Productivity Growth in Services Industries: Is There a Role for Measurement?

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IN HIS CLASSIC 1967 PAPER, Baumol stressed that unbalanced growth between the manufacturing and the services sector induces a resource reallocation towards the 'stagnant' services sector, eventually slowing down aggregate growth. Baumol's views derive from the perceived characteristics of the manufacturing and the services sector, based on empirical evidence of the 1960s. The manufacturing sector would typically be characterized by technological progress, capital accumulation, and economies of scale; due to its specific nature, the services sector, notably education, performing arts, public administration, health and social work, was perceived to be rather stagnant, and the potential productivity increases would be weak.

Low or negative productivity growth in the services sector may, however, be due to problems in measuring productivity growth in specific services industries.[2] For instance, low or negative productivity growth rates over longer periods can be observed in some business services despite evidence for productivity increasing activities and the use of modern technologies in these industries. If measurement bias leads to an under-estimation of growth in services as compared with manufacturing industries, aggregate productivity growth may also be under-estimated.

This article sheds some empirical light on these issues, using the OECD Structural Analysis (STAN) Database and the OECD Input-Output Tables. These provide internationally comparable information for a broad variety of indicators such as employment and value added at current and constant prices, on a sectorally disaggregated level and, for most countries, in long time series. The first section provides a descriptive overview of patterns of industry and aggregate productivity growth in OECD countries. The second section analyses the role of measurement for industry and aggregate productivity growth. The third and final section concludes.

1 The author is an economist in the Economic Analysis and Statistics Division, Directorate for Science, Technology and Industry. This paper benefited greatly from ideas and comments by Carol Corrado, Marilyn Manser, Eunice Lau, Alice Nakamura, Dean Parham, Dirk Pilat, Paul Schreyer, Andrew Sharpe, Seppo Varjonen, Henry van der Wiel and Andrew Wyckoff. Particular thanks go to Colin Webb and Nadim Ahmad for their work on the STAN database and the Input-Output Tables. The views presented in this paper are those of the author and do not necessarily reflect those of the OECD or its member countries. An unabridged version of this paper is posted at www.csls.ca under the *International Productivity Monitor*. Email: anita.woelfl@oecd.org.

2 Throughout this article the services sector covers the industries of the International Standard Industry Classification (ISIC) classes 50-99.

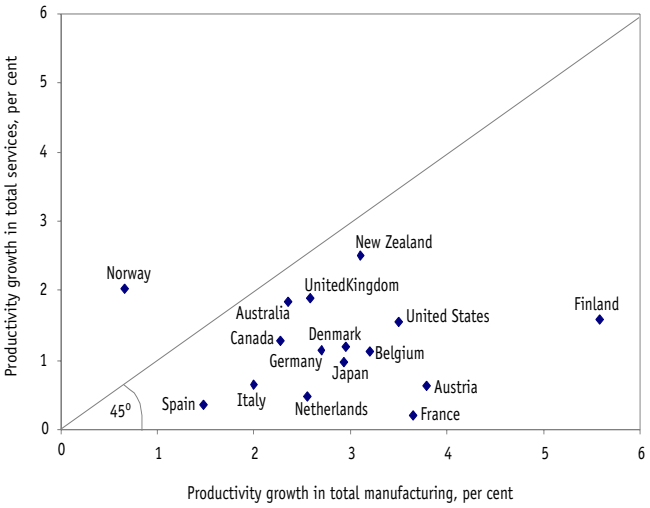
Empirical Evidence for Baumol's Cost Disease?

Productivity growth in services industries[3]

At a rather aggregate level, a differential in productivity growth can be observed between relatively strong productivity growth in the manufacturing sector and low productivity growth in the services sector. Chart 1 shows a concentration of productivity growth to the right of the 45° line, which would represent equal productivity growth in manufacturing and services industries. Despite a slight increase in productivity growth of the services sector relative to the manufacturing sector from the 1980s to the 1990s, productivity growth in the 1990s is still higher in manufacturing than in services in (almost) all OECD countries. In most countries, services productivity growth is about one half of manufacturing productivity growth and less than one third in certain countries, such as Austria, France and Finland.

Some industries within the services sector show relatively strong productivity growth (Chart 2). For example, post and telecommunication services, and financial intermediation, have experienced average annual productivity growth rates of 4.5 per cent and 10 per cent respectively, which is comparable to certain high-growth manufacturing industries. Relatively strong productivity growth can also be found – albeit to a lesser degree – in wholesale and retail trade, and transport and storage services. Productivity growth rates in these services industries have been on average about 2.5 per cent per year across countries, which is equivalent to aggregate productivity growth. Moreover, these business-related services industries have shown persistently strong productivity growth rates over the past twenty years, and the pick-up in productivity growth since 1995 in these industries in several countries indicates a potential for the future.[4]

Chart 1
Growth in Labour Productivity in Manufacturing and Services
Annual compound per cent growth rates, 1990-2001



Note: For countries for which data are not available for the whole period, growth rates refer to the period of the nearest years available. The services sector covers International Standard Industry Classification (ISIC) classes 50-99.

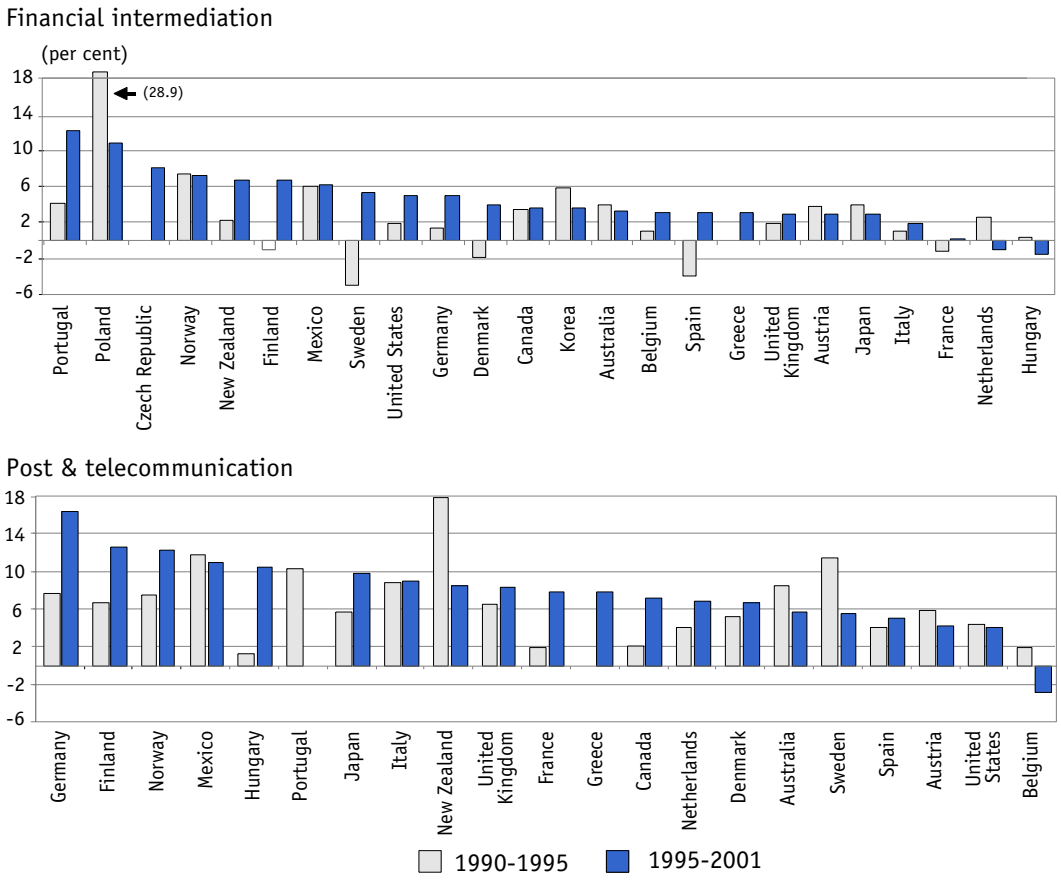
Source: OECD STAN Database 2003

However, several industries have negative productivity growth over long periods. Chart 3 illustrates this for renting of machinery and equipment and business services, as well as community, social and personal services. To some degree, zero or negative productivity growth may be linked to labour-intensive production and small firm size. Small firms, for instance, are not able to exploit economies of scale and often lack the financial means to invest into risky cost-

3 Within the STAN database, data are available on value added at current and constant prices, but not on capital input and constant price gross output at the industry level. This paper focuses, hence, on growth of labour productivity as measured by value added per unit of labour input. See also Wölfl (2003).

4 For further empirical evidence and a discussion of possible explanations for the productivity increase in these industries, see for example, Baily and Gordon (1988), Johnston et al. (2000), Triplett and Bosworth (2000 and 2002), and Wölfl (2003).

Chart 2
Services with Strong Growth in Labour Productivity
(compound annual growth rates, per cent)



Source: OECD STAN Database 2003.

reducing technologies. Small firm size is often found in services industries where productivity growth is low, notably in social and personal services and in certain business and professional services.

Despite possible explanations for zero or negative productivity growth rates, it is difficult to envisage why productivity growth rates should be negative over longer time periods. This is particularly the case in industries such as renting of machinery and other business services where the opposite might be expected. For example, these services are strong users of cost-reducing technologies such as information and communication technologies (ICT). They produce also mainly for intermediate use and face intensive international competition. These factors typically contribute to positive productivity growth rates. In addition, negative productivity growth over long periods would mean a steady decline in efficiency, and it could be questioned how such firms could survive in the market if this situation were true.

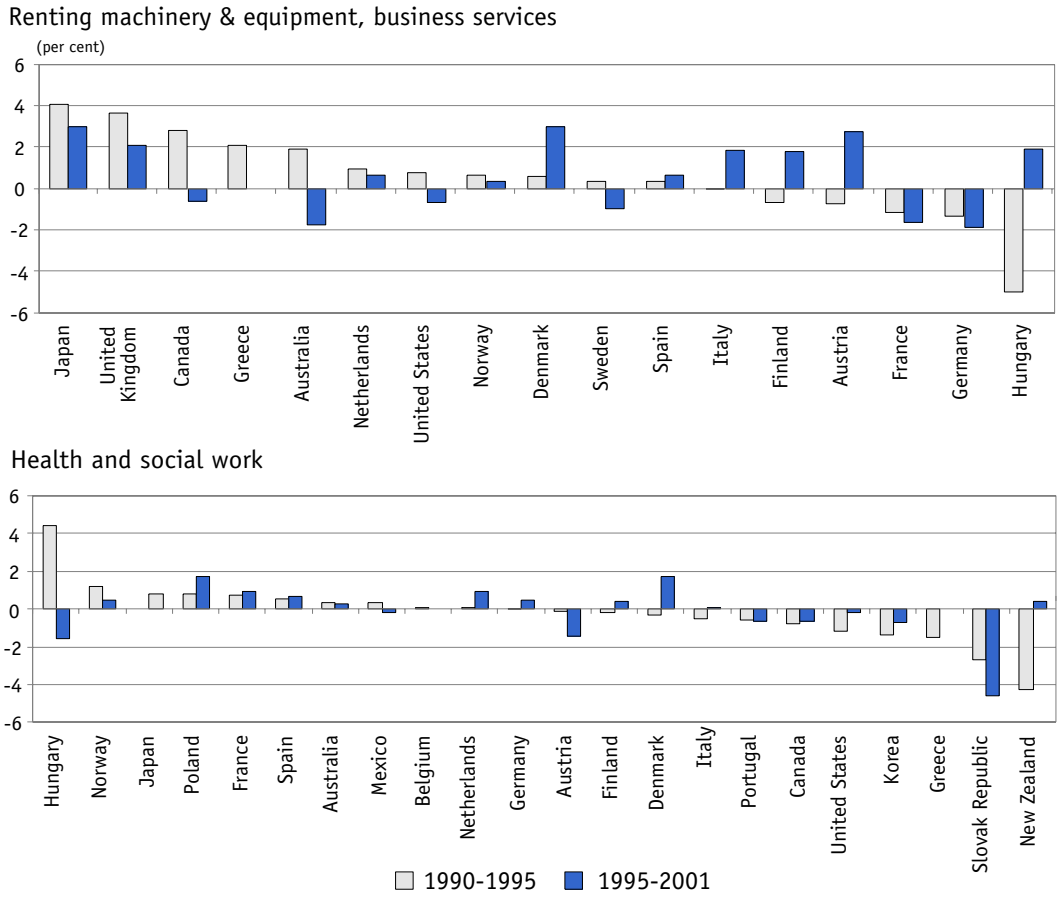
The Role of Services for Aggregate Productivity Growth

The picture is also ambiguous with regard to the role of services industries in aggregate productivity growth. Chart 4 illustrates that aggregate productivity growth can in particular be

Chart 3

Services with Low or Negative Growth in Labour Productivity

(annual compound growth rates, per cent)



Source: OECD STAN Database 2003.

attributed to high-growth business sector services industries, such as finance, insurance and business services, as well as transport, storage and communications. These services industries contributed about one-third of aggregate productivity growth in several OECD countries between 1995 and 2000. Their relative contribution increased in the late 1990s in certain OECD countries, notably the United States, Australia, Finland, Germany, the United Kingdom and Japan (Wölfl, 2003).

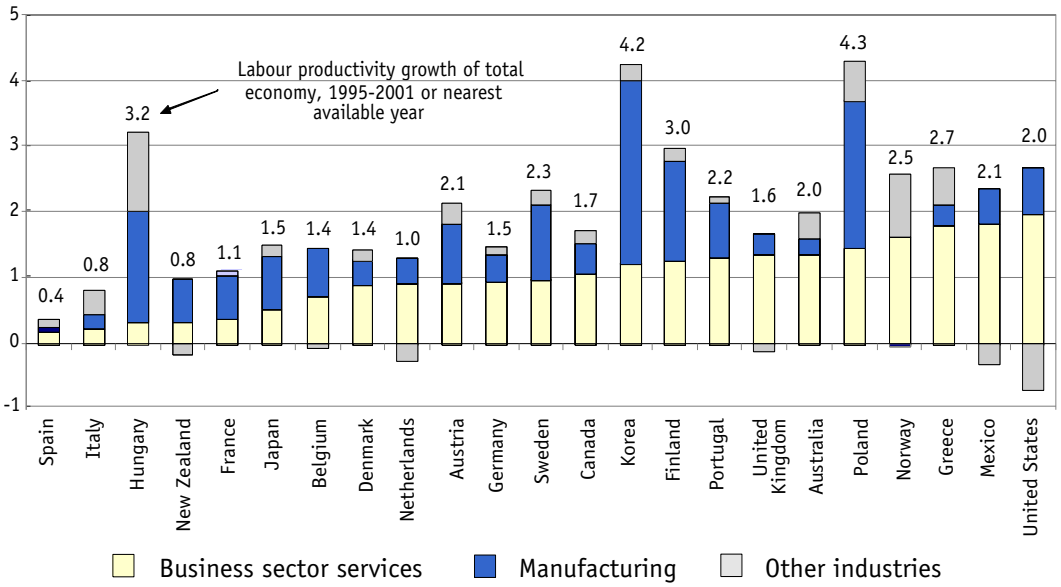
However, Chart 4 illustrates also that in many OECD countries, manufacturing – and not the services sector – still accounted for the bulk of aggregate productivity growth in the 1995-2001 period. This is also because in many cases, high productivity growth in certain services is compensated by low or negative estimated productivity growth in other services industries, notably social services or hotels and restaurants, which in some countries have a relatively high share in value added (Wölfl, 2003). This has particularly been the case in Austria, Belgium, Canada, Korea, Norway and to some degree in Finland and the Netherlands.

Cross-industry and cross-country differences in productivity growth per industry and their contribution to aggregate productivity

Chart 4

Contribution to Aggregate Labour Productivity Growth, 1995-2001

(annual average contribution, percentage points)



Notes: Ranked by business sector services. For countries for which data are not available to 2001 growth rates refer to the period from 1995 to the most recent years for which data are available.

Source: OECD STAN Database 2003, Scoreboard 2003

growth may relate to the degree of competition in the markets for which the respective industries are producing. In contrast to the traditional perception of services, and the one underlying Baumol's Cost Disease, services industries are not always focused on domestic markets for final demand (Wölfl, 2003). First, some services industries contribute indirectly to aggregate productivity growth through the provision of intermediate inputs. This is either though outsourcing of specific services from manufacturing to specialized business related services firms, or through the use of specific services to improve the management of manufacturing production, e.g. just-in-time delivery or module production. The traditional view of services is still reflected by community, social and personal services. About 80 per cent of total output in this industry goes to final consumption, with government consumption accounting for the bulk. In contrast, more than half of the output of transport and communications services, as well as finance, insurance, real estate and business services are used as intermediate inputs while the share of services for final demand is relatively low.

Second, some services industries, such as transport, storage and communications services, are exposed to international markets. In smaller countries such as the Netherlands, Denmark or Norway, exports account for about 30 to 40 per cent of total production of these services industries. One reason may be the increasing number and quality of modes by which those services can be traded, i.e. cross-border supply; consumption from abroad, notably in tourist services; and commercial presence, e.g. via affiliates, or the presence of natural persons, i.e. nationals of one party in the territory of another (OECD, 2001c).

The role of Measurement

Low or zero productivity growth in some services industries may be due to problems in measuring productivity growth in these services. The analysis of the role of measurement in this section asks what precisely is meant by "bias in measuring services labour productivity growth", whether there is evidence for an under-estimation of services productivity growth due to measurement bias, and what might be the impact of a measurement bias in services industries on aggregate productivity growth?

Some general considerations

Breaking down value added based labour productivity growth into its main components, there are mainly three areas of potential measurement biases (Chart 5).[5] The first area relates to the choice of inputs, notably the measurement of the primary labour input in terms of total number employed or total hours worked. In cross-country comparisons, measurement bias can result from the use of different definitions, different modes of data collection and different data processing methodologies to estimate employment and hours worked. Cross-industry differences in the measurement of hours worked relate, for instance, to differences in the treatment of part-time labour and in the share of self-employed persons.

The second measurement component relates to the choice of output at current and constant prices. The most relevant issue in this regard is the computation of constant price value added. It is, for instance, difficult for several services to isolate price effects that are due to changes in the quality or mix of services from pure price changes, and to adjust for such quality changes in the price index. There are reasons to assume that these measurement problems are stronger in the services than in the manufacturing sector. This might result from the general problem of how to define output of specific services. Empirical evidence and common practice in statistical offices indicate also a lack of information for price index estimation in services such as education, health care, telecommunications, computer-related services and personal services (Wölfl, 2003).

The third component of potential measurement bias relates to the estimation of aggregate productivity growth. Measurement problems in productivity growth of services industries may work through to the aggregate level via aggregation, i.e., via the relative weight that is attributed to the mis-measured services in total value added and employment of the economy. They may also work through to the aggregate level via intermediate input flows. This relates to the question whether productivity growth is under-estimated in services as compared to manufacturing, or, alternatively whether the productivity growth of manufacturing is overestimated as compared to the services sector.

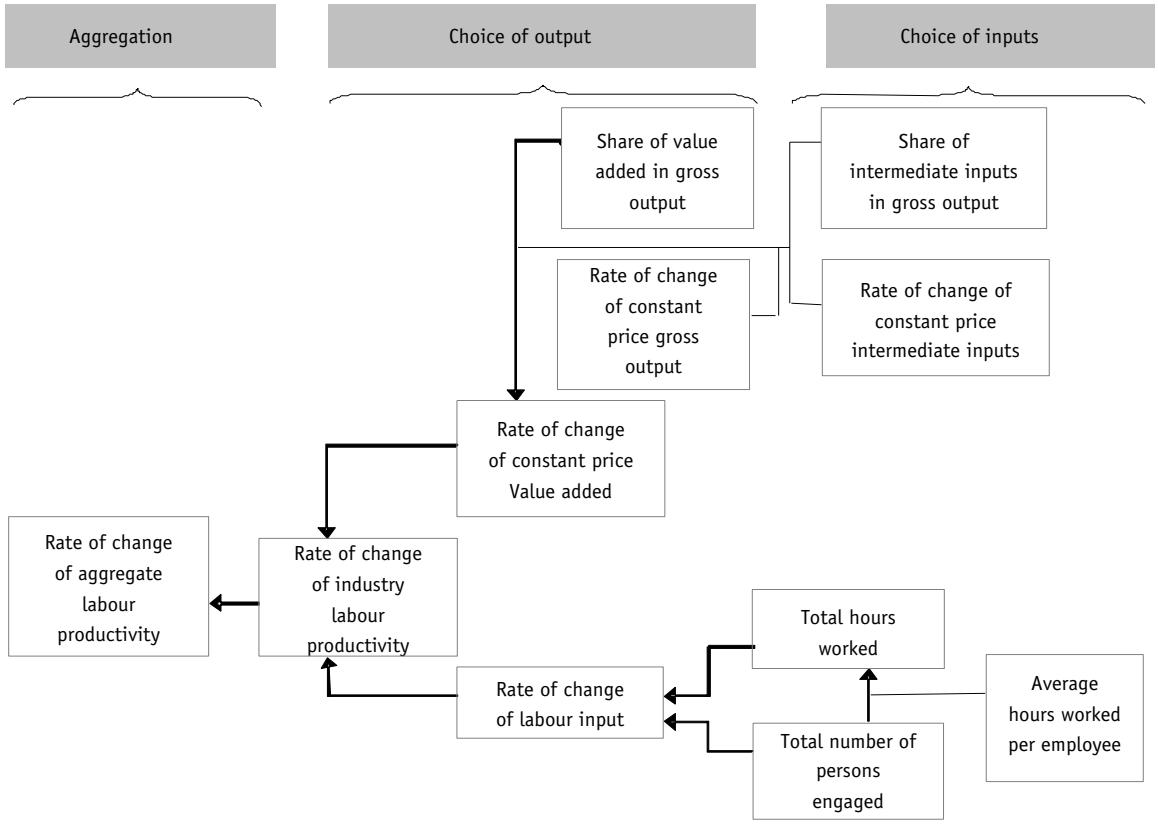
Employment or hours worked

Chart 6 presents results on cross-country comparisons of labour productivity growth between 1990 and 2000 whereby labour productivity is measured either as value added per person employed or value added per hour worked.[6] For several countries, differ-

5 The analysis focuses on labour productivity growth as defined as the rate of change of constant price value added per unit of labour input. For present purposes, growth in value added is defined as the weighted difference between growth in constant price gross output and intermediate inputs, with the current price shares of value added and intermediate inputs in gross output as weights. The *OECD Productivity Manual* provides an extensive description of measurement issues (OECD, 2001a and Schreyer, 2001b). See Kendrick (1985) for a short discussion of measurement of services output and productivity. See Wölfl (2003) for an overview of previous empirical studies.

6 The countries examined are those for which data on employment and hours worked are available in STAN. In the case of Italy, productivity growth per hour worked has been calculated as value added per full-time equivalent employment due to lack of data on hours worked.

Chart 5
Breakdown of Labour Productivity Growth into its Measurement Components



Note: For a more formal analysis see OECD (2001a).
Source: OECD.

ences between labour productivity growth per person employed and per hour worked across countries and sectors range between 0.1 and 0.3 percentage points per year for both manufacturing and services. In general, the absolute difference between productivity growth in manufacturing and services is larger if productivity growth is measured per person employed than per hour worked in most countries. For Canada, for instance, Maclean (1997) shows that this was particularly the case in the 1962-1971 period, when hours rapidly declined in the services sector.

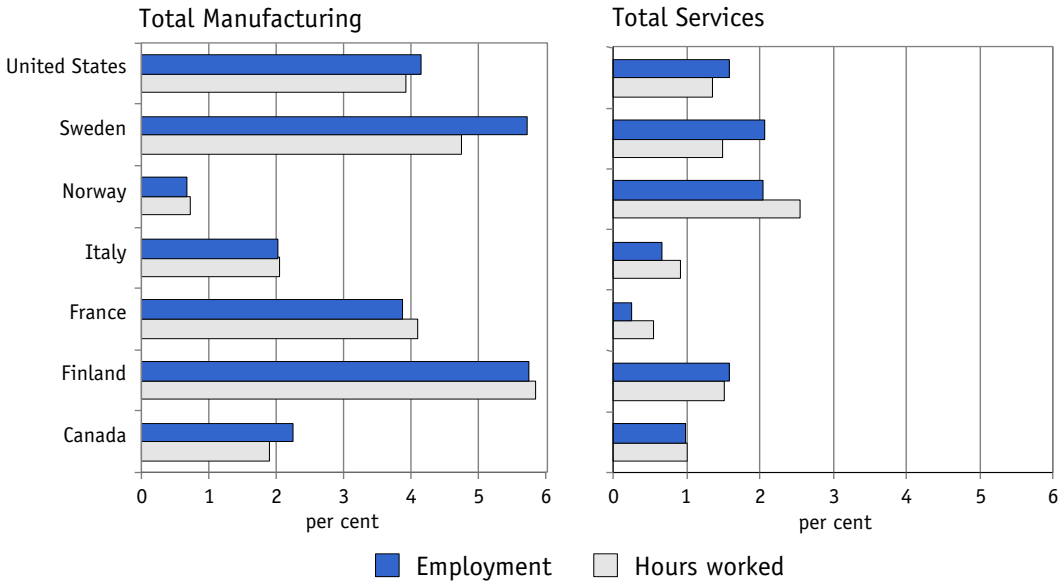
For the countries and industries for which data are available, working hours are in general lower and declining in the services sector while they are relatively high and, in some countries, increasing in manufacturing (Wölfl, 2003). Average working hours per employed person range between 1,300 and 1,700 hours per year in the services sector and between 1,500 and 2,000 hours per year in manufacturing.[7] Average hours worked are lowest in personal and social services, such as education and health, and highest in market-related services industries, such as transport and communications services, and financial and business services.

7 The numbers refer to total hours worked per person employed per year. If one assumes five weeks of annual leave and holidays, 1,700 hours per year would be equivalent to about 36 hours per week.

Chart 6

Labour Productivity Growth per Person Employed and per Hour Worked in Manufacturing and Services, 1990-2000

(compound annual growth rates, per cent)



Note: The Services Sector covers ISIC classes 50-99.

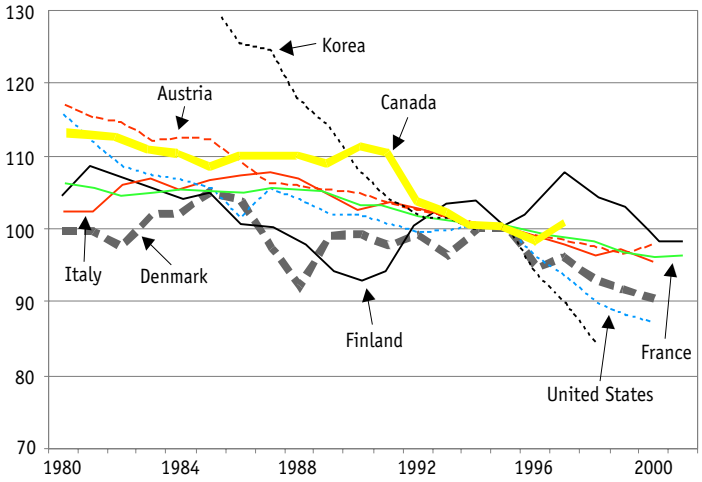
Source: OECD STAN Database 2002.

Adjustment for hours worked may be particularly important due to cross-industry and cross-country differences in the share of self-employed persons and part-time work (Wölfl, 2003). The incidence of part-time jobs was much stronger in services, notably personal and social services and in retail trade, than in manufacturing (OECD, 2001b). The share of self-employment in total employment is also much higher – albeit decreasing – in services than in manufacturing industries and the share and changes in the share of self-employed in total employment differ across countries. Also the source of data for hours worked affects the comparability of hours worked estimates and this may lead to greater uncertainty in estimates of productivity growth in the services sector than in the manufacturing sector.

The computation of constant price value added

It is more difficult for services than for manufacturing to clearly identify output and to divide current-price time series into volume and price components. Some indications for this can be seen in the large variety in developments of implicit deflators in identical industries across countries, notably in wholesale and retail trade, transport and storage services, post and telecommunication services, and in financial services (Chart 7 and 8). Country-specific factors, such as the pattern of overall economic development, regulatory reform and the role of competition, may all affect this diversity. However, it is also likely to reflect the broad variety of methods that are used by different OECD countries in services where there is no standard measure of constant price value added (Wölfl, 2003).

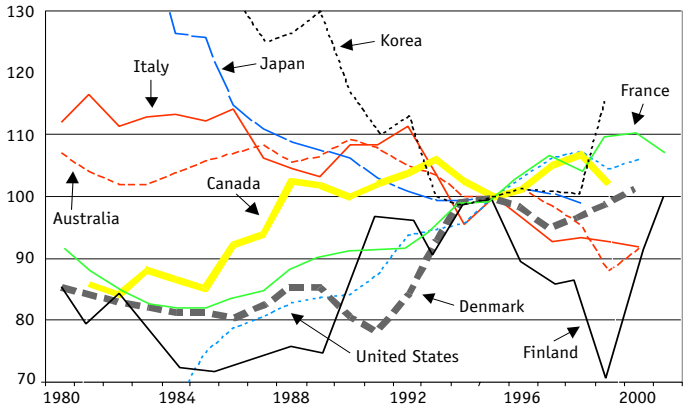
Chart 7
Implicit Price Deflators of Value Added for Wholesale and Retail Trade Services
(Index, 1995=100)



Notes: Implicit value added deflator per industry relative to the one for the total economy. Index of constant price value added rebased to 1995 for Finland and Canada.

Source: OECD STAN Database 2003.

Chart 8
Implicit Deflators of Value Added for Financial Intermediation Services
(Index, 1995=100)



Notes: Implicit deflator per industry relative to the one for the total economy. Index of constant price value added rebased to 1995 for Finland and Canada.

Source: OECD STAN Database 2003.

Problems in measuring constant price value added directly influence the rate of productivity growth. In health services, for instance, most OECD countries use information on labour input as the only available indicator to derive constant price value added. However, input-based methods of this sort cannot grasp changes in the quantity and quality of output, and typically presume zero productivity growth. In wholesale and retail trade (Chart 7), constant price value added is typically computed by deflating retail margins, using the volume of sales or the sales price index as a reference (Ahmad et al., 2003). Such a treatment ignores, however, changes in the quality of distribution services that are not associated with the volume of sales, such as convenience or tailoring to specific needs. Moreover, the volume measure of distribution as computed in current practice would change in line with the sales price which serves as a proxy for volume measures of distribution services. However, this direct link between the volume of distribution services and the price or the quality of what is sold does not necessarily exist.

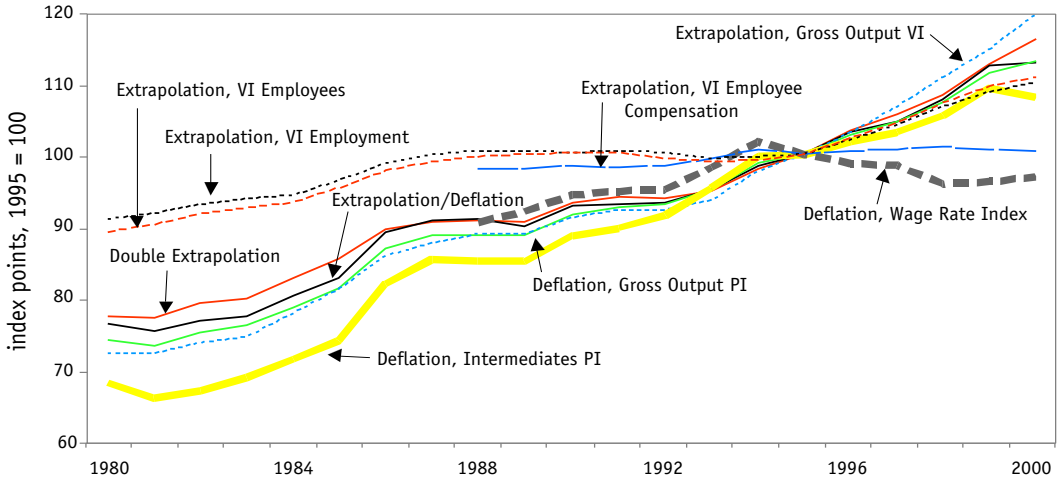
Measurement problems also reduce the comparability of estimates of productivity growth across countries. Large cross-country differences in price indices can be found, for instance, in post and telecommunications services. This is primarily due to the difficulty in finding an appropriate quality adjusted price index.[8] Another example is financial services (Chart 8). Although the basic approach towards measuring the production of financial services is similar across OECD countries, there are, for instance, differences in the degree to which financial services are considered intermediate purchases by other industries or final purchases by consumers (Ahmad et al., 2003). In countries where no ade-

8 The impact of the introduction of hedonic prices for ICT-related goods on output and productivity growth has been analyzed in several studies, e.g. Schreyer (2001a).

Chart 9

Scenarios of Value Added Indices Using Alternative Methods to Compute Constant Price Value Added

The example of Denmark



Note: Extrapolation, VI Employees (Employment): Extrapolation of a base year value of constant price value added using a volume index of employees (employment). Deflation, Gross output (intermediates) PI: Deflation of current price value added time series using the gross output (intermediates) price index as deflator.

Source: OECD STAN Database 2002.

quate volume indicator exists, the value of financial services is typically deflated by applying base-period interest margins to the inflation-adjusted stock of assets and liabilities. This approach does not take account of quality changes and may not sufficiently track the volume of transactions.

Chart 9 presents, using Denmark as an example, results of a thought experiment to examine the effect of measurement problems on measured growth of value added. It compares indices of constant price value added if alternative methods to compute constant price value added were used (Wölfl, 2003). The chart illustrates that value added growth would typically be under-estimated if constant price value added was computed on the basis of a volume index of employment, employees or labour compensation of employees. In contrast, time series of constant price value added show much higher rates of growth when value added has been extrapolated or deflated on the basis of price or volume indices of output or intermediate goods.

The impact on aggregate productivity growth

A potential under-estimation of productivity growth in services industries may result in an under-estimation of aggregate productivity growth. This is analyzed through a Slifman-Corrado type of thought experiment, examining what would happen if negative productivity growth rates were set to zero.[9] Such a thought experiment is primarily intended to show the potential size of the problem. It does not suggest that negative productivity growth necessarily implies mis-measurement, nor does it suggest that the size of the adjustment made in the paper is the correct one.[10] Such a thought experiment does provide, however, an initial

9 See Slifman and Corrado (1996), Gullickson and Harper (1999, 2002), Sharpe, Rao and Tang (2002) and Vijselaar (2003).

picture of the extent of a potential under-estimation of productivity growth in industries with services inputs.

There are two possible indirect effects of mis-measurement on productivity growth of the whole economy. As long as the services industry under consideration produces mainly for final demand, the increase in real output due to a correction for measurement bias would raise aggregate productivity growth via aggregation across industries. However, if the mis-measured services industry mainly produces for intermediate production, the increased output leads to higher growth in the value of intermediate inputs that are used by other industries. All other things equal, productivity growth in these industries would be lower, which would limit the effect of an increase in productivity growth in the services producing industry for which output has been adjusted. The total effect depends thus on the extent and type of measurement bias and on the weight of the mis-measured services industry for intermediate demand and the whole economy.

This simulation or "what-if experiment" is divided into three steps.[11] The first step consists of calculating the percentage change in the measure of gross output that would have been required to achieve a zero measure of productivity growth in industries where the current measure of productivity growth is negative. The second step consists of estimating the effect of this percentage change in the measure of gross output on the growth rate of intermediate inputs of the other industries, using input-output tables. The final step is to calculate the adjusted measures of growth in value added and, thus, productivity growth rates per industry and for the whole economy. Due to data constraints, however, the analysis could only be applied to selected countries and has to be based on appropriate assumptions on the relationship between the growth rate of gross output and value added as well as the intermediate input flows.

The simulation has been undertaken for France, Germany and the United States. France experienced negative productivity growth over the 1990-2000 period in hotels and restaurants, finance and insurance, renting of machinery and equipment, as well as other social services. In the United States, services with negative productivity growth rates are education, health and social work and other social services. In Germany, hotels and restaurants, real estate services, renting of machinery and equipment, as well as other social services experienced negative productivity growth over the 1990-2000 period. Since these services industries have a considerable weight in the economy and are different with respect to the degree to which they produce for final or intermediate demand, the simulation for these three countries provides broad insights concerning the potential importance of direct and indirect impacts of mis-measurement in services industries on aggregate productivity growth.

Charts 10 and 11 illustrate the simulated impact of potential under-estimation of services productivity growth for selected services industries. Two main results prevail. First, the effect on industry and aggregate productivity growth depends on the extent of the measurement bias. In the case of Germany, output growth had to be adjusted more than in France in almost all industries with negative productivity growth; also aggregate productivity growth would increase by a slightly higher amount in Germany as compared to France.[12] Second, the effect on

10 While setting negative productivity growth rates to zero may overstate the size of the measurement problem, it is also possible that it understates the size of the problem. Actual, i.e. correctly measured, productivity growth rates might be substantially above zero.

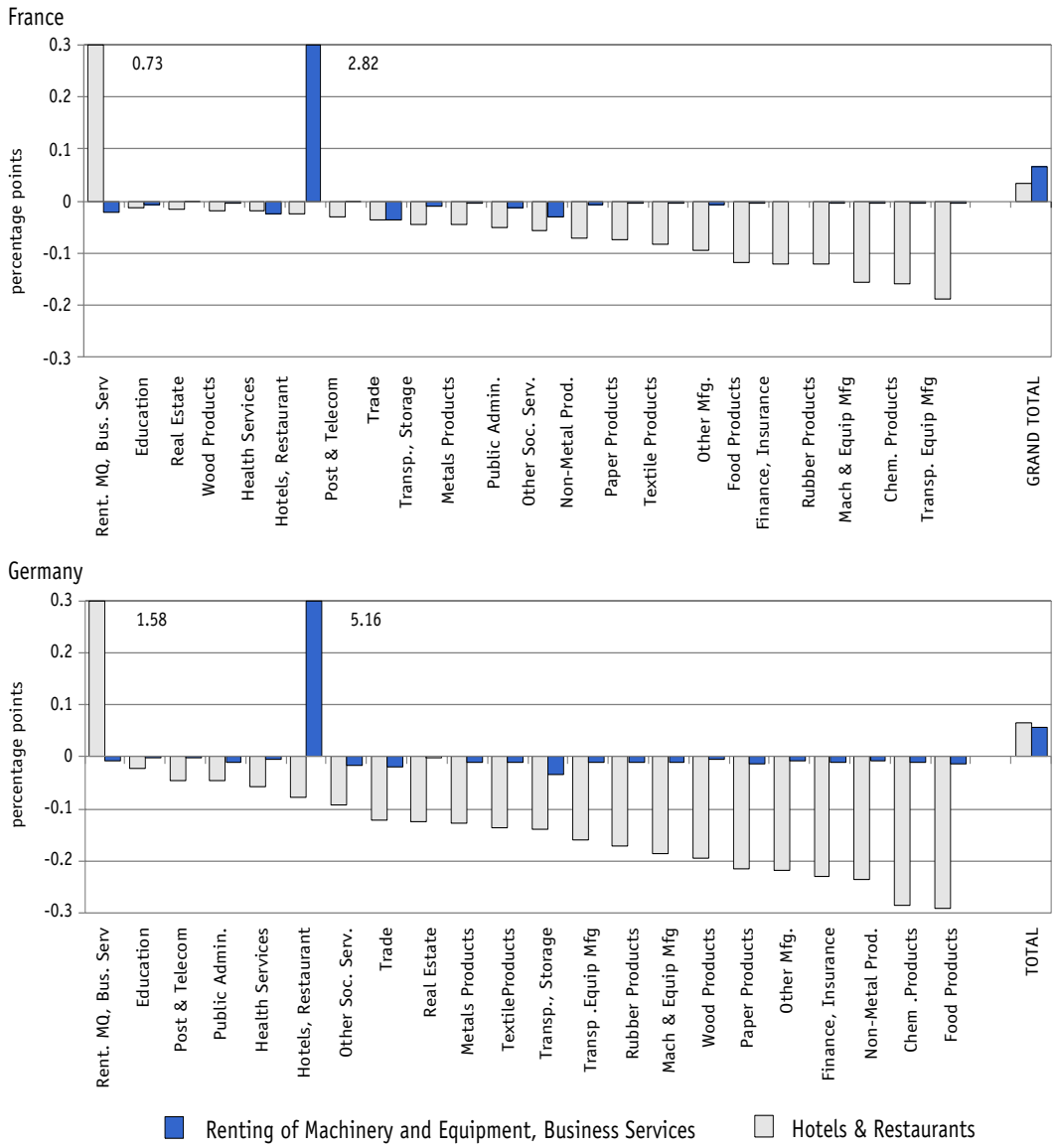
11 See Wölfl (2003) for details on the assumptions, the procedure applied and detailed results.

12 An adjustment of all services industries with negative productivity growth, as opposed to only the selected two industries as shown in Chart 10, would raise aggregate productivity growth by about 0.35 percentage points in Germany as compared to 0.19 percentage points in France.

Chart 10

Effect on Industry and Aggregate Productivity Growth when Selected Negative Services Productivity Growth Rates are Set to Zero, 1990-2000

The example of Germany and France



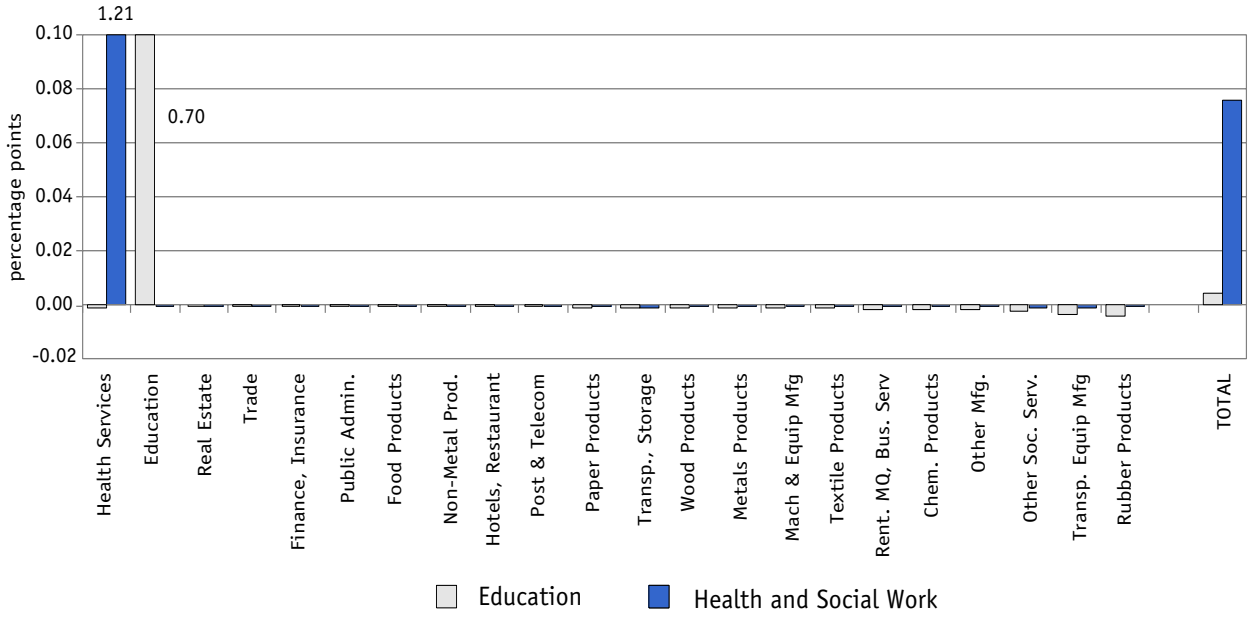
Source: OECD STAN Database 2002, Input-Output tables 1995, 1997.

aggregate productivity growth depends on the share of production of the mismeasured services industry that is destined for intermediate demand. There seems to be almost no effect on the measured productivity growth of other industries from a correction for hotels and restaurants, a services industry which produces primarily for final demand. In contrast, the effect of a correction in renting of machinery and equipment, a services industry that mainly produces for intermediate demand, would be spread across all industries. A correction in renting of machinery in Germany, for instance, would reduce measured productivity growth in other

Chart 11

Effect on Industry and Aggregate Productivity Growth when Selected Negative Services Productivity Growth Rates are Set to Zero, 1990-2000

The example of the United States



Note: The industries are ranked according to the overall effect if all negative services productivity growth rates are set to zero.

Source: OECD STAN Database 2002, Input-Output tables 1995, 1997.

industries by up to 0.3 percentage points, since intermediate inputs would grow more rapidly than initially measured and value added growth would thus be lower.

The relevance of both the extent of the measurement bias and the degree of production destined for intermediate demand becomes particularly clear by comparing the results for France and Germany with the ones for the United States (Chart 11). First, the upward revision of the productivity growth rate for all services under consideration is lower in the case of the United States than in France or Germany. As a consequence, also the change in the productivity growth rate of all industries is lower. Second, the services where the United States showed negative productivity growth rates at this level of aggregation are social services, such as education and health and social work. These industries produce mainly for final demand and only to a small extent for intermediate production. Both factors together might explain the relatively small impact of a correction for measurement bias on productivity growth in other industries and on aggregate in the United States as compared to France or Germany.

Overall, this thought experiment suggests that the principal impact of possible mis-measurement is a shift in the attribution of productivity growth to specific sectors of the economy. This could imply a greater contribution of services industries characterized by mis-measurement to total productivity growth, and a smaller contribution of other sectors, including manufacturing. The impact on aggregate productivity growth is not clear, a priori, but the results for Germany, France and the United States suggest that strong positive effects on services industries

are reduced by negative indirect effects on productivity growth of the industries that are using the adjusted services as intermediate inputs. Thus, although the effects of comparisons among services industries or between services and manufacturing industries could be substantial, the final effect on aggregate productivity growth may be relatively small.

Conclusion

The question of whether the productivity performance in services industries may lead to slower aggregate productivity growth through the unbalanced growth process identified by Baumol (1967) cannot be answered unambiguously. On a rather aggregate level, the productivity growth patterns indicate an apparent productivity differential between the manufacturing sector on the one side and the services sector on the other side. Several services industries show productivity patterns that are typical of high-growth manufacturing industries, e.g. transport and communications services, financial intermediation, and, to a lesser degree, wholesale and retail trade. Nevertheless, productivity growth is estimated to be low or negative in many services industries, including social and personal services, such as education and health, and even in some business services despite the use of productivity enhancing technologies.

However, there is substantial evidence that low or negative productivity growth rates in services are partly linked to measurement problems. For one thing, different definitions and data sources are used for employment and hours worked and this may bias international comparisons of labour productivity growth. Second, the way constant price value added estimates for services are computed strongly influences measured value added time series and, consequently, productivity growth estimates by industry. Finally, a potential under-estimation of services productivity growth may lead eventually to an under-estimation of aggregate productivity growth. This effect would depend on the type and extent of the measurement bias, and on the role of the under-estimated services for other industries and the whole economy.

More work needs to be done with regard to the role of measurement problems in estimating productivity growth in services industries. Some countries have recently taken steps to improve services sector output measurement and the OECD is working with its member countries in several areas, including financial services, insurance and software. Progress on basic services sector measurement problems will improve productivity growth measures and enhance our understanding of the cross-country differences in productivity growth performance.

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