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Since this volume is a record of conference proceedings, it has been exempted from the rules governing critical review of manuscripts by the Board of Directors of the National Bureau (resolution adopted 8 June 1948, as revised 21 November 1949 and 20 April 1968).


**Comment**

M. Ishaq Nadiri

In this interesting paper, Siegel and Griliches examine whether the observed increase in total factor productivity (TFP) growth at the total manufacturing level between 1979 and 1987 is partly due to mismeasurement of growth of inputs. They focus on three areas of potential mismeasurement: (1) outsourcing of some activities by the manufacturing sector to the service sector, (2) import of intermediate materials and components from foreign establishments and (3) increases in the rate of investment in computers by different manufacturing industries. If there are measurement errors present from these sources and they are not taken into account, the observed deflators for capital and materials are overstated, thereby understating the growth of real inputs and leading to an overestimation of measured TFP growth.

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The basic model employed in this paper is straightforward: TFP is calculated using the standard technique of logarithmic change in output minus a Törnqvist index of real factor inputs. Six inputs are considered. The first five are capital, energy, nonenergy materials, production workers, and nonproduction workers. Capital and materials are assumed to be measured with errors due to the overestimation of investment deflator (not measuring the decrease in computer prices) and material deflator (not reflecting import prices). The sixth input is purchased services such as machinery and building repair and maintenance services and communication services.

The authors assemble a large body of data at the four-digit SIC industry level from a variety of sources. Careful examination of different bodies of data reveals substantial increases in the use of computers, particularly in high-tech and petroleum, chemicals, food and tobacco industries. The authors also document significant percentage changes in the use of foreign materials among different industries. They also explore the effect of sample design changes by the Census Bureau in 1979 and sectoral switching of plants among establishments.

The surprising result of this paper is that with all the careful effort to document the trends that have exacerbated measurement errors in factor inputs, these results are not correlated with productivity change or with the post 1979 acceleration of TFP growth. Siegel and Griliches report evidence of acceleration of about 1/5 percent in TFP for the period 1979–86 at the disaggregated four-digit industry level. That is, the recovery in measured manufacturing productivity cannot be attributed to increases in purchased services, foreign outsourcing or decline in the quality of industry data.

The analysis presented in the paper requires a great deal of effort and is a necessary requirement for solid empirical work. The authors should be commended. I would like to raise a few questions and suggest some possible extensions for future work:

First, Siegel and Griliches consider mismeasurement of only two inputs: materials and capital. It could be argued, however, that errors of measurement may exist in output deflator, hours worked, energy, and employment data. Clearly the authors need to examine these potential sources of errors as well to ensure the reliability and accuracy of the results presented in this paper.

Second, the measurement errors of different inputs may interact depending on the underlying production structure. For example, the introduction of new computers may lead to compositional changes in labor and materials as well as changes in the quality of output. Such changes may not be captured by the relevant deflator.

Third, the treatment of computer purchases excludes computer parts and, more importantly, the use of software. However, because the increased innovation in software is a primary source of enhancement of computer services, this should be reflected in the measurement of the capital stock deflator. To adjust for import prices, a disaggregation of capital and materials by country of origin would be needed because the exchange rate differs by country.
Fourth, The surprise in the paper is that after all the adjustments, some fairly sizable, the measurement errors and sampling changes are not correlated with TFP growth and particularly its acceleration after 1979. The problem could be either that the measurement errors offset each other or that the magnitudes of the changes in the period are not large enough to affect TFP growth or that the list of adjustments may not be extensive enough. Finally, if one is interested in explaining aggregate TFP growth, it may be that, as Griliches argued a quarter of a century ago, aggregation pays. However, measurement errors may affect TFP growth at the individual industry level. Because there is considerable interest in industry productivity growth, the authors might want to consider this line of research.


Elizabeth Kremp and Jacques Mairesse

The present paper has three distinct but intertwined motivations, pursuing jointly three purposes, each corresponding to one of the subsequent sections.

Since the early 1980s, the French National Institute of Statistics and Economic Studies (INSEE) has been conducting an annual survey of market services, which is thought to be a very good, and in some respects rather unique, source of general information on this sector. Our first goal is to give a brief description of this survey (in section 12.1 of the paper). This survey not only is useful to ensure a knowledge of the relevant macrofacts but also provides a wealth of microeconomic information on the structure of these industries. In recent years, an increasing number of studies have taken advantage of information at the microlevel to investigate the behavior and performance of firms. Most of these studies have, however, concentrated on manufacturing industries, because the more easily accessible data bases cover primarily large publicly traded corporate companies, which are numerous in these industries. In view of the growing importance of service industries, it is clearly desirable to initiate similar studies also for them.

The outlooks of economists working at the micro- and the macrolevels, and the ways they treat the data are quite different. Our interest, in section 12.2 of the paper, is to illustrate some of the basic problems involved and to provide

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The authors are grateful to Zvi Griliches for encouragement and suggestions and to the participants of the NBER productivity seminar for comments. We thank also Jean Albert, Jean Marie Chanut, Ian Cockburn, Marc Taian, and Philippe Trojgan for their help in gaining us access to the French annual survey of market services data.