"Conceptual and practical problems measuring service productivity"

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1. Economic importance of services (why should services be measured?)
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Abstract

Developed national economies are characterised by the fact that services gain in importance and account for an increasing share of value added. Consequently, the statistical coverage of this economic sector becomes increasingly important. While agriculture and industry are well, or even very well, covered in official statistics, relatively little information is available on the service sector. One reason is that, in contrast to agriculture and industry, services did not reach national economic significance until the second half of the last century. Another major reason is that collecting and recording data on the service sector is difficult in both conceptual and practical terms. This contribution identifies the difficulties of conceptually modelling services and, especially, their productivity and explains why the statistical coverage of services is challenging.

Key Words: goods and services, services industries, definition of services, quality of services, service productivity, measurement problems.

1. The importance of services (why should services be measured?)

A national economy's level of development is often measured by the share of services in the macro-economic aggregates (turnover, employment, value added). In an international competitive environment, the industrial production of mass products is shifting more and more to developing or newly industrialising countries. In return, services – and especially business services – are becoming more important in highly developed economies as regards the production of the national income. A good example of this development is the shares of the sectors in German value added in 1970 and 2010: agriculture: 3.4%/0.8%; industry: 48.3%/29.7%; services: 48.3%/69.5%.

The growing importance of services in a highly developed economy is one of the main reasons why the statistical coverage of this economic sector must be as good as the coverage of the production of goods. However, there are more good arguments why the statistical coverage of services is important.[1]

The liberalisation of international trade in goods is considered as a model for the further liberalisation of international trade in services. In an international competitive environment, countries which can produce at lower costs or, to put it in other terms, which have a higher productivity, have an advantage. This means that measuring the productivity of services is of major importance in a globalised world.

Another reason why service productivity should be measured is the assumption that the economic growth in industrialised countries is rather small and decreases continuously. To put it more precisely, the share of services in value added is increasing, while the growth of services is smaller because their productivity is lower. To provide empirical evidence for this assumption, the productivity must be measured statistically.

There is a growing interest in services also because services are considered to have a relatively large share in the informal economy (clandestine work). If the share of services in value added increases, the informal economy will grow, too. This means that the government will lose more tax revenue as the informal economy, or clandestine work, increases along with the service sector. What is the level of such losses?

[1] Zweifel (1987)

Another assumption is that employment in the service branches remains rather constant during the economic cycle. So, a large share of services in the national economy has a stabilising effect on the labour market. Is this a lasting phenomenon or just a consequence of an artificial isolation from international competition? So, here we have another issue where the productivity of services in international trade is relevant.
As we can see, there are quite a number of reasons why we should examine the statistical measurement of services and their productivity.

2. Theoretical concepts (what are services?)

It is obviously possible to cover the service sector in statistical terms by applying the traditional methods of statistical measurement and to compare it with the agricultural or the industrial sector. How else could we know the share of services in a national economy's performance? When we examine such figures, it is hard to understand why covering services should be difficult – because, we do have information on this topic.
We know how many businesses there are in a given economic branch, how many people work there and what they earn. However, that information is not sufficient in the long term. What we should know about an increasingly important part of the national economy is its productivity. Only a productive sector is attractive for a national economy over the medium or long term because it attracts investments and, consequently, safeguards future jobs, income and wealth. To be successful in international competition, it is important to assess how attractive a business location is. All the reasons mentioned before why the statistical coverage of services is important finally lead to measuring the productivity of services. So the question arises what the real output of a service is and how its productivity can consequently be measured.
This means that the main point is measuring the output of a production process. The accuracy of the measurement is both a conceptual and a statistical-practical problem.
What are the conceptual or theoretical differences of goods and services? How can services be defined? The following terms can be distinguished:[2]

- Producer (person or institution performing an economic activity)
- Production process (production of products; economic activity)
- Product (result of a production process).

These three different terms or concepts are helpful in a distinction between goods and services. In the production of goods, it is easy to distinguish between the production and the product. The product is created during the production process, but it will not be available to consumers until the end of the process. Generally, a produced good can easily be measured in physical terms. Contrary to services, goods can be touched, and you can view them and store them.
In the production of services, the product is created during the process and is consumed at the same time. The production process itself and the result of the production merge, they form a unit. The result of such a production process is more difficult to measure. What can be measured to some extent is how a person or good has been changed through the service.
At this point, another difference between goods and services emerges, that is, the producer/buyer relationship. Who is the producer, and who is the recipient, user or consumer of a good or service?
By means of criteria, it can be determined whether a product is a good or a service. Goods are generally produced for anonymous consumers, whereas services are very often produced individually for specific products or people. However, there are exceptions for every criterion. As regards the production of goods, there are cases where such goods are produced individually for a specific consumer (e.g. make-to-order production of ships or houses). The reason usually is the duration of the production process and the high production costs, so that such goods cannot be produced for stock because the risk of not selling them would be too high. However, as is the case for any other production of goods, there is a distinct time difference here between the production process and the consumption of the good, the product can be measured in physical terms and it can be stored. In turn, there are a number of products among services which are produced for a large quantity of anonymous consumers (e.g. theatre performances). However,

[2] Lützel (1987)

here the production process and consumption form a unit, which is typical of services. While goods generally can be produced for stock - which means that the time of production is not linked to the time of consumption -, services cannot be stored. So the aspect of whether a product can be stored is just another way of examining the time coincidence between production and consumption. It should be mentioned that it is useful to distinguish between services whose recipient is a good and those whose recipient is a person. This distinction cannot be made for the production of goods. This conceptual difference can be another reason for practical problems of measurement.

The production of software is generally defined to be a service. According to the above criterion of time coincidence between production and consumption, neither the Microsoft Office product nor any software individually produced to order is a service. Why such products nevertheless are considered to be services? What is the underlying definition? The only criterion by which software can be defined as a service is the aspect of intangibility – you cannot touch software. The criterion of "not being tangible" alone is not sufficient to define services. Repairing an item (good) is a service, although the product – that is, the result of the service – can be touched or viewed. So there must be other criteria for services. As regards the Microsoft Office package, buyers purchase just a right to use the software, rather than the software product itself. The fact that they physically receive the software on CD is irrelevant here. The right of use is an immaterial (intangible) good, it can neither be touched nor measured in physical terms. However, the production of software is not different from the production of goods. The same production process runs where software is produced to order for a specific customer. In this case, the product is made to order for a customer by the software manufacturer before it is sold to the customer who then owns the software. No right of use is involved here and consumption – that is, the use of the software – is separated from production in terms of time. Strictly speaking, this company should not be classified to the service sector according to the definition introduced here. Individual make-to-order production alone does not justify its being considered as a service. However, as it is considered as a service, it is not quite clear what the underlying criteria are. The only aspect applicable here is that this software is intangible, too.

Table 1: Criteria for goods and services

Products / Criteria	Good	Service
Can physically be measured, tangible	yes	no
Can be viewed	yes	not always
Anonymous buyers	generally	sometimes
Can be stored, production and consumption are separated	yes	no

Another distinctive criterion to define the production of goods and services is the question of whether or not it is manufactured for the market. Although this distinction is important especially for services, it is not examined here because, for non-market production, both the theoretical-conceptual reflections and the practical problems of measurement are much more complicated than for market production.

According to the above reflections, a service can be defined as follows:

> *A service generally cannot be physically touched, cannot be stored, is customer-specific and is consumed during production.*

However, as shown above, this is not an accurate definition of services, either.

The only criterion applying to all services and, at the same time, not applying to any good is the criterion of time coincidence between production and consumption. This means that, in our nomenclatures, services are not consistently classified. So how can we statistically represent an item which is very difficult to define?

3. Practical problems of measurement

As the major differences between goods and services have been mentioned, the questions to be explored now are why a national economy's service branches are more difficult to cover statisti-

cally than the branches of goods production and why measuring the productivity of services involves particular problems.
Economic branches differ considerably in structure. The number of enterprises (statistical units) in the service sector is almost twice that in the production of goods (+82%). On average, enterprises in the service sector have considerably less turnover (-77%) and a significantly smaller number of persons employed (-61%). The fluctuation of enterprises in the service sector – measured by start-ups and closures as a percentage of the total population – is by almost a third higher than in goods production (+28%). One of the reasons certainly is that the investments required for a start-up are much lower in the service sector.

Table 2: Structural differences in the German economy, 2010

Structural characteristics	Goods production (1)	Services (2)	Difference in % ((2):(1)-1)·100
Number of enterprises	695,000	1,262,000	+82%
Average turnover per enterprise	3.5 million	0.8 million	-77%
Average number of persons employed per enterprise	12.2	4.7	-61%
Fluctuation	14%	18%	+28%

These structural differences have a major influence on the statistical methods (sample sizes) and, consequently, on the costs of the surveys. The quality of the results is affected, too. A larger fluctuation means that the population changes more quickly and that the sample has to be adjusted more frequently. This leads to quality losses (learning effects among new respondents) and increases the handling costs.
Restructuring the overall sample sizes to have a larger share of services would bring more disadvantages than advantages. Studies in Germany have shown that the quality loss caused by reducing a sample for goods production can be offset only by an overproportional increase of the sample for services. Enlarging the sample for services without reducing the sample for goods production cannot be financed in Germany.
The above-mentioned definitional differences in terms of the criteria of measurability and viewability are another reason why services generally are more difficult to cover statistically.

Let us now come to measuring the productivity. Experts disagree even on the definition of productivity. If we take the traditional formula to calculate productivity and apply it to services, the problem is reduced to determining the real output.

$$PROD = \frac{output}{input}.$$

The real output (at constant prices) is obtained through price adjustment of the nominal output (at current prices). This means that the prices of the individual products would have to be known. For many services, especially business services, it is very difficult to determine the price. The prices of services are agreed upon between customers and producers more often than is the case in goods production. But even knowing a specific service's price would not guarantee that its quality is equivalent to the quality of another comparable service. The reason is that services cannot be touched physically and, consequently, are difficult to measure, so that they escape statistical observation. It is easy to imagine that these problems will not diminish when we examine a whole package of very heterogeneous services. The quality of services rendered to people is particularly difficult to determine because people's subjective perception plays an even greater role here and such moments are also difficult to cover statistically.
Theoretical approaches of hedonic price measurement[3] attempt to escape this dilemma. The idea is that the productivity of services could be measured indirectly through price differences between goods already in use and modified by services (e.g. car repairs) rather than directly through the services' price. What is measured is the effect of services, i.e. what physical changes they cause in the quality variables (q_i) of a good and, consequently, in its price.

$$\Delta p = g_1 \cdot \Delta q_1 + g_2 \cdot \Delta q_2$$

[3] Griliches (1971)

Although this concept was described by Hill as early as in 1977, it has not been widely applied in practical work[4]. A method measuring the value of a service only by its effect and disregarding the costs involved (input) is questionable. Productivity measures the efficient use of resources. This means that services involving different costs, while having the same effect, cannot have the same productivity. In addition, monitoring prices of repaired goods is not easy in practice. The statistical offices have much experience in hedonic price measurement and know that this method is suitable only for a limited range of goods, one of the reasons being the difficulty of obtaining information on their quality characteristics.
There are similar theoretical approaches for services rendered to people. The target variable here is the wage difference between people in the labour market. This is influenced by the people's quality characteristics which, in turn, can be modified by services rendered to those people (training). It is obvious that, in the practical work of the statistical offices, these theoretical approaches will not become popular either.
For product-integrated services (e.g. consultation), this approach cannot be applied even theoretically because such a service cannot be considered as an input to modify a good's physical state.

Things get even more complicated when the traditional productivity formula is considered as unsuitable. The consumer influences the result of a service, both in terms of output and input. Three dimensions should be considered here.[5] Services must potentially be held available (*potential dimension* = promise of performance), which can be considered as an input factor in the production process. At this point already, the customer's subjective judgment becomes relevant. What is the customer's judgment of the availability in terms of time, space, quality and quantity (flexibility of the offer, competence of consultation, waiting times)? In the production process itself (*process dimension*), the customer is directly involved and directly influences the production process. Finally, the consumer assesses the production result (*result dimension*), which represents the benefit of the service. Also, the experience acquired with regard to the potential dimension and the process dimension are relevant here. In the production of goods, there are measurable quality criteria, which allow a much more objective assessment of the output (see hedonic price measurement) than is possible for the assessment of many services. So, contrary to the production of goods, the production of services is a highly complex and multi-dimensional process, in which producers and consumers are closely interconnected regarding both input and output.

$$PROD = \frac{f^{output}(consumer)}{h^{input}(consumer)}$$

These interconnections (functional relationships) are very difficult to model, let alone to cover statistically, and they definitely have an influence on productivity. The traditional productivity formula is not suitable for this situation.
It is mainly this complex, multi-dimensional process which makes it difficult, and maybe even impossible, to determine or measure the productivity of services as compared with the production of goods.

Since 2009, the German Federal Ministry for Research has funded a research project on the productivity of services to find answers to the question of how to measure service productivity.[6] Although the topic is politically important, the project is not aimed at the macro-economic measurement of service productivity. Its goal is, first of all, to study the micro-economic relationships in the production of services. In various scenarios, specific services and their production processes are analysed. This is done in co-operation with the producers. The goal is to determine all factors that are relevant for the service to be a success. If the project manages to describe those factors and their interactions, entrepreneurs can see where they should optimise their subprocesses to achieve a higher productivity. The project's approach is micro-economic and can be

[4] Hill (1977)
[5] Bruhn; Hadwich (2011)
[6] Bundesforschungsministerium (2009)

considered as government-financed operations research or consultation for the German service sector. It remains to be seen whether the findings of the research project will allow to develop a macro-economic measuring instrument for the statistical calculation of the productivity of services.

4. Conclusions

The main reasons for the difficulties of good statistical coverage, measurement and assessment of service productivity are the intangibility, the great heterogeneity, the time coincidence of production and consumption and the strong involvement of external parties (customers, clients, patients, users, consumers, etc.) in the production and assessment process. Research has been done for decades to find solutions for measuring the productivity of services. At present, there is no consistent and generally accepted concept. It remains to be seen whether the government research project currently carried out in Germany will be able to give answers to the question of measuring service productivity. I am very sceptical that major progress can be made here in the next ten years. The decoupling of production from space and time, which has recently been observed as a result of modern information and communication technologies (ICT), and the growing trend towards integrated product-service systems will make it even more difficult to measure the productivity of services.

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