should build the house, this conclusion would be true independently of the contractual form of the payment. The salary could be fixed on a time or a piecework basis. In both cases the quantity of service is measured by a flow-variable.

Preventing services

The outcome, which is agreed upon, may be *a not-change*, instead of a change in the condition of a person or of a good belonging to some economic unit as required by that definition. For instance, the maintenance of a machine provided by a firm to another firm “maintains” the machine in a satisfactory state of efficiency and exempts the firm from the inconvenience of repairing a broken machine (of course, repairs change a broken machine into a working machine). Similarly, a person may ask for a service, which maintains certain features of his personal state or of his material belonging unchanged, e.g. preserving his normal health conditions or keeping his goods in normal working conditions; compared to the undesirable change in these elements, which would occur in the absence of the service.

2.4.2 **Gadrey’s definition**

Later contributions have modified Hill’s 1977 definition with the intention of offering a more satisfactory rationale of the statistical definitions of the service activities. In this respect, many interesting contributions can be found in the literature.³ Let us briefly examine the definition of services that Gadrey (2000) has recently proposed. We read:

The economic production of services is reckoned to take place in developed capitalist systems in the following two cases:

- a) *when an organization A, which owns or controls a technical and human capacity (this latter can also be denoted by the term ‘competencies’), sells (or offers without payment in the case of non-market services) to an economic agent B the right to use that capacity and those*

³ See Griliches (1992), Bryson and Daniels (1998), Hill (1999) and Gadrey (2000).

competencies for a certain period in order to produce useful effects on agent B himself or on goods C that he owns or for which he is responsible.

- b) *when a household himself employs a wage earner to look after his goods or his own person (or possibly toward whom he has a duty of care: children, parents...).* (Gadrey, 2000, p. 384)

Despite the stimulating insights offered by the author in his article, part a) of this formulation is questionable. The “*right* to use that capacity and those competencies for a certain period” cannot be a service; this *right* being a non-material entity which can be written in the balance sheet of a firm. Furthermore, if the use itself of that capacity is a service, the use of a capital good is also a service, to the extent that it makes up a capacity which leads us back to the too wide concept of services adopted in the neoclassical tradition.

The difficulties encountered in the previous definitions induce us to conceive the notion of service not as a relation between individuals, but as a relation between processes (production or consumption processes).

3. The logical position of services in the economic process

3.1 The concept of service revised

Let us take the words “things” and “activities” as primitive concepts. A process involves material and immaterial *things* (machines, raw materials, workers, industrial designs etc.) and *activities* (assembling, repairing, communicating, eating, singing etc.), which are related to things. An *economic* process is described by quantities of *commodities*, which include marketable things called goods, and by quantities of *marketable activities*, which will be shortly characterized as *services*. We maintain that labour services are indispensable for any production process.

Assume that we can identify the *independent* production and consumption processes activated during a uniform production-consumption period. An independent process can be run independently from the activation of other processes, if the necessary inputs are available.

Independence implies that alternative processes can supply the same input used by a certain process, otherwise only a single integrated process would be possible, instead of independent (supplier and user) processes.

Two kinds of relations can exist among independent processes. The first kind is the usual *serial* input-output relation in terms of *goods*: the output of a process *at the end* of a production period can be the input of another process in the next period and can restore an inventory of goods used up in the previous period. The other (rather neglected) is a parallel input-output relation: the *activity* brought about by a process can be *an input* of another process *during the same period*. This activity is an output of the provider process and an input of the user process and this is called *service*. Therefore a process, which produces a service, “serves” another process by performing a *function* used by the latter, but it cannot restore an “inventory” of services. This negative feature conforms to one of the specific properties that Hill attributes to services. However, such a feature does not imply that the provider and the user processes are not independent any more. In fact, like in the case of the input of goods, the user process remains independent from the provider process because it can be activated if the needed *function* (e.g. repairs) is available, whatever the technique used to supply such a service and therefore whatever the process that provides the service.

It should also be noted that this concept of service is wider than that of labour service and at the same time it is narrower than the neoclassical catchall concept of service. It is wider because a service generally is an activity, which requires not only labour as input, but also other means of production. It is narrower because it requires labour and cannot be attributed to individual goods.

3.2 A graphical representation

Figure 1 illustrates the distinction between goods and services. It describes an economy in which three processes 1, 2, 3 work during a uniform production-consumption period, say a month, delimited by the dates $t = 1, 2$.

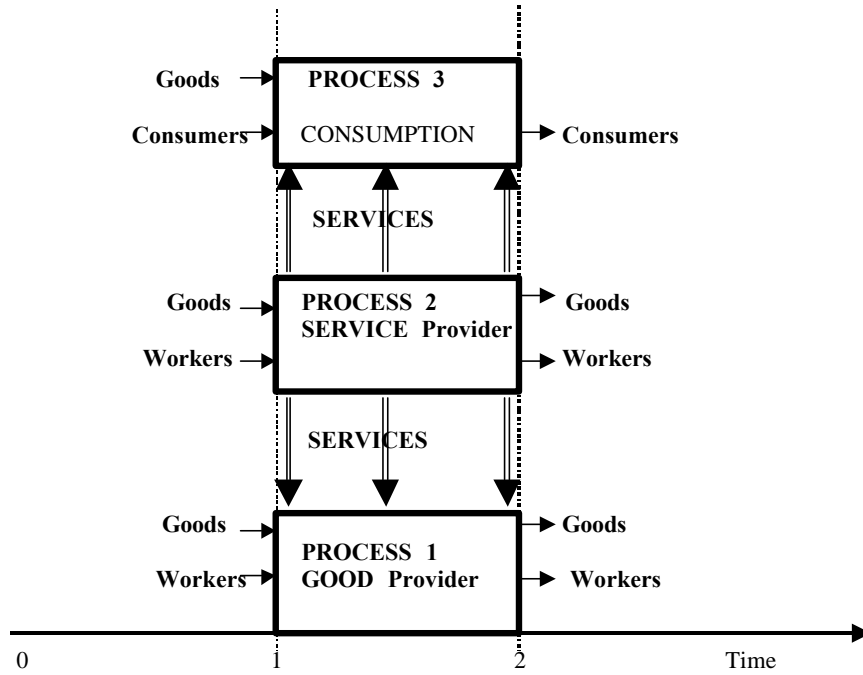


Figure 1

We assume that process 1 produces only goods, process 2 provides services and goods (e.g. used machines) as joint products, and process 3 is an activity of final consumption. Labour services are internal to each production process 1, 2 and are not represented. Many economic models, more or less explicitly, adopt a “black box” representation, but they confine the description to the quantities (inputs and outputs) of goods at times $t = 1, 2$ and to the amount of labour performed *during* the period $[1, 2]$. If we are not concerned with externalities, it is legitimate to neglect all non-vendible elements (workers and consumers in particular). Instead it may not be an innocuous simplification to neglect the existence of services as distinct from pure labour services. In Figure 1 we fill this gap with the oriented flows of services leaving process 2 and entering processes 1, 3. The horizontal and the vertical arrows point out the logical distinction between goods and services. The quantity of a good, despite the fact that it is a dated quantity ($t = 1, 2$), has no time dimension. Instead a service *is a quantity of a certain activity performed during* a period of time.

Notice that the device of the black box exempts us from specifying the distribution of the service activity during the month.⁴ The price paid for the service may depend on such a distribution, according to special conventions and contractual arrangements. We shall come back to this important issue in section 4.6, but a few words are needed at this stage of analysis. Suppose that process 2 supplies electricity. Kilowatts (Kw) are usually the physical measure of the quantity of electricity. This quantity can be measured by the total amount of Kw consumed during the month and its price can be a certain amount of money per Kw. However, quite often the price paid for this utility is set on the basis of a more complicated stipulation. Some characteristics of the *distribution* of the consumption of energy during the period may be taken into account: e.g. the peak value of the consumption or the distribution between day and night consumption. As a consequence, if we adopt the black box model, we should treat certain classes of profiles of the same amount of Kw consumed as amounts of different services with their own prices.

As a result, our approach departs from Hill's (1977) definition of services, but preserves Hill's (1999) distinction: *services are not immaterial goods*. For example, a firm, through its internal R&D activities, can achieve a new industrial design protected by a patent. In this case the firm produces an immaterial good. Alternatively, it can supply a certain R&D activity to another firm during a period of time, without selling any vendible intellectual outcome: in this case the firm acts as a *service* provider. In conclusion, commodities include goods and services, goods can be material or immaterial, but services are not immaterial goods. Services are a distinct economic category. It might seem that a service is still hardly distinguishable from a pure perishable good. This is not the case, because, despite the common feature of not being storable, the latter must first be produced during a certain period before being instantaneously consumed.

There remains the distinction between labour (services) and services (*tout court*). Services are commodities produced by labour and other means of production.

⁴ Georgescu-Roegen adopts a different approach in which such a distribution is fully specified. His analytical representation of the production process in terms of flows and funds is illustrated in many of his publications, like in Georgescu-Roegen (1971).

3.3 Goods and services in process analysis

From the viewpoint of discrete period analysis, a process is usually described by a vector of inputs and outputs of commodities. It is assumed that each production process uses labour as indispensable input and produces at least one commodity. Instead only a vector of inputs characterizes a consumption process, whereas its outcome has a use value but is not a vendible commodity.

With reference to Figure 1, suppose that only three commodities exist: a produced good, a produced service and labour. Let $\mathbf{y}_1, \mathbf{y}_2$ denote the two production processes and \mathbf{y}_3 the consumption process. In this section we adopt the convention that negative and positive quantities denote inputs and outputs, respectively. Then process j ($j = 1,2,3$) over period $[1, 2]$ is described by the row-vector $\mathbf{y}_j = (B_j \quad A_j \quad S_j \quad L_j)$ where

$A_j \leq 0$: Input of the good

$B_j \geq 0$: Output of the good

$S_j \leq 0$, ($j=1, 3$): service input

$S_2 \geq 0$: Service output

$L_j < 0$: labour input.

Since \mathbf{y}_3 is assumed to be a pure consumption process, we replace $B_3 \geq 0$ and $L_3 < 0$ with $B_3 = 0$ and $L_3 \leq 0$.

3.3.1 Services in the price equations

Let us denote the dated (discounted) prices in terms of a given numeraire: $p(t)$ the price of the good; $p_s(t)$ the price of the service; $w(t)$ the wage rate, $t = 1,2$. The inner product $\mathbf{y}_j \mathbf{p}$, where $\mathbf{p} = [p(2), p(1), p_s(1), w(1)]'$ is a column-vector, is the profit on process j . Under perfect

competition the following system of price equations must hold: $\mathbf{y}_j \mathbf{p} = 0$, $j = 1, 2, 3$. It is assumed here that labour and services are paid *ex ante*, i.e. when the period begins. Alternatively, we could write $\mathbf{p} = [p(2), p(1), p_s(2), w(2)]'$, still keeping $\mathbf{y}_j \mathbf{p} = 0$, if the payment of such services is assumed to be made *ex-post*, i.e. at the end of the period. *This change in the payment hypothesis does not imply a change in the different timing of a service versus a good.* For each type of payment, the simultaneous production and use of a service is revealed by the fact that the same time (either t or $t+1$) is associated with the prices of its input and output, whereas the prices of the input and of the output of the good are related to two subsequent times (t and $t+1$). This feature will lead us to a revised formulation of the price equations of well known linear models (section 4).

3.3.2 Services in the quantity equations

Let us define the signs of the total quantities:

$$B_1 + B_2 + B_3 \equiv B \geq 0$$

$$A_1 + A_2 + A_3 \equiv A \leq 0$$

$$S_1 + S_2 + S_3 \equiv S = 0$$

$$L_1 + L_2 + L_3 \equiv L < 0.$$

The strict equality $S = 0$ points out that the product of a pure service activity can be used either for intermediate or for final consumption during the production period, but cannot be accumulated⁵. As $S > 0$ is ruled out, the economy can grow through accumulation only if $B + A > 0$. In this sense accumulation requires that labour *ultimately fixes itself into a material or immaterial* good, whereas services, in the words of Adam Smith, “perish in the very instant of their performance”.

It should be noted that the same type of service could be both an intermediate service and a consumption service, like the same type of good can be used for production or for consumption. Furthermore, in the general case, all production process may exhibit the joint production of goods and services. In this case the theory is unable to distinguish between service processes and goods

⁵ The product might be also wasted under the assumption of free disposal.

processes, although a statistical approach can maintain such a distinction on the basis of some conventional criterion of prevalence.

3.4 The measure of services and the border of the process

We can compare the costs and revenues of service production only if:

- 1) The unit of the service is specified;
- 2) The boundaries of the provider process and of the user process are defined.

Usually 1) and 2) cannot be satisfied by a pure physical criterion, because both the unit of a service, which is fixed in a contractual stipulation, and the boundary of the process depend on the existing social norms. Furthermore requirement 2) raises special difficulties in the case in which an interaction exists between the provider and the user. Some examples may help us to clarify the problem at issue.

In section 4.1 we assume an economy in which land, infested with parasites, has to be periodically disinfested and a service process (provider process) supplies a cultivation process (user process) with a disinfesting service. The quantity of such a service is measured by acres of land disinfested per year. However, the amount of infested land does not appear as an input and neither the disinfested land does appear as an output of the provider process. If we are interested in assessing the profitability of the two processes, the quantity of land, which is yearly disinfested, enters the description of the processes only as a measure of the service. An acre of land without parasites is a unit of a good, but disinfesting one acre of it during a year is a unit of service. In other circumstances we may describe the quantity of a service not by the amount of some commodity affected by the service, like the amount of disinfested land, but by the quantity of some non-vendible commodity, which plays the role of a proxy.

With regard to private education processes, less educated and more educated students should not be included as inputs and outputs of goods, because students are not vendible commodities and learning depends also on the student's attitude and behaviour. Instead the quantity of education and

the price paid for it (e.g. enrolment fees) can be related to a mixture of teaching and learning, according to the existing social norms. The conventional measures adopted for this purpose change from time to time and from place to place (e.g. a measure might be the difference between the number of students which obtain a diploma, weighted by the final mark, and the number of enrolled students, weighted by the results of an admission test).

Similarly, a doctor who visits a patient according to our social norms receives an honorarium, which to a large extent is independent of the good or bad outcome of his prescription. Instead, in different institutional contexts, the “norm” which regulates the payment for a medical service might also take into account the resulting change in the health conditions of the patient, who is also responsible for the outcome.

4. Price equations with services in linear models

In the following sections we shall assume only single product industries, under the usual convention that positive quantities denote both outputs and inputs.

4.1 A simple model

At the outset let us assume a corn economy in which a cultivation process produces a unit of corn in a year by means of a units of corn, $a < 1$, and l hours of labour. Land is free by assumption. Let p_g be the price of corn, w the nominal wage rate, and r the given rate of profit. The price equation of corn is

$$(1+r)a p_g + wl = p_g \quad [1]$$

In this equation p_g is the price of a good and w the price of a not produced service (a labour service). Assume that the process of corn cultivation initially includes the activity of disinfecting land from parasites. Subsequently an independent disinfecting process becomes available and is adopted as the result of a cost minimizing choice of techniques. According to our definitions, this new process supplies the cultivation process with an intermediate service. In the long period under free

competition, the following price equations with a uniform r correspond to the user process and to the provider process:

$$(1+r) p_g a_g + p_s s + w l_g = p_g \quad [2]$$

$$(1+r) p_g a_s + w l_s = p_s \quad [3]$$

where a_g and a_s denote the inputs of corn, l_g and l_s the labour inputs, s the quantity of the service used to produce one unit of corn, and p_s the price of the service. Let the unit of service be measured by one acre of land disinfested during a year. If the monetary unit is one Euro, then p_s is measured in Euro per acre and per year. In the equations [2], [3], a_g, a_s , are quantities of a good which must be available at the beginning of the production period and can be reintegrated at the end of the period by the current production. Instead the outcome of the disinfesting process and its use by the cultivation process are *simultaneous*. Such simultaneity is revealed by the same price p_s appearing on the side of the costs in equation [2], in which the service is an input, and on the side of the revenues in equation [3], in which it is an output. We could also assume that the payment for the service is anticipated and then $(1+r) p_s$ would appear in both equations instead of p_s . Similarly we may assume that wages are paid either ex post (like in our case) or ex ante; yet labour services are not present at the beginning of the period, as if they were inputs of goods, and neither ex post as if they were outputs of goods.

We can interpret equations [2], [3] as a structural form, from which a reduced form can be derived. Substituting p_s in equation [2] with equation [3] and setting $a' = a_g + s a_s < 1$; $l' = l_g + s l_s$, we obtain:

$$(1+r) p_g a' + w l' = p_g \quad [1]'$$

Equations [1] e [1]' have the same form. Therefore the initial form [1] or the reduced form [1]' do not reveal if other services, besides labour, intervene in the economy. Only the structural form [2], [3], compared with equation [1], allows us to establish whether a distinct service process exists on the side of the production process of the good. We observe that the same kind of service could also be a consumption service (e.g. the service for disinfesting a house) used in a consumption process.

4.2 Generalization

Let us extend the previous simple model assuming an economy in which m goods and n services are produced by means of m and n processes, respectively. Let the subscript g refer to goods and s refer to services. The compact form of the price equations:

$$(1+r)\mathbf{A}_g\mathbf{p}_g + \mathbf{S}_g\mathbf{p}_s + w\mathbf{l}_g = \mathbf{p}_g \quad [4]$$

$$(1+r)\mathbf{A}_s\mathbf{p}_g + \mathbf{S}_s\mathbf{p}_s + w\mathbf{l}_s = \mathbf{p}_s \quad [5]$$

In equations [4], [5], \mathbf{A}_g , \mathbf{A}_s are input matrices of goods; \mathbf{S}_g , \mathbf{S}_s are input matrices of services; \mathbf{l}_g , \mathbf{l}_s are column vectors of labour inputs; \mathbf{p}_g , \mathbf{p}_s column vectors of nominal prices; \mathbf{A}_g , \mathbf{S}_s are square matrices.

Assuming that matrix $[\mathbf{I} - \mathbf{S}_s]$ satisfies the Hawkins-Simon conditions, we obtain the following reduced form by substituting \mathbf{p}_s in equation [4] with the solution to equation [5],

$$\mathbf{p}_s = (\mathbf{I} - \mathbf{S}_s)^{-1}[(1+r)\mathbf{A}_s\mathbf{p}_g + w\mathbf{l}_s]:$$

$$(1+r)\mathbf{A}\mathbf{p}_g + w\mathbf{L} = \mathbf{p}_g \quad [6]$$

$$\text{Where } \mathbf{A} \equiv [\mathbf{A}_g + \mathbf{S}_g(\mathbf{I} - \mathbf{S}_s)^{-1}\mathbf{A}_s]; \quad \mathbf{L} \equiv [\mathbf{S}_g(\mathbf{I} - \mathbf{S}_s)^{-1}\mathbf{l}_s + \mathbf{l}_g].$$

The coefficients of equation [6], like those of equation [1'], represent only input coefficients of goods and labour. The reduced form coincides with Sraffa's price equations and conceals, so to speak, the services represented in the structural form [4], [5]. A positive solution to equation [6] requires that \mathbf{A}_g , \mathbf{A}_s , \mathbf{S}_g are such that matrix $[\mathbf{I} - \mathbf{A}]$ also satisfies the Hawkins-Simon conditions and that the value of r is fixed within its feasible range. Then, given the numeraire, equations [4], [5] can determine the relative prices of goods and services and the real wage rate.

The recognition of services would lead us also to revise the quantity equations of Leontief-Von Neumann type models. Such an extension is straightforward in the light of the analysis of

section 3.3.2 and will be omitted here. The existence of services, even in a steadily growing economy, would be revealed by the fact that they cannot be accumulated. A further extension should deal with immaterial goods as non-pure private commodities, because they are mainly non rival and only partially excludable goods (Parrinello 1993).

We shall neither carry out the further generalization needed to cope with the usual type of joint production of goods and services. Instead a special sort of jointness, which is often associated with the supply of services, will now be examined.

4.3 Packages of goods and services

An important kind of commodity can be classified as neither a good nor a service. It is the case in which the commodity is sold as a package of goods and services and the mix as a whole has its own economic identity, distinct from the individual components. We find several important examples. A retailer purchases goods at wholesale and sells goods and services to his customers as a package with its own price. This package includes the information conveyed by the assortment of goods on the shelves and the nice behaviour of the sales-clerk, jointly with the goods on sale. Similarly the banking and tourism sectors are activities where packages are transacted as single vendible entities. A bank supplies financial “products” and also services of payment and safety to cash holders. The hotelkeeper supplies packages of goods for rental (the rooms) and services (information, fitness facilities etc.). A company, which rents cars, supplies a bundle of commodities including the use of a good (the car) for a certain period and a variety of services (assistance, information, insurance, etc.). The theory has often dismissed the existence of markets for packages as distinct from their components (services and goods).

Let us assume that packages are sold as lumps on the market. The individual components of the package may or may not have a market price. However, even if they have all a distinct price, the market value of the package may not be equal to the sum of the market value of the individual

components. The existence of such a hybrid commodity (a collection of goods and services) raises a problem for the choice of cost-minimizing processes.

Assume that a package contains one unit of a good and one unit of a service and let Π denote the undiscounted price, which the provider receives by selling one package. How should the same package be valued as a cost if we want to assess the profitability of the user process? Should we value it at price Π , as if it were a service? Or at price $(1+r)\Pi$ as if it were a capital good? Or at price $(1+r)p_g + p_s$ where p_g , p_s are the prices of the good and of the service sold individually? Not one of the above evaluations would be correct. In this case, a cost-minimizing choice of techniques must attribute distinct accounting prices to the good and to the service, as if they were characteristics of the commodity (the package) in the sense of Lancaster (1966). Let π_g , π_s be the two accounting prices. Next, the cost of the package for the user process should be reckoned by $(1+r)\pi_g + \pi_s$ and the corresponding revenue of the provider process would be $\Pi = \pi_g + \pi_s$. In this case there is room for another process, besides the number of processes equal to the number of commodities, so as to adapt the good-service input ratio to the composition of the package available on the market and to maintain a determinate system of price equations.

4.4 Commodity circulation

Transportation, commerce, banking and pure intermediation are usually classified as service activities. These activities seem to belong to the circulation of commodities, conceived in a broad sense and distinct from the production activities. Steedman (1977) and Parrinello (1992) have dealt with this distinction with regard to the Marxian and Sraffian theories of prices, respectively. However, as soon as we try to characterize a circulation activity, we realize that two kinds of circulation processes can exist in a time-phased economy. One is similar to that carried out by a transportation process; the other reflects pure intermediation in the transfer of property rights. The former has been modelled by the contributions mentioned above. Assume that the output of a production process enters a circulation process *first* as an input (combined with other inputs) and

then as an output that can be used in another production process or for final consumption. Only goods can undergo such a sequence of transformations in virtue of their permanence; like a ton of steel that is *first* produced in a certain location and *then* moved to a different consumption location through a transportation process. Production and circulation of each commodity are carried out by a sequence of two *serial* processes and *the circulation process produces a good instead of a service*. In this case two *qualities* of the same good must be specified and receive different prices: the good before and after circulation.

Instead the *second kind of circulation implies a service* activity. Parallel processes carry out production and circulation. For example, a middleman can act to achieve a transaction between a producer, who sells his product, and the consumer of the product itself, *during* the production period instead of waiting until the product is finished. The exchanged commodity can be a good (produced or not) or a service. In both cases the intermediation process supplies a service to the producer process and a service to the user process. The corresponding structural form of the price equations is [4], [5] and the reduced form [6]. We need a reinterpretation of these equations. Assume for simplicity that all n services are circulation services which all production and circulation processes use up. A *uniform* price for the same commodity rules in the economy, instead of the two (ex ante and ex post circulation) prices of the previous case. However, the price received by the seller and paid by the purchaser includes the costs of the respective circulation services and is consistent with two different prices from which such costs are detracted. In this case the same circulation process can “move” different goods among many production processes and, despite the fact that the circulation process is not characterized by technically joint production, the output of the circulation process must be measured by many attributes. We immediately perceive this complication if we are engaged in measuring the output of a bank or of a commercial activity. In fact, remaining at the level of aggregation of a process analysis, we cannot say that the output of a circulation process is the same if the *total* amount of the traded commodity is the same but the number of the trading processes involved is different.

5. Services and knowledge

Although sections 3 and 4 have presented some theoretical applications of the revised concept of services to important fields of analysis, we intend to argue that its scope cannot reveal the current trend of a “new” economy, which is supposed to be a “de-materialized” capitalist economy associated with the more pervasive role of knowledge and information.⁶ The formulation of two opposite ideal states of the society will help us clarify our argument.

5.1 An ideal stage of society

Following Baumol’s (1967) assumption of unequal productivity growth, we can suppose that process innovations are concentrated only in the goods processes represented by the coefficients of equation [4]. Let us assume that such a technical progress – in which product innovations are absent- brings about the tendency $\mathbf{A}_g \rightarrow \{\mathbf{0}\}$, $\mathbf{S}_g \rightarrow \{\mathbf{0}\}$, where $\{\mathbf{0}\}$ is a zero matrix, and $\mathbf{l}_g \rightarrow \mathbf{0}$, where $\mathbf{0}$ is a zero vector. In the final state all goods become free, $p_g = 0$, by taking any basket of labour and services as the standard of value. Then we would be in the presence of a *pure service economy*, characterized by the price equation:

$$w\mathbf{l}_s + \mathbf{S}_s\mathbf{p}_s = \mathbf{p}_s \quad [7].$$

Such a limit-state of the economy is “de-materialized” in a certain sense, because it is deprived of any economic good. Although the economy is technologically more advanced, it is not a capitalist economy any more, as capital has disappeared. Assuming that no product-innovation intervenes and that the labour force is constant, the economy must be stationary, since accumulation cannot exist. If we ignore that by assumption equation [7] corresponds to the final advanced state of the economy, the same equation could represent the primitive state of the society that Smith describes:

⁶ Other authors have already presented this negative view, although from different perspectives. See Stanback, Bearse, Noyelle, Karasek (1981); Walker (1985).

In that early and rude state of society which precedes both the accumulation of stock and the appropriation of land, the proportion between the quantities of labour necessary for acquiring different objects seems to be the only circumstance which can afford any rule for exchanging them for one another.....In this state of things, the whole produce of labour belongs to the labourer.
(Smith , 1937, Book I, p.47).

The analytical representation of the pure service economy illustrated in this section and the corresponding price equation [7] can be easily transformed to represent a pure labour economy. Such an economy formally coincides with the core of Pasinetti’s model (1993) and can be combined with the assumption of structural change adopted in the same model.

Assuming again that matrix $[\mathbf{I} - \mathbf{S}_s]$ satisfies the Hawkins-Simon conditions, we can write the solution to equation [7]:

$$\mathbf{p}_s = w\mathbf{L}_s \quad [8]$$

$$\text{Where } \mathbf{L}_s = (\mathbf{I} - \mathbf{S}_s)^{-1}\mathbf{1}_s.$$

The coefficients $\mathbf{L}_s = (L_{s1}, L_{s2}, \dots, L_{sn})$ are consolidated labour coefficients, embodying intermediate *services*, and the outcomes of the n “industries” are quantities of services instead of quantities of goods. Let us assume that our pure service economy is subjected to structural change caused by an exogenous change in the input coefficients over time. The price equations [8] can be written:

$$\mathbf{p}_s(t) = w(t)\mathbf{L}_s(t). \quad [9]$$

The individual equations of the compact form [9] are *formally* identical to the price equations of Pasinetti’s model (1993). Of course, the rate of profit on the value of capital goods does not appear in equation [9] simply because capital goods have become free goods.

5.2 An opposite ideal stage of the society

We may perform another analytical exercise and compare the state described by the price equation [7] with the state, which would be reached if we assume, against the accepted evidence, that technical progress is concentrated exclusively in the service sector. In this case the tendency,

opposite to the former, would be indicated by $\mathbf{A}_s \rightarrow \{\mathbf{0}\}$, $\mathbf{S}_s \rightarrow \{\mathbf{0}\}$, $\mathbf{l}_s \rightarrow \mathbf{0}$. In the final state a pure economy of goods and labour would be established with $\mathbf{p}_s = \mathbf{0}$, by taking any basket of labour and goods as the standard of value. The corresponding price equation is:

$$(1+r)\mathbf{A}_g\mathbf{p}_g + w\mathbf{l}_g = \mathbf{p}_g \quad [10] .$$

This economy is in another sense “materialized”, capitalistic and technically more advanced, in comparison with the initial system of production.

5.3 A mythical view

Despite the fact that the service sector is made of highly heterogeneous sub-sectors and should not be analysed as a homogeneous whole, a certain myth about the whole intrudes itself into the rhetoric of the *service, tertiary, post-industrial, new economy*. The myth rests upon a sort of deduction from two spurious premises: i) services are immaterial *goods* ii) immaterial goods are fragments of knowledge and information; hence iii) more services reflect more knowledge and more information (assuming that the problem of measurement of these intangibles can be solved). The ideal cases illustrated above and our definition of services help us to clarify that such a mythical view of the service economy is untenable. In fact, it should be noticed that each system of production, underlying equation [7] or equation [10], represents in a non-ambiguous way a superior technology *vis a vis* the initial system associated with equations [4], [5]. Still, we do not know how the two alternative final systems can be compared in terms of technical knowledge. This agnostic result derives from the fact that the technical coefficients do not reveal the kind of tasks and skills of the labour force employed in the two polar cases. Knowledge creation, learning and information diffusion are inherent in the individuals. Their dynamics is not reflected by the change in the weight of the service sector relative to that of manufactured goods. Instead it should be investigated through a detailed analysis of the ongoing change in the composition of labour employment in terms of skills, jobs and tasks, and in the light of the triple distinction: services, material goods and immaterial goods.

6. Research agenda and conclusions

We will suggest here that the proposed definition of services, combined with the distinction between material and immaterial goods, can also be used to reconsider two specific research areas of the recent literature on services. Some final conclusions will follow.

6.1 Outsourcing

Although the revised concept of service implies a simultaneous relation and a direct interaction between the user process and the provider process, it does not imply *by definition* a geographical closeness between the two processes. We find many examples in which such proximity and a consequent dispersion of the supply of service activities occur (e.g. the case of barbershops and car repairs), but also important examples that point in the opposite direction (e.g. electric plant stations and communication facilities which serve many dispersed users connected only by a network). As a consequence, the explanation of the trend toward an increasing outsourcing of economic activities should be reconsidered. Outsourcing must be conceived as a substitution of integrated processes, which produce and use an intermediate (material or immaterial) good or a business service, with distinct processes, which supply and use the same intermediate element. If initially this element was not a vendible commodity, its outsourcing brings about both a process innovation and a commodity innovation. In particular, a certain industry may outsource part of its internal service activities, that then become the outcome of specialized processes and are recorded as part of the service sector (a simple example is illustrated in section 4.1). We can also observe the alternative decomposition of the initial integrated process, in which a *good in progress* is produced by means of two processes, connected by the usual serial input-output relation. In both cases the choice between a certain type of outsourcing and other methods of production, should be assumed to be a cost-minimizing choice of techniques and of organization and to imply a certain *geographical dispersion* of specialized activities. Progress in transportation technology (TT) and in

information and communication technology (ICT), under the *ceteris paribus* clause, can make both kinds of outsourcing more profitable than the integrated process, by decreasing the cost of transportation, the former, and the cost of communication and data processing, the latter. A priori a progress in TT seems to bring about no bias in favour of one type of outsourcing. Instead any progress in ICT seems to induce more outsourcing of services and immaterial goods, considering the simultaneous interaction between the provider and the user of services, and the informative content of the immaterial goods. Further empirical investigation is needed to corroborate such a conjecture.

6.2 Unbalanced growth disease

It is now widely accepted that we should not focus our attention on the idea of a stagnant *aggregate* service sector; a sort of indistinct sponge-sector, especially exposed to the fluctuations of demand, due to the lack of service inventories and in sharp contrast to a progressive aggregate manufacturing sector. Instead, it is suggested, we need to group the laggard activities of both sectors in order to investigate the features of the ensuing unbalanced growth of the economy. Baumol (1967) pointed out the source of the low productivity growth of those laggard activities by means of his famous example of the Mozart quartet, whose execution is not apt to benefit from a cost reduction through the substitution of the musicians labour with other increasingly cheaper means of production. He argued that a special *cost disease* affects an economy subjected to such unbalanced growth⁷. His initial idea underwent many refinements and has generated a literature which is still in a state of flux and development.⁸ However even the recent contributions in this field of analysis do not seem to recognize that the tendency toward a service *and* intangible good economy may bring about a different and perhaps deeper disease, that is suggested by the ideal case of de-capitalization

⁷ Under perfect competition and constant returns to scale, the aggregate output of the laggard sector would exhibit a progressively cost and price increase, relative to the cost and price of other commodities.

⁸ The volume edited by ten Raa & Schettkat (2001) presents a collection of essays by Baumol and by other contributors which update his initial cost disease argument.

illustrated in section 5.1. In fact, the production of most intangible goods (new industrial designs, software, medical treatments etc.) does not seem to admit substitutability of intellectual and creative labour to a greater extent than the living execution of the same piece of music⁹. Furthermore, such intellectual achievements possess some of the distinctive features of public goods. We point out the following possibility.

Let us assume that the share, in the total capital of the economy, of material goods remains more or less stable *in real terms*, in the presence of highly progressive industries of *material* goods and of the decreasing price of their outputs, relative to the price of services and immaterial goods. Then the share of the total *value* of material capital goods in the total capital of the economy will decrease in terms of the other commodities and the economy would tend towards de-materialization. This result may derive only from the increasing dominance of the value of services and, in this case, the tendency would lead the economy towards the state of de-capitalization of a pure service economy. Alternatively and less dramatically, the decreasing share of the value of material capital in total capital can be accompanied by an increasing share of the value of immaterial (intangible) capital goods. Such goods are mainly *non rival and only partially excludable* (quasi public goods). As a consequence, the “new” economy might become *less capitalized* also because it would find it more and more difficult to enforce property rights. Capital would tend to become a *fuzzy* magnitude in the absence of progress in the technology of enforcement of such rights.

6.3. Conclusions

We emphasized the distinction between goods and services, based on different time phases among processes: serial versus parallel input-output relations, respectively. We argued that our revised notion of service can be used to extend the traditional process analysis, along Leontief-Von

⁹ We by-pass here the problem of finding a meaningful measure of the quantity of the same type of intellectual results that are inherently heterogeneous.

Neumann-Sraffa guidelines, to deal with a service economy. We stressed the fact that the “new” role of knowledge and information should be decoupled in a certain sense from the dichotomy “goods and services”. On the basis of the revised distinction among services, material and immaterial goods, we pointed out some directions for future research that require the support of statistical data. In our approach the elementary units of analysis are processes represented at the system level, instead of individual units, like firms or households. A further disaggregation can be superimposed to such a framework, if the processes associated with different *individual* units are treated as distinct processes. This disaggregation would isolate the outside services, which are usually counted in statistical records, from the services performed and consumed inside the individual units. This would open the road for a generalization of the theory of the choice of processes (techniques) in order to develop a theory of the choice of *techniques and of the organization* of the economy in terms of processes, firms and markets. It would also reduce the gap between the proposed concept of services and the standard international classifications of industries and products. However, the basic conceptual difference between our notion of service, associated with processes, and those pragmatic definitions of services, formulated in terms of individual relations, remains. The standard statistical classifications should be reconsidered in the light of the kind of process analysis presented in this article.

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