The state of the art in the measurement of intangibles in national accounts statistics

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Abstract

This paper examines the state of the art in the measurement of intangibles in national accounts statistics and draws conclusions for the future production of data for macro-economic and micro-economic analysis. The review of these measurement problems concludes without ambiguity that the compilation of all these and a number of other indicators poses a host of methodological questions. The persistent reference to, and use of, “labour productivity” as equivalent to technological progress is not only a conceptual fallacy but also a source of serious policy failure. These fallacies persist despite the insistence by respectable economists in recent decades, and in fact since the birth of economic analysis, that human capital formation is the principal driver of economic growth. The inertia in the public debate carries the risk of serious mistakes in the field of public policy that will only aggravate the key problems of sustainable socio-economic development in general.

Keywords: Productivity, accounting standards, human capital

1. Introduction

During several decades a considerable amount of research has attempted to explain technological progress or productivity growth by introducing various assumptions concerning the nature of innovation (embodied or disembodied technical change, etc.). This research has on the whole concluded that the residual could, as argued by Jorgenson, be attributed to improvements in “intellectual capital”, that is, a number of factors that constitute the main characteristics of the ’knowledge society’. This led leading researchers in this field to conclude that the “residual”, was not an “unexplained” aspect of economic growth but essentially the result of a gap in the understanding of the growth process and in the availability of data. The measurement problem therefore arises from the failure of most economists to make a clear distinction between “productivity growth” and “technological change”. The solution to this measurement problem would lie in the introduction of a much broader concept of investment, including investment in R&D, in the creation of ideas, in training and education, etc.

The present paper, which is a condensed version of a deliverable prepared in the context of the BLUE—ETS research project (www.blue-ets.com), firstly examines some of the basic measurement and accounting problems raised by the endeavours to arrive at a better understanding of the growth of output and productivity at the level of the firm or in national accounting. It then examines briefly the approach in national accounting standards and then reviews the approach and findings in quantitative analysis of intangibles, their level and their
effect on economic growth. Finally it draws some conclusions as regards the further steps which could be envisaged to improving the understanding of the role of intangibles for economic performance.

2. Reconsidering the basic accounting categories

A large step in the analysis of the effect of intangibles on economic growth was made in 2002 by Corrado, Hulten and Sichel, in a paper presented at an NBER conference (CHS, 2002). In what could perhaps be considered as a return to Böhm-Bawerk’s interpretation of capital as an “advance of money”, the 2002 paper argues that the conventional production function treats capital as “predetermined” (p. 16) and therefore cannot fully describe the growth process; saving and investment being “choice variables” in a complete model of growth.

In an application of this theoretical framework, they then identify a number of innovative property categories, which are not normally included in the list of intangibles established for example by Kendrick and others and undertake a recalculation of the amount of business spending on intangibles for selected periods for the United States.

The 2002 paper is then followed up and expanded with a growth accounting analysis in a Federal Reserve working paper in 2006 (CHS 2006), and which fully confirms and reinforces the earlier analysis by Kendrick.

Stressing that published macroeconomic data traditionally exclude most intangible investment from measured GDP (they suggest that as much as $800 billion are still excluded from US published data as of 2003), Corrado, Hulten and Sichel find that this conventional approach leads to the exclusion of more than $3 trillion of business intangible capital stock. To assess the importance of this omission, they produce a new estimate of intangible capital. They add this to the standard sources-of-growth framework used by the Bureau of Labor Statistics and find that the inclusion of intangible assets thus defined makes a significant difference in the observed patterns of US economic growth. The rate of change of output per worker increases more rapidly, when intangibles are counted as capital and capital deepening becomes the unambiguously dominant source of growth in labour productivity. The role of multifactor productivity is correspondingly diminished, and labour’s income share is found to have decreased significantly over the last 50 years.

The work by Corrado, Hulten and Sichel (CHS) was followed up by Marrano and Haskel (MH 2006) for the UK and presented in a working paper in 2006. They find that the UK private sector in 2004 spent about 10% of GDP on investment in intangibles, an amount equal to the investment in tangible assets. They thus confirm the huge importance for growth in the UK of intangible investment, although marginally less than what CHS found for the US. More recently their methodology has been applied more broadly in FP6 research projects such as, notably, INNODRIVE and COINVEST and a study by Bart van Ark and associates (van Ark, 2009).

From the very beginning of the growth accounting exercises in the 1960s, it has indeed been recognised that conventional business accounts and statistical data could provide only scant and incomplete evidence of the presence of ‘intangibles’ illustrated above. Firstly, there was a
perceived need to distinguish clearly between, on the one side, investment in (expenditure on) intangibles and, on the other, the resulting improvement in the stock of intellectual capital. Secondly, the classifications utilised in national and business accounts in general did not allow a separate identification of investment in intangibles. Thirdly, the general failure to distinguish between ‘services’ and ‘intangibles’ creates a fundamental problem of perception and taxonomy in the analysis of economic performance. While there is broad recognition that intellectual capital formation has become a decisive factor of economic growth and welfare, our knowledge of the process has, therefore, remained elusive, subjective and dispersed.

As indicated above, in growth accounting the response has generally been to move beyond the original elementary definition of capital and labour as homogenous entities. In its place a detailed classification of capital by category and vintage and of labour by level of education and skill has been introduced to take account of hours worked etc. This analysis has not involved modification of the traditional statistical data but has mainly relied on the search for additional indicators, frequently through ad hoc surveys or education statistics, etc.

However, even at the time of writing, the various stakeholders and researchers have not reached a consensus with respect to the approach of handling intangibles in business accounting. In particular, as emphasised most strongly by Douglas Skinner (Skinner, 2007):

1. Many intangibles are not separate, saleable or discrete items;

2. Well-defined property rights associated with most tangible and financial resources often do not extend to intangibles;

3. There are no liquid secondary markets for many intangibles, making it difficult to reliably measure the value of these resources;

4. It is often difficult to write fully-specified contracts for intangibles.

Moreover, as stressed by Leonard Nakamura (Nakamura 2009), whereas there is an increasingly urgent need to consider intangible assets as an integral part of productive assets, intangibles also have a number of particular characteristics that must be taken into account when assessing their weight in the economy and their contribution to economic growth:

- Intangible assets in general are ‘non-rival’, meaning that their utilisation by one producer or worker does not exclude their utilisation elsewhere or by another worker.

- Whereas an intangible asset may lose its value due to the emergence of alternative, competing products, for example due to the arrival on the market of a new operating system for PCs, it is not subject to the same physical wear and tear as a tangible asset.

- Due to this non-rival nature of intangible assets their value for the society as a whole will not necessarily be the aggregate of their market value for the individual producers and users.

- The units of measurement of intangible investments in ‘real’ terms are not intrinsic. Even when R&D results are patented, the links between the original R&D spending and the value
of a patent are weak or inexistent and for these and other categories of intangibles the units of measurement must be ‘extrinsic’ or must depend on a research project’s future success.

- The other side of the coin to measuring the ‘volume’ of intangible investment: the determination of the price is also, by analogy, likely to be based on ‘extrinsic’ assessments. This involves determination in the first instance of whether an intangible is ‘new’ or just an improvement or modification of an existing product.

3. Intangibles in national accounts

As underlined in 2003, in an important review of basic national accounts issues by Brent R. Moulton of the US Bureau of Economic Analysis (Moulton, 2003), several important statistical issues were up for consideration within the framework of the work undertaken in the international forum with the aim of agreeing on a revision of the 1993 System of National Accounts (SNA), which has served as a major milestone in creating international standards for compiling a fully integrated set of accounts measuring a nation’s production, income, and wealth.

Among the issues identified by Moulton, the following are particularly relevant for the estimation of the economic role of intangibles:

- The taxonomy and classification of production accounts used as the basis for the calculation of multi-factor productivity;
- The definition of the ‘borderline’ (asset boundary) between gross fixed asset formation and consumption, whether intermediate or final.

In the traditional formulations of the production function, the ‘input’ of capital is measured as the deflated stock of capital. However, as a matter of principle, estimation of multi-factor productivity would require an estimate not of the ‘immobile’ stock of capital but of the ‘services’ delivered by the capital stock. Already in 1973, in the context of debates on improving the basis for productivity analysis in the US national accounts, Christensen and Jorgenson proposed the introduction of a set of accounts incorporating indices of input volume by sector. Furthermore, in 1983, Jorgenson, Gollop and Fraumeni extended the accounting system to measuring the output, with measures of multi-factor productivity, an element not included in the SNA.

As stressed by Moulton (op.cit.) source data on capital – service lives, depreciation schedules, and constant-price indices by type of assets and by industry – are generally considered to be less reliable than data measuring most of the other flows in the SNA. Measurement of capital services involves the introduction of a rental equivalence of rate-of-return calculation that may be controversial, notably for non-market producers. And more generally, many observers argue that multi-factor productivity needs not necessarily to be part of the core SNA accounts and may be more appropriately dealt with as part of a satellite account.

In fact, the revised version of SNA, published in 2008, contains a new chapter on capital services and which proposes that, for statistical institutes interested in providing material for a deeper analysis of productivity issues, a table supplementary to the standard accounts (a satellite
account) could be prepared to display the implicit services provided by non-financial assets. The SNA, however, does not provide explicit guidelines on the approach to these, analytically essential, methodological issues.

However, as underlined for example by Moulton (op.cit.), a number of important weaknesses are apparent in the available data on intangibles and asset values. The accounts of business enterprises are not designed to provide information on intangible capital formation, especially when the capital formation consists of production for own final use. For some types of intangible investment, especially organisational capital, it is not often directly apparent whether expenditures have an expected service life of less than one year – in which case they should be treated as current costs – or more than one year – in which case they should arguably be classified as capital formation.

Furthermore, intangible expenditures are generally not adequately measured in official price statistics, so there is a lack of adequate information on producing quality-adjusted price or volume indices (Moulton, p. 9). Other problems concern valuation, as current costs of production may not be the most appropriate indicator for the value. This is the case for R&D products, but possibly even more so for software and artistic originals.

The revised SNA undertakes to expand somewhat the asset boundary and also to refine the definition of intangible assets but, as could perhaps be expected, abstains from incorporating all of the intangibles identified by Corrado, Hulten and Sichel as intangibles.

The identification of intangibles in the national accounts is, nevertheless, improved and expanded in several ways:

1. The information, computer and telecommunications (ICT) equipment is included as a new category under machinery and equipment. Since ICT equipment embodies a considerable amount of intangibles it should become easier to identify the latter.

2. The term “intangible fixed assets” has been renamed “intellectual property products”. The word “products” is included to make it clear that it does not include third-party rights which are non-produced assets in the SNA. Research and development products are included within intellectual property products. Consequently, patented entities no longer appear as non-produced assets and are ‘subsumed’ under research and development.

3. The term “mineral exploration” has been renamed “mineral exploration and evaluation” to emphasize that the coverage conforms to international accounting standards.

4. Computer software has been modified to include databases; software and databases are two sub-components of this category.

5. The term “other intellectual property products” replaces “other intangible fixed assets”.

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1 System of National Accounts 2008 (EU, IMF, OECD, UN and World Bank), New York 2009, Chapter 20: Capital services and the national accounts. The chapter usefully underlines that capital ‘services’ are not to be assimilated with conventional services such as transport services but rather as the term “for the way in which the changes in the value of assets used in production are captured in the production account and the balance sheet”. The chapter also refers to two OECD manuals, Measuring Capital and Measuring Productivity for further technical details.

2 See SNA 2008, op.cit. annex on the changes compared to the 1993 version.
6. This general category now includes: research and development, mineral exploration and evaluation, computer software and databases, literary or artistic originals and “other intellectual property products”.

It can thus be concluded that, pending further examination of the interpretation of the new SNA, several of the intangibles identified, for example, in the seminal paper by Carrado, Hulten and Sichel, are not considered as “assets” alongside “intellectual property products”. This would include advertising and spending on organisational investment; as such spending would not directly give rise to a “marketable” product. In this respect the new SNA involves some degree of alignment to the standard for business accounts, insofar as the latter attach a considerable importance to the scope for “attachment” of an asset and to the scope for marketing separately from the general capitalisation of the firm.

For fully understandable reasons, the new SNA has therefore not solved (and could not solve) one of the basic problems in business accounting: the accounting treatment of assets obtained by merging and acquisition and which obviously include organisational capital, which, in other cases may be produced in-house.

All in all, the analysts are still coping with a number of major issues and obstacles in the process towards obtaining a better understanding of the new economy.\(^3\)

A provisional conclusion therefore is that:

- no reform of business accounting can eliminate uncertainty and risk,
- we should therefore respect the basic criteria for sound accounting: record of transactions,
- we should accept that investment in intangibles is an important determinant of competitiveness and that, consequently, firms are not necessarily ready to reveal this spending to the general public or investors,
- but economic analysis and national accounting must clearly pay a lot of attention to the ‘immaterial parts’ of the economy and, to the extent that this information is not directly available in the core national accounts, there is an increasing need for satellite accounts showing these and other selected aspects of the economy.

So we need to find new and innovative ways of measuring intangibles, organisational and human capital; that is, to search for the missing data on intangibles.

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In addition to exploring alternative data sources covering the intangibles not identified as such in business accounting and the SNA, other tasks to be coped with include such daunting challenges as:

- measuring, and in which units, new products’ contribution to growth;
- amortisation of intangible assets;
- deflation of the current-price values;
- measuring the social value of intangible assets, which may differ from the private value whereas the social value is the relevant measure to explain growth.

As will be evident from the presentation of the theoretical issues and the model formulated by Corrado, Hulten and Sichel, obtaining estimates of nominal spending by business on intangibles is only the first step in the measurement of intangible assets and their contribution to economic growth.

First, as stressed by Aizcorbe, Moylan and Robbins (op.cit.), “some additional assumptions are required that pose a separate set of challenges”. This essential phase includes:

1. Translation of the estimates of the value of expenditure on intangibles into “real investment”, that is, the influence of inflation must be removed so that conceptually, what remains is a ‘fixed–price’ value;
2. Conversion of the resulting data on investment into an estimate of the stock of intangible capital, requiring an additional assumption of the depreciation rate or service lives of the assets which, in addition, as for tangible assets, is conditional upon the availability of sufficiently long series, or certain additional assumptions with respect to the evolution through time of the investment;
3. Estimation of the value of services provided by the intangible assets, requiring the construction of estimates of user cost of the capital.

As stressed by Nakamura, there are no intrinsic units by which to deflate a series on intangible investments in nominal terms so as to split this series into estimates of the price and volume change. In this respect, Corrado, Hulten and Siechel opted for deflating nominal series using the non-farm business output deflator, stressing that they considered this a “plausible placeholder until further research permits better measures”. However, for software they chose to use the National Income and Production Accounts (NIPA) price index for this category.

As also explained in a paper by van Ark and co-authors (van Ark, 2009), a number of steps are needed to transform the data on intangible investment into the capital stocks and capital service prices needed for estimating the contribution of intangibles to growth. The first step is to apply a perpetual-inventory method to measure the stocks of intangible capital (a proxy for the flow of capital services). The next step is to calculate the user cost of each asset type, including intangibles. The user cost is made up of the rate of return, the depreciation rate and a capital gains term.
. The examination of the problems of measuring volume and price changes for R&D clearly suggests a strong need for an equivalent examination of the scope for using better output indicators wherever possible as far as other marketable intangibles are concerned. However, a digression to consider the measurement of price and volume changes for financial intangibles may serve to illustrate even better the huge methodological issues which need to be considered before we can pretend to understand and measure the functioning of the ‘new economy’.

4. Conclusions and recommendations

The present review of these measurement problems concludes without ambiguity that the compilation of all these and a number of other indicators poses a host of methodological questions that need further examination. In particular, there is a most pressing need to promote alternative indicators for the basic economic performance and, in particular, productivity. The persistent reference to, and use of, “labour productivity” as equivalent to technological progress in public debate is not only a conceptual fallacy but also a source of serious policy failure. But the abuse of an erroneous statistical measurement of the output per person employed is regularly accompanied by another equally dangerous fallacy: the persistent use, even in the knowledge society, of ‘fixed capital formation’ as a key indicator of the degree to which an economy is ‘ploughing back’ a part of its output so as to ensure the harvest in the future. These fallacies persist despite the insistence by respectable economists in recent decades, and in fact since the birth of economic analysis, that human capital formation is the principal driver of economic growth.

The inertia in the public debate and of the predominant paradigms with respect to socio-economic issues is understandable but not excusable since, as stressed above, it carries the risk of serious mistakes in the field of public policy that will only aggravate the key problems of sustainable socio-economic development in general.

First of all, it is essential to recognize that Gross Domestic Product in itself is not as “objective” an indicator of economic activity as generally assumed in the public debate. Truly GDP is supposed to be an indicator of easily-measurable output of goods and services. However, as shown in the present Review, the measurement and comparability across economies and through time of a very large number of the production and consumption those goods and services is not easier than the measurement of many activities which, at present, are not taken into account in GDP.

In addition, economic development implies a significant shift into the market economy of a number of non-market activities which in earlier stages of development are undertaken by the households or individual persons for individual or community consumption. The compilation of a global indicator, including those non-market activities might therefore provide a better tool for cross-country comparison or for measuring the evolution of output over longer time spans.

As demonstrated in the studies on intangibles referred to above, the compilation of net capital formation will unavoidably incorporate estimates of the depreciation of the existing capital and, thus, to compile figures for the capital stock.
There are methodological issues which, although not new, need to be regularly reconsidered:

- Measuring, and in which units, new products’ contribution to growth
- Amortisation of intangible assets
- Deflation of the current-price values
- Measuring the social value of intangible assets, which may differ from the private value whereas the social value is the relevant measure to explain growth.

Furthermore, both tangible and intangible investments are valued not in themselves but for their consequences. However, the lifetime of a tangible product is limited by physical wear and tear as well as by obsolescence. A tangible product is usually rival too – when put to the use of one set of workers, it cannot be used by others. An intangible is non-rival in the sense that it can be used by additional agents without preventing use by those originally using it.

In addition, the intellectual property associated with the private value of an intangible is typically of limited duration. So its value as private wealth to their inventors or creators (or their heirs or assigns) has vanished. The social and private values of a tangible good tend to coincide, while the social and private values of an intangible good almost invariably differ.

Discovering how best to deflate intangibles as output – and thus the productivity of the sectors that produce intangibles – is an important project that is unlikely to be complete until we have a relatively settled understanding of endogenous growth.
5. References


