On misusing National Accounts data for governance purposes

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Abstract

According to HULTEN (2003, p. 6), "the political economy of statistical measurement is largely terra incognita in the practice of economics". The paper ventures forward into this largely unknown terrain by discussing the relevance of National Accounts data for economic governance. After a brief sketch of the history of National Accounts from the 17th century onwards, section 2 addresses policy domains that rely heavily on National Accounts data. Yet – useful as they are –, National Accounts can also be misused in the context of governance. The paper focuses on this potential for misuse, arguing that because countries use statistical methods that differ substantially, international comparisons on the basis of National Accounts data can produce biased results that might lead to questionable policy conclusions. To illustrate the point, it is shown that the divergence in growth rates between the U.S. and the EU since 1997 can be explained almost entirely in terms of differing statistical methods.

Key words: National Accounts, governance, inflation and growth comparisons, deflation methods, statistical artefacts

JEL classifications: C43, C82, E31, O47, O57

1 Introduction: A brief history of national accounting

William Petty (1623-1687), whom Marx lauded as 'father of Political Economy, and to some extent the founder of Statistics', was the first to provide rough estimates of 'national income' in his *Political Arithmetick* that appeared in print posthumously in 1690. This remarkable work combines already, and in a perplexing manner, most of the elements that have been regarded as crucial for national accounting up to the present day. Not only does Petty acknowledge that 'The Labour of the People' is the source of national income, which is echoed in modern 'Production Accounts', but he also estimates the division of national income between wages, rents, interest, and profit; and he opposes this with the disposition of income by giving an estimate of annual domestic consumption expenses. Petty's practice comes remarkably close to the modern system that establishes the link between the 'Distribution of Income Account(s)' and the 'Use of Income Account(s)' by means of double-entry bookkeeping. Finally, Petty also appears to be 'modern' with respect to the intentions behind his national income calculations. Above all, he aims at devising a means to compare the relative strength of the English economy with that of her main commercial rivals of the time, that is, France and the Netherlands. To allow for international comparisons is still an important task of present-day National Accounts. Also, governance aspects of national accounting have not gone unnoticed by Petty, as is evidenced by the title of the fifth chapter of the *Political Arithmetick*: 'That the Impediments of England's Greatness, are but contingent and removable' (cf. HARTWIG 2001).

For the next two hundred years, progress in national accounting was slow. Admittedly, François Quesnay's *Tableau économique* (of 1766) which, for the first time, envisaged exchanges in an economy as a circular flow, was a precursor of later Input-Output-Tables that now form a part of National Accounts. Also, there was an important contribution coming from Adam Smith who, in *The Wealth of Nations* (1776), laid emphasis on productive activities that 'fix themselves' in commodities rather than services. This concept was later adopted by Karl Marx (although the theory of the latter, in principle, does not preclude the provision of services from being productive as long as it is organised along capitalist lines and thus yields surplus value) and became the basis of the 'Material Product System' of National Accounts prevalent in the Soviet Union and other communist countries – even in France, for some time. It was only later under the influence of Alfred Marshall that production was fully understood to include the provision of services; and this concept was adopted by the United Nations in their recommendations for compiling National Accounts.

Up to 1890, national income estimates were made in France, Russia, the United States and Austria, adding to the English estimates. All these estimations, though, were restricted by the poor quality of the data at hand; and they comprised only particular years or short periods of time. The focus of the investigations remained 'national income' as an aggregate. Even Simon KUZNETS's (1934) study – which is widely regarded as a pioneering effort – in fact showed the distribution of national income by type of income received, but not yet the breakdown of national product by type of final demand.

Until the end of World War I, national income estimates were prepared in eight additional countries, including Australia, Germany and Japan. Gradually, government agencies were taking over the task of composing statistics from individual researchers, hence data quality improved. Two incidents fostered the final breakthrough of national accounting: first, J. M. Keynes's *General Theory of Employment, Interest and Money* (1936) encouraged thinking in terms of macroeconomic aggregates such as consumption and investment demand. Also, Keynes proposed an appropriate delineation for these aggregates to show that production, distribution and appropriation aspects of national income are in fact inextricably interwoven. But the final impetus for National Accounts came from the outbreak of World War II. In urgent need of a reliable basis for its war budgets, the British government advised economists

at the Central Statistical Office to prepare a set of income and expenditure estimates. These estimations – published as an appendix to the 1941 U.K. budget – were made by James Meade and especially Richard Stone. Both Stone and Meade were later awarded the Nobel Price in Economics; the former explicitly 'for having made fundamental contributions to the development of systems of National Accounts and hence greatly improved the basis for empirical economic analysis'. STONE's work (1947, 1951) was fundamentally new in that it integrated national income in a double-entry bookkeeping format so that every item entering as income would be matched by some expenditure item on the other side of the account. Such a double-sided account in principle allows for an analysis of the distribution and disposition of national income. Stone also disaggregated the Appropriation Account by major sectors and linked it to the consolidated Production Account by suitable double entries. After the war, his approach strongly influenced the first recommendations published by the United Nations' Statistical Office for reporting national income and its components (UNITED NATIONS 1953).

During the following two decades, virtually all nations began to set up National Accounts. On a conceptual level, the thrust was towards improving data quality on the one hand and to broaden the group of economic activities covered by the System of National Accounts (SNA) on the other. Hence, the revised SNA 1968 (cf. UNITED NATIONS 1968) integrated the Production, Distribution and Appropriation Accounts with Financial Accounts (or Flow-of-Funds Accounts, as they are called in the U.S.). Also, the Production Account was disaggregated into Input-Output-Tables in respect of industries and commodities. The inclusion of Balance Sheet Accounts was intended to secure full stock-flow-consistency of the respective aggregates over time. Constant-price data for the supply and disposition of goods and services were also integrated. Admittedly, not all countries saw themselves able to devote enough resources to their statistical offices to arrive at the intended high degree of sophistication; and still others, like the U.S., preferred sticking to their own national income accounting rules that differed somewhat from the international standards. Nevertheless, in 1993, yet another version of the SNA was published (cf. INTER-SECRETARIAT WORKING GROUP ON NATIONAL ACCOUNTS 1993); a new version that – although it did not introduce any major conceptual changes – once again raised the level of detail and thus the complexity of the system as a whole. Due to space restrictions, it is not possible to present and explain the SNA 1993 sequence of accounts here – cf. ABRAHAMSEN/HARTWIG (*forthcoming*) instead.

2 Uses of National Accounts for governance purposes

"The chief impetus to the development of economic accounts", writes KENDRICK (1996, pp. 4-5), "has come from central governments, which probably remain their chief users. By monitoring economic movements, policy-making agencies including the central bank can see if they are on track with respect to national objectives regarding growth, price inflation, the trade balance, unemployment, and so on, and, if not, they can take appropriate actions."

National Accounts are the main source of information about the state of the economy. Their data serve as input for growth predictions and business cycle forecasts, which are usually made with the help of intricate econometric models and techniques. Also, medium-term budgeting is typically done within the framework of National Accounts. It has to be stressed, though, that National Accounts synthesise data usually collected for other purposes (e.g. tax collection). A lot of estimation is involved in calculating the aggregates entering into the SNA. Therefore, data revisions are common and sometimes substantial – and National Accounts may have a time lag of up to three years for final estimates. So, unlike meteorologists, applied economists normally do not know the present day situation and not even the recent past when making predictions. This might be one reason why business cycle forecasts based on National Accounts data are generally regarded as being unsuccessful in a medium-term horizon (of more than one year or so). Also, Kendrick's optimism as to the possibility

that "the economic relationships revealed by analyses based on the income and product accounts make it possible to predict the consequences of given or alternative policy actions" (KENDRICK 1968, p. 33) is now widely discarded, following the influential 'Lucas Critique' (LUCAS 1976). Nevertheless, National Accounts have still a significant impact on economic governance. Growth, productivity, and inflation forecasts serve as input into the wage bargaining process and thus affect the disposable income of households. The so-called 'functional' distribution of income between labour and capital can be read from the Generation of Income Account, though it is not possible to gather information about the 'personal' distribution of income (between different types of households) from the SNA. Price data not only inform the wage bargaining process, they are also crucial for the alignment of retirement pensions in countries with pay-as-you-go-systems, where pensions are automatically increased in line with inflation. (The same holds good for all price-indexed contracts such as – in some countries – mortgage loans.) Elsewhere, e.g., in Germany, retirement pensions should rise to the same extent as after-tax wages (although in recent years this rule was occasionally breached). So here we need wage data to calculate pension alignments. Both price and wage data could, in principle, be gathered from National Accounts. In practice, though, the time-lag in publication is too long, so that wage and price data are taken from other statistical sources such as consumer price and wage indices. These then serve as input for the construction of the 'real' – or constant price – time series in National Accounts.

Price data and inflation forecasts are also indispensable for gearing monetary policy. It is now consensus that the main task of central banks is to keep inflation under control. Since monetary policy has a time lag of up to three years in some countries, the central bank needs to forecast what will be the rate of inflation in the future if it keeps the interest rate unchanged. Central banks use regression equations and other models for that purpose. National Accounts data not only enter into the coefficients of these models. Also, projections of National Accounts data, e.g., of demand variables, are necessary to produce a forecast for the rate of inflation. If such a forecast signals that inflationary pressures will emerge in three years time, then, if this is the length of the monetary policy lag, the central bank will raise the rate of interest now. So, projections for National Accounts data have an impact on current interest rates and, hence, rentier income. Also, the exchange rates of the domestic currency will be affected. An interest rate hike leads to an appreciation of the currency in the short run. This has an adverse effect on the balance of trade, unless the development of the terms of trade acts as a counterbalance. The terms of trade are a measure for the overall competitiveness of the domestic economy. They are calculated as the ratio of export prices over import prices, which can both be read from the Goods and Services Account (being the last in the sequence of National Accounts). If the terms of trade improve – export prices rise faster than import prices –, then a greater basket of goods (and services) can be bought from abroad in exchange for a certain amount of domestic output. On the other hand, if export prices rise faster than import prices, this could impair the competitiveness of domestic exporters on the world market. In a small open economy, such a development could prompt the central bank to cut interest rates – aiming at a devaluation of the domestic currency to support the export industries.

If, in a country, fiscal policy follows an activist approach, then it will react to an unsatisfactory growth or business cycle outlook by taking discretionary measures. Traditional 'Keynesian' measures, i.e. deficit spending, are now widely out of fashion, especially in Europe, because it is believed that they irresponsibly add to public debt and thus overburden future generations. It is also argued that, since much time is lost debating over the measures in the parliamentary process, the phase of the business cycle might have changed until they become effective. So their repercussions will be pro-cyclical rather than anti-cyclical. As a

consequence of this view, fiscal policy now restricts itself to improving the general set-up of the economy (the supply conditions) in many countries in order to tackle dim growth prospects. This may involve tax-cutting or deregulation policies that aim at fostering competition and thus the competitiveness of the domestic economy.

The mistrust of discretionary fiscal policy has become so great that many countries have decided to adopt rules of conduct for their government politicians. One example is provided by the 'Maastricht criteria' which prescribe, amongst other things, that in (potential) member countries of the 'European Monetary Union' (EMU) the rate of consumer price inflation shall not exceed 2 percent, that the ratio of new public indebtedness to nominal Gross Domestic Product (GDP) shall not be higher than 3 percent, and that the ratio of gross public debt to nominal GDP shall not be higher than 60 percent. These criteria, which, in practice, place considerable constraints on both monetary and fiscal policy in the EMU, are all checked using (early estimates of) National Accounts data. Switzerland, to give another example, has adopted an expenditure rule that necessitates the planned expenditures of the federal government to be equal to the projected receipts multiplied by a 'business cycle factor'. This factor is calculated as the ratio of potential output over next year's forecasted output. Again, public expenditures depend on projections of National Accounts data.

Private businesses can also benefit from National Accounts. Input-Output matrices "can be converted to employment and capital requirements ... The projections are useful not only to enterprises in the various industries but also to governments in planning outlays for infrastructure, education, training and retraining, and so on" (KENDRICK 1996, p. 4).

3 Misuse of National Accounts in the context of governance

Although economic governance would be impossible today without the information embedded in the National Accounts, there is also a potential for *misusing* National Accounts data in the context of governance. The worst misuse of National Accounts comes along with international comparisons. This must be surprising – since national accounts have been conceived right from the beginning to serve this very purpose. What should we need an internationally agreed-upon standard – the SNA 1993 – for if not to allow for international comparisons? Indeed, the main impetus for the first SNA came from the lack of an objective criterion on which to base the dues of the United Nations. These are now calculated by a formula that includes per capita income – a national accounts magnitude. The same holds good for the contributions that its member states have to transfer to the European Union. Also, the World Bank assesses eligibility for loans or aid on the basis of a country's per capita income.

International comparisons are often suggestive and sometimes inescapable. Yet, the way in which international comparisons on the basis of National Accounts data are often carried out amounts to an abuse of this framework that might lead to questionable policy conclusions.

Let us take the debate over economic growth as an example. As a matter of fact, many European countries are experiencing declining growth rates of real GDP. While, from a theoretical point of view, international convergence in per capita income should be expected – so that declining growth rates in rich countries are to a certain extent normal (cf. MANKIW ET AL. 1992) –, there is one radiant counter-example: the United States. Since the mid-90s, the U.S. has outperformed 'Old Europe' with respect to economic growth. The gap between the transatlantic growth rates of real GDP has widened by as much as half a percentage point (PP) per year. National accounts data show this clearly (cf. Tab. 1).

Table 1: Difference in growth rates of real GDP USA – European Union (EU)

	GDP growth rate USA	GDP growth rate EU	Difference
1980-1997	2.6% p.a.	2.3% p.a.	0.3 PP p.a.
1997-2003	3.0% p.a.	2.2% p.a.	0.8 PP p.a.

Source: OECD Quarterly National Accounts

Can we conclude that other rich countries could also grow faster if only their institutions were adequately designed? – At least, this conclusion has been drawn in many European countries where public debate centres on the question how to devise 'structural reforms' in order to make the set-up of the respective economy more similar to that of the United States. Tax-cutting, reducing the size of the public sector, and 'labour market reforms' (e.g., introducing a low-wage sector, curtailing the influence of trade unions, and increasing either weekly or lifetime working hours) are typical ingredients of this kind of debate, which is also promoted by international organisations such as the OECD, the IMF, and the WTO. The main impact of National Accounts on governance can be found here.

We shall not discuss the theoretical validity of the arguments behind the debate just sketched out. Of course, the better growth performance of the U.S. could have other reasons than a more flexible labour market etc. Our point here will be that a careful analysis of the relevant National Accounts data reveals part of the U.S. lead in growth as a statistical artefact. The misuse of National Accounts in the context of macroeconomic governance consists in drawing policy conclusion from published numbers without scrutinising how these numbers have been constructed. The next section illustrates the problem by calculating the portion of the gap between transatlantic growth rates of real GDP that is solely attributable to differing methods to construct deflators on both sides of the Atlantic. As we will see, this portion is substantial.

4 Illustrative example: The influence of differing deflation methods on the trans-atlantic growth gap

In 1996, a commission headed by Michael Boskin concluded that the U.S. Consumer Price Index (CPI) was upward-biased by as much as 1.1 percentage points per year. In the aftermath of the Boskin-report, the U.S. *Bureau of Labor Statistics* (BLS) implemented several reforms in the calculation of the CPI[1] which prompted the published rate of consumer price inflation to go down. Since, in the U.S., approximately 50% of all expenditures that make up nominal GDP are deflated using CPI components, the elimination of an upward bias of 1.1 PP – if this was a proper estimate – would translate into an annual growth rate of real GDP that is higher by 0.6 PP (cf. ELDRIDGE 1999, p. 43).

The Boskin Commission identified four sources of upward bias in the CPI: the 'lower level substitution bias', the 'upper level substitution bias', the 'outlet substitution bias', and the 'quality change and new product bias'. In what follows, these biases – except for the 'outlet substitution bias' because the BLS has done nothing to eliminate it – will be explained; and the impact of their removal (or moderation, respectively) by the BLS on the rate of inflation and on the growth rate of real GDP will be quantified.

No reproach is implicit in these calculations. We do not share the opinion of, e.g., GRANT (2000) that the BLS is guilty of 'book-cooking'. However, one has to make clear that most European countries have not yet implemented reforms in the calculation of deflators

[1] BLS publishes several CPIs. We focus on the 'CPI-U', the 'Consumer Price Index – All Urban Consumers'.

comparable to those in the U.S. – and probably never will. The main reason for differing calculation methods is a different 'philosophy' on what the consumer price index should measure. In most European countries – the Netherlands and Sweden being exceptions – the statistical offices maintain the 'traditional' view that a price index should track the price of a certain basket of goods. It should be a 'cost-of-goods index' (COGI). In the U.S., however, the majority of statisticians are convinced that the consumer price index should reflect the development of the cost of living ('cost-of-living index', COLI), cf. TRIPLETT (2001a). In COGIs, the 'substitution biases' that occupy much space in the Boskin-report are no issue. Comparability is impaired by differing methods reflecting differing 'philosophies'; and it is unlikely that this problem will ever vanish.

It is tempting to ask: 'How much higher would growth in Europe be if the European statistical offices used U.S. deflation methods?'. However, the 'Balkanisation' of European statistics – every national office has its own conventions (cf. for instance AHNERT/KENNY 2004) –, in conjunction with the fact that comparative research on European price indexes has just begun (cf. WYNNE/RODRIGUEZ-PALENZUELA 2004), renders this question intractable for the time being. Alternatively, we could ask: 'By how much have the reforms increased real growth in the U.S.?'. Or, in other words: 'By how much would economic growth in the U.S. be lower if still the same deflation methods were used that are common in Europe?'. If we can answer this question, we will obtain growth rates for the U.S. that can be compared with European rates on an equal footing.

4.1 Removal of the lower level substitution bias

4.1.1 Impact on the rate of consumer price inflation

A 'cost-of-living index' must be able to display the fact that consumers tend to substitute goods and services that become relatively more expensive for others that become cheaper. If it cannot, then the index is 'upward-biased', that is, it indicates more inflation than there actually is.

Substitution can take place within the same basic spending category of the CPI –known as *Entry level items* (ELI), for example 'Apples' – or across ELIs. If a 'Granny Smith' becomes more expensive, you can substitute it for a 'Golden Delicious' – or you choose a fruit from another ELI, for example 'Bananas' or 'Citrus fruits'. Substitution of an apple for an apple would be a 'lower level substitution'; the switch from apple to banana is an example for an 'upper level substitution'.

The Boskin Commission's estimate for the 'lower level substitution bias' in the published rate of inflation was 0.25 PP per year. To remove it, the Commission proposed to change the way the mean price is calculated for each ELI.[2] Instead of the arithmetic mean, the geometric mean should be computed. It is possible to show that, if the elasticity of substitution between goods is one, then a geometric mean captures exactly the change in the cost of living (cf. MOULTON/SMEEDLY 1995). Moreover, explorations at the BLS had shown that the use of the geometric mean leads to an attenuation in the rise of the index, and the difference was more or less arbitrarily interpreted as 'lower level substitution bias' (cf. TRIPLETT 2001a, p. 124-125, for a critique).

Since January 1st, 1999, the BLS uses the geometric mean formula for the purpose of elementary aggregation for 61% of the ELIs. The geometric mean understates the rise in the cost of living when substitution between goods or services does not occur and thus would introduce a downward bias into the CPI in these cases. BLS doubts the existence of substitution behaviour for 39% of the ELIs, including shelter, public utilities, and health care.

[2] This procedure is called 'elementary aggregation'.

The removal of the 'lower level substitution bias' led to a 0.21 PP drop in the annual rate of inflation (cf. ELDRIDGE 1999, p. 41). This roughly conforms to the estimate of the Boskin Commission.

4.1.2 Impact on the growth rate of real GDP

SESKIN (1999) reports the results of the 1999 Revision of the U.S. *National Income and Product Accounts* (NIPAs) in the official journal of the *Bureau of Economic Analysis* (BEA).[3] Every 3-4 years, BEA carries out Comprehensive Revisions of the NIPAs; and it uses these opportunities to introduce new methodologies, definitions or improved data. The NIPA time series are then calculated backwards to 1959 (or even to 1929) on the new basis so that every Comprehensive Revision changes U.S. economic history to some extent. A comparison of the old and new time series reveals the effects of the statistical revisions on levels and growth rates. 1999 marked the introduction of the geometric mean formula for the purpose of elementary aggregation not only to the CPI, but also to the NIPA deflators. As a result of the 1999 Comprehensive Revision, the growth rate of real GDP was revised upward by 0.4 PP p.a. over the period 1995-98 (cf. SESKIN 1999, p. 17).

But the switch to the geometric mean formula was not the only reform BEA introduced in 1999. Also, and equally important, were the expenses of enterprises and the government for software reclassified. These counted no longer as intermediate inputs, but as capital formation instead. Since intermediate inputs do not increase GDP, but investments do, this reclassification had an impact on the GDP level. And because software production is a business that currently grows faster than the overall economy, the growth rate of GDP was also pulled up for recent years. JORGENSON/STIROH (2000, Tab. 2) estimate that software investment contributed 0.2 PP to real annual growth in the U.S. over the period 1995-98. Taking this estimate for granted, we can attribute the other half of the 0.4 PP increase of the GDP growth rate after the 1999 Comprehensive Revision to the removal of the 'lower level substitution bias'.

Here, we are only interested in the effects of statistical *differences* between the U.S. and European countries on published growth rates. The reclassification of software (outside the household sector) as capital good is no such difference. In the meantime, all OECD countries (except Turkey) count the respective software expenses as investment. But note that not all countries follow the U.S. practice of calculating their time series (far) backwards after switching to new methodologies or definitions. If they don't, then their historical GDP-levels and recent growth rates are biased downward vis-à-vis the U.S.[4]

Table 2 (below) summarises the estimates of the quantitative impact of U.S. reforms to deflation methods on inflation and real growth along with the sources of these estimates and a 'period'. The 'period' is the year for which the estimate has been calculated or the period of time over which annual growth rates have been averaged in the sources. As can be seen from the table, the periods do not always overlap. But that doesn't matter as long as we assume that the effect within the respective periods can be extrapolated. In other words, we assume that, were the reforms revoked, the respective growth rates would fall back to their status quo ante. This seems to be a plausible assumption for most cases – except perhaps for the impact of the removal of the 'upper level substitution bias' on real growth (see below).

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[3] The BEA, not the BLS, is the statistical office in charge with the U.S. National Accounts.

[4] Note also that the reclassification of software expenses only increases GDP in software-producing countries. If a country imports all its software, then the reclassification is GDP-neutral (except for a small positive effect coming from capital consumption).

4.2 Removal of the upper level substitution bias

4.2.1 Impact on the rate of consumer price inflation

The Boskin Commission also criticised the CPI for not taking account of the possibility for consumers to reduce their cost of living by substituting goods and services across *Entry level items*. The Commission estimated that this default would introduce an upward bias of 0.15 PP per year into the published rate of inflation.

The 'upper level substitution bias' is in fact a problem of outdated weights. The CPI is a hierarchical construct, with the ELI being its basic category. A sequence of aggregations leads up to the top-level 'Major Groups', like 'Food and Beverages', which are then aggregated to obtain the CPI. Each category in the CPI carries a certain weight; only the goods or services entering the ELIs, e.g., different apple brands, are not weighted.[5] But for all component indexes from ELI up, weights have to be chosen. It is straightforward to take the share of spending for, e.g., apples in all consumers' spending as the weight of the ELI 'Apples' in the index.

'Upper level substitution' leads to a rearrangement of the consumer basket and to new *de facto* weights for the components. So, frequent updating of the index weights to adapt them to the new *de facto* weights would remove the 'upper level substitution bias'. This is exactly what the Boskin Commission recommended.

Beginning with 2002, BLS updates CPI weights every second year based on the BLS *Consumer Expenditure Survey*. This should have eliminated the 'upper level substitution bias'.[6]

A solution to the problem of outdated weights alternative to updating them every second year on the basis of the *Consumer Expenditure Survey* would be to calculate a 'chain index'. The CPI-U is no chain index, but BLS also computes such a chain index, the 'C-CPI-U'. In a chain index, weights are updated every period by taking either the share of spending for, e.g., apples in all consumers' spending in the (at any one time) previous period as a weight – as in the (chained) Laspeyres-Index – or the mean of this share over two adjacent periods (as in the Fisher- and Törnqvist-Indexes).

4.2.2 Impact on the growth rate of real GDP

The weighting issue is also crucial for the calculation of real growth. GDP growth is a weighted average of the growth of the components of GDP (consumption, investment etc.), with the growth of each component on its part being a weighted average of the growth of the various sub-components. SNA 1993 recommends to resolve the weighting problem by taking the share of each component in previous year's nominal GDP as a weight – respectively the share of each sub-component in previous year's nominal value of the higher level component. This is tantamount to calculating 'real' GDP as a chained Laspeyres volume index.[7] In the U.S., the BEA has chosen to use a chained Fisher-Index instead and has implemented chaining in the course of the 1995/96 comprehensive NIPA revision. While the choice of the index formula – Laspeyres vs. Fisher – has no substantial impact on international

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[5] The average price for apples is calculated by applying the geometric mean formula to all apple sales (see Section 4.1).

[6] This conclusion is in accordance with the ECONOMIC REPORT OF THE PRESIDENT (1999, p. 94), which forecasts a reduction of 0.17 PP in the rate of inflation thanks to the regular updating of the CPI weights. These 0.17 PP can be split into 0.15 PP due to the removal of the 'upper level substitution bias' and 0.02 PP as a result of the moderation of the 'new product bias', which is a part of the 'quality change and new product bias' (see below). Cf. HARTWIG/SCHIPS 2005 for greater detail.

[7] Henceforth, 'real' is put in inverted commas in 'real GDP' to make clear that 'real' GDP is no bulk of things. 'Real' GDP is nothing but a volume index.

comparisons, the switch to chaining has. The former practice was to use the component shares in nominal GDP not in the previous year but in a fixed 'base year' as weights and to update the base year every ten years. (The last base year in the U.S. was 1987.) Obviously, the switch to chaining was a reform of deflation methods. It was a new choice of relative prices deemed relevant to weighting. Components that increased their share in total GDP recently get a higher weight. Here we can see the analogy to the removal of the 'upper level substitution bias' in the CPI most clearly (cf. also TRIPLETT 1997, p. 22).

Under the old regime, when an economic sector or GDP component was growing fast, and with falling prices, its weight in the total economy was still evaluated at the old prices of the base year – which were still 'high'. So, overall growth was reported higher than under the new regime. BEA believes this to be the typical case and, therefore, maintains that the switch to chaining would *lower* 'real' GDP growth (cf. LANDEFELD/GRIMM 2000, p. 18-19). On the other hand, there are also sectors and GDP components that exhibit fast growth at rising prices, e.g., the production/consumption of health care services. Here, chained volume indexes show higher growth rates than fixed-weight indexes. Which tendency is predominant, is an empirical question. In the U.S., the switch to chaining – as opposed to fixed 1987 weights – *raised* the growth rate of 'real' GDP by 0.4 PP p.a. on average over the period 1959-1972 and by 0.1 PP p.a. between 1973 and 1994 (cf. LANDEFELD ET AL. 1995, p. 35).

There could be doubts, however, that this value of 0.1 PP p.a. can be extrapolated into the future. If the LANDEFELD/GRIMM (2000) argument is valid, then chained indexes would exhibit higher growth rates than fixed-weight indexes before the base year of the fixed-weight index and lower growth rates afterwards (cf. SCARPETTA ET AL. 2000, p. 86). SCHREYER (2001, pp. 354-356) presents evidence for five countries that Fisher volume indexes of final expenditure grow slower than the corresponding fixed-weight Laspeyres indexes subsequent to base years. KOHLI (2004, p. 349), on the other hand, shows that the chained Törnqvist volume index of 'real' GDP displays higher growth than the Laspeyres volume index with fixed 1960 weights for 20 OECD countries out of 26 over the period 1960-1996.[8] Since the U.S. is in both samples, the empirical evidence is mixed.

If we suspect that the removal of the 'upper level substitution bias' has raised the growth rate of 'real' GDP in the U.S. after 1996 by 0.1 PP or so, we have to concede that the transatlantic comparability of growth rates is thereby impaired since half of the EU countries (including the 'heavy weight' Germany) have not yet changed their national accounts to a chained, annually re-based Laspeyres method (cf. AHMAD ET AL. 2003, p. 28). It is planned that these countries will have followed by the end of 2005.

4.3 Removal of the quality change and new product bias

4.3.1 Impact on the rate of consumer price inflation

The Boskin Commission allocated more than half of the upward bias that it perceived to the 'quality change and new product bias'. If this bias were completely eliminated, the annual rate of consumer price inflation would be 0.6 PP lower, according to the Commission.

Surprisingly – given the presumed magnitude of this bias –, the Commission made no concrete proposals how to remove it. The BLS took action itself and in 1998 adopted the so-called hedonic method for deflating expenses for certain goods whose quality improves quickly. The hedonic method constitutes one of several possibilities to cope with the fact that goods and services whose price development one wishes to measure may change in quality. The basic idea is to estimate the money value of certain product characteristics by performing statistical regression analysis on cross-section or pooled data. The hedonic method seems to

[8] The Törnqvist index has properties similar to the Fisher index.

lend itself especially well to computer hardware. On the one hand, hardware quality (computing speed) improves quickly, whereas the price for a desktop computer remains rather stable. This means that there is a large difference between a quality-adjusted and a non-quality-adjusted price index for computers. On the other hand, all relevant product characteristics, like computing speed or memory size, can be easily quantified (which is necessary for the regression analysis). The estimated coefficients are used to deduce the estimated money value of quality improvements from price increases. If prices, e.g., for desktop computers remain stable, then the quality-adjusted price index will show a decline in desktop prices.

In the meantime, BLS uses the hedonic method not only for calculating quality-adjusted prices for desktop computers, but also for TV sets, DVD players, VCRs, camcorders, audio systems, micro wave ovens, refrigerators, freezers, washing machines, tumble-dryers, college textbooks, non-residential structures, photocopying equipment and possibly other goods – their number increases continuously. Already some time ago, MOULTON (2001) noted that 18% of all expenditures that make up nominal U.S. GDP were deflated using price indexes that use hedonic methods. It has to be emphasised, however, that the switch to hedonic techniques has not always lowered the rate of price increase; for some goods and services the latter has increased (cf. HARTWIG/SCHIPS 2005 for further detail).

The removal of the upward 'quality change bias' in the CPI with the help of hedonic techniques had no great impact on the rate of consumer price inflation, though. This is revealed by a comparison of the CPI-U with another index published by BLS, the 'Consumer Price Index Research Series Using Current Methods' (CPI-U-RS). The CPI-U-RS answers the question how the CPI would have developed, if the current up-to-date definitions and methodologies had already been in use in December 1977 (the starting point of that series). The CPI-U itself is never revised since it forms the basis for numerous indexed contracts and also for adaptations of social benefits. Hence, the difference between the two series is a measure for the impact of CPI revisions on the index level. If a revision was introduced in, e.g., in Jan. 1999, we can evaluate its impact on the index level over the *earlier* period Dec. 1977 – Dec. 1998 because the CPI-U-RS calculates the revision backwards. We can then extrapolate the difference between the two series by assuming that from Jan. 1999 onwards, the revision lowers the CPI-U by the amount of the difference.

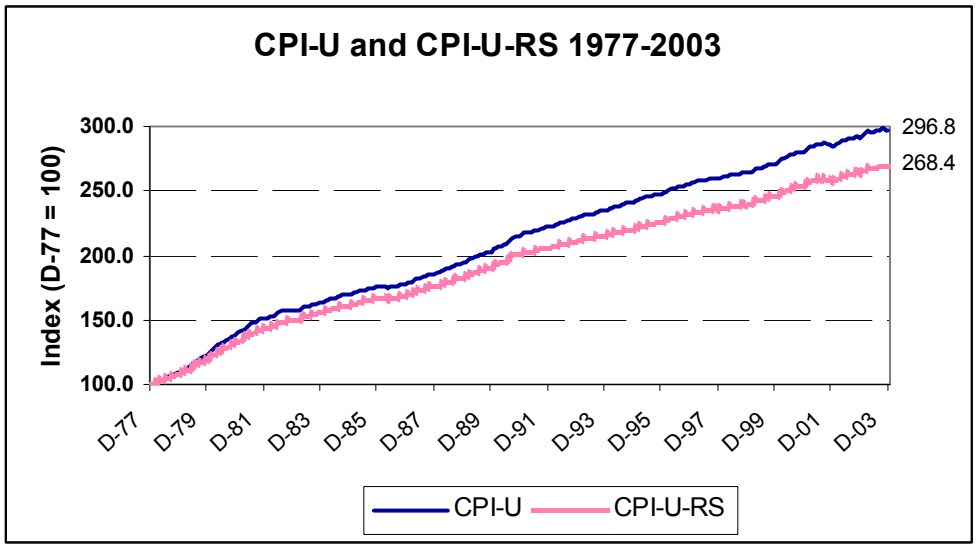
STEWARD/REED (1999) examine the magnitude of the difference between the CPI-U and the CPI-U-RS as well as its sources. Over the period 1978-1998, the CPI-U-RS grew with an average annual rate of 4.28% while growth in the CPI-U amounted to 4.73%. But we cannot attribute the difference of 0.45 PP per year entirely to the CPI revisions in the aftermath of the Boskin report.[9] A closer inspection shows that the gap between the two series opens up in the late seventies and early eighties as a consequence of a revision to the calculation of homeowners' implicit rent in 1983. Before 1983, real estate prices and capital costs were used to approximate homeowners' implicit rent. These rose quickly at that time. Since 1983, BLS takes rent equivalents as a proxy for homeowners' implicit rent. This revision was the only significant action taken to remove any upward bias from the CPI before 1998 (cf. STEWARD/REED 1999, p. 31). So, if we concentrate on the period from 1983 onwards, we get an accurate estimate of the impact of the 'Boskin revisions'.

Carrying Steward & Reed's analysis forward to Dec. 2003 – the current end point of the CPI-U-RS – and focussing on the period Dec. 1982 – Dec. 2003, we find that the CPI-U grows on average 0.25 PP faster than the CPI-U-RS each year (cf. Fig. 1). Of these 0.25 PP

[9] At the time Steward & Reed wrote their contribution, two of these revisions were already in effect: 1) the hedonic quality adjustment of prices for Computers and TV sets, and 2) the switch to the calculation of geometric means in the process of elementary aggregation.

we know 0.21 PP to be attributable to the removal of the 'lower level substitution bias' (see above). The 'upper level substitution bias' and the 'new product bias' are not removed from the CPI-U-RS because component weights are not updated in this index (cf. STEWARD/REED 1999, p. 34). So we can conclude that the difference between 0.25 PP and 0.21 PP, i.e. 0.04 PP, must be attributable to the removal of 'quality change bias' through the use of hedonic techniques.[10] 0.04 percentage points are not much. But such a low value is coherent with the fact that the lion's share of the removed upward bias falls on computers (cf. LANDEFELD/GRIMM 2000, p. 18) which (together with peripheral equipment) merely carry a weight of 0.23% in the CPI (cf. BLS 2004, Appendix 4).[11]

Figure 1: *Consumer Price Index – All Urban Consumers* (CPI-U) and *Consumer Price Index Research Series Using Current Methods* (CPI-U-RS)



Source: BLS homepage (http://www.bls.gov)

4.3.2 Impact on the growth rate of real GDP

Computers are not only consumption goods, but also – and more prominently – capital goods for business firms and the government. Hedonic quality adjustment of computer prices in the U.S. goes beyond making adjustments to the Consumer Price Index. As early as 1985, the *Bureau of Economic Analysis* adopted the hedonic method for the quality adjustment of the GDP deflator, especially for the capital goods deflator that enters it (cf. MOULTON 2001, p. 4). According to BEA's hedonic deflator, computer prices dropped by 88% between 1986 and 1998 (cf. TRIPLETT 2001b). This huge decline in quality-adjusted computer prices was fully reflected in the U.S. GDP deflator and increased 'real' spending on computers – and thus 'real' GDP – since before the beginning of the genuine computer boom. Now it becomes clear why, in the comprehensive NIPA revision of 1999, the growth rate of 'real' GDP was revised

[10] In Tab. 2, these 0.04 PP are added to our estimate of 0.02 PP for the 'new product bias' (see above) to yield an estimate for the removal of the 'quality change and new product bias' of 0.06 PP.

[11] Our estimate for the removed 'quality change and new product bias' of 0.06 PP deviates from the Boskin Commission's estimate of 0.6 PP by factor ten. This is explained by the fact that the Commission defined the upward 'quality change bias' very broadly to include such things as the improved safety of air travel, higher freshness of fish thanks to better transport facilities or the reduction of pain thanks to minimum invasive surgery (cf. GORDON 2000, p. 29). Obviously, hedonic techniques are incapable of removing these kinds of biases.

upwards 'merely' by 0.4 PP p.a. over the period 1995-98 (see above). The 'quality change bias' had already been addressed since 1985; and the 'upper level substitution bias' had been removed in 1995/96. Only the 'lower level substitution bias' was eliminated in 1999.

The U.S. was the first nation to introduce a quality-adjusted price index for computers into their National Accounts. Seven EU15 countries still don't apply hedonic methods at all; in the other eight countries, the use of hedonics is very limited compared to the U.S. (cf. AHNERT/KENNY 2004, pp. 27-28). So, to establish better comparability, we might ask how much U.S. growth would have been lower if computer prices had not been quality-adjusted.

VANHOUDT/ONORANTE (2001) try to answer this question on the basis of the traditional 'growth accounting' approach.[12] They contrast the official deflator of the U.S. fixed capital stock (which has quality-adjusted computer prices) with a 'traditional' deflator that does not adjust computer prices for quality changes. They construct the latter using data from JORGENSON/STIROH (2000). Since computer prices are higher in the 'traditional' deflator, the whole index is pulled up vis-à-vis the official deflator. Hence the 'real' capital stock, which enters into the growth accounting, is smaller. Vanhoudt & Onorante calculate the growth rate of U.S. labour productivity using their alternative estimates for the 'real' capital stock and compare it with the official data. They find that, without hedonic adjustment of computer prices, labour productivity growth was 0.19 PP p.a. slower over the period 1995-98 than with such an adjustment made.[13] This means that the removal of the upward 'quality change bias' in the GDP deflator through hedonic quality adjustment of computer prices has increased the growth rate of 'real' GDP by 0.19 PP p.a. also (cf. Tab. 2).

SCHREYER (2001) adds communication technology as well as a range of electronic appliances to the picture. His approach is to calculate two different price indexes for each of the ICT products – one with full quality-adjustment of the prices in question, the other without any quality-adjustment at all. For each product, Schreyer takes 'lower bound' estimates of the difference in growth rates between the two indexes from the literature. These are 10 PP p.a. for computers and 2 PP p.a. for most other products. Schreyer deflates current ICT expenditures with both the adjusted and the unadjusted price indexes and then aggregates over all goods and services. He thus arrives at two different fixed-weight Laspeyres volume indexes for total final expenditure. With quality-adjusted ICT-prices, 'real' U.S. final expenditure grew 0.29 PP p.a. faster over the period 1987-93. (Remember that this has to be interpreted as a lower bound, according to SCHREYER.[14]) Admittedly, final expenditure differs from GDP, with the difference consisting in 'changes in stocks'. SCHREYER (2001, p. 353) claims, however, that the bias generated by this omission is small.

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[12] 'Growth accounting' was introduced by SOLOW 1957.

[13] Cf. VANHOUDT/ONORANTE 2001, p. 77. An error has sneaked into their Table 6, but the correct figures are in the text.

[14] 'Real' final expenditure grows faster based on the quality adjusted price index for ICT products in all five countries examined by Schreyer. The difference in growth rates ranges from 0.03 PP p.a. (Canada) to 0.73 PP p.a. (Japan), cf. SCHREYER (2001, pp. 354-356).

Table 2: Impact of statistical changes on the rates of inflation real GDP growth in the U.S.

Bias removed	Rate of inflation (PP p.a.)	GDP growth (PP p.a.)
Lower level substitution bias	**–0.21**[a]	**0.20**[b]
Upper level substitution bias	**–0.15**[c]	**0.10**[d]
Quality change & New product bias	**–0.06**[e]	**0.19**[f]**–0.29**[g]

[a] Source: ELDRIDGE 1999; Period: 1997
[b] Sources: SESKIN 1999, JORGENSON/STIROH 2000; Period: 1995-98
[c] Sources: ECONOMIC REPORT OF THE PRESIDENT 1999, HARTWIG/SCHIPS 2005; Period: since 2002
[d] Source: LANDEFELD ET AL. 1995; Period: 1973-94
[e] Sources: ECONOMIC REPORT OF THE PRESIDENT 1999, HARTWIG/SCHIPS 2005; Period: 1983-2003
[f] Source: VANHOUDT/ONORANTE 2001; Period: 1995-98
[g] Source: SCHREYER 2001; Period: 1987-93, based on a fixed-1987-weights Laspeyres volume index of final expenditure

There is an additional positive effect of hedonic deflation on 'real' growth which is not related to the capital or ICT deflators. Though probably important, this effect is absent from Table 2 since no evidence exits up to date how to quantify it.

This additional effect concerns the value added of the wholesale and retail trade sectors, which are among the largest service industries. The value added in each sector is measured by the value that it literally 'adds' to purchased 'intermediate inputs'. In wholesale and retail trade, value added is defined as the trade margin. To arrive at the 'real' value added, the trade margin has to be deflated. In the U.S., a sales price index is used to deflate the trade margin while in Europe it is normally assumed that trade services grow in proportion with the volume of sales. BEA's use of a sales price index that is adjusted for quality change as deflator in fact implies that the sale of higher quality goods requires more effort on the part of the trade industries than the sale of goods of lower quality. While this might be a defensible proposition in some cases,[15] transatlantic comparability of 'real' growth rates is nevertheless impaired since the European countries use different deflation methods. AHMAD ET AL. (2003, p. 25) show that the U.S. trade deflator has not risen at all between 1993 and 2001 while, over the same period, the German deflator has risen by 30%, and the Italian by 20%. Concomitantly, 'real' value added per employed person in the wholesale and retail industry has increased by 40% in the U.S., but only by 10% in Italy, and not at all in Germany.

As said, it is hard to distinguish 'really real' productivity increases in U.S. trade from statistical artifacts; but the fact that the distribution industry – together with residential building – is considered as the motor of U.S. expansion since the second half of the nineties should keep us vigilant with regard to measurement biases in the context of international comparisons of economic performance. Further research is needed in this area.

Conclusion

Useful as they are as a source of information for anybody in charge with macroeconomic governance tasks, National Accounts can also be misused in the context of governance. The current debate over economic growth that comes along with a plethora of international

[15] TRIPLETT/BOSWORTH (2004, p. 240) remain sceptical, though, with respect to computers. Electronic stores sell boxes filled with computers. The salesperson's effort is hardly associated with the technical characteristics of the machine inside the box. Even so, electronic stores have witnessed the strongest productivity growth of all outlet categories in the U.S. between 1987 and 2001, according to official statistics (cf. TRIPLETT/BOSWORTH 2004, Table 8-1).

comparisons performed, rankings compiled, and far-reaching policy conclusions drawn can serve as an example of such a misuse. In many European countries, the seemingly better U.S. growth performance has spawned plans for 'reforms' that would make the set-up of the respective economy more similar to that of the United States. Tax-cutting, reducing the size of the public sector, and 'labour market reforms' (e.g., introducing a low-wage sector, curtailing the influence of trade unions, and increasing either weekly or lifetime working hours) are typical ingredients of such reform plans, which are also promoted by international organisations such as the OECD, the IMF, and the WTO. Yet, a comparison of Tables 1 and 2 of the present paper shows that the divergence in growth rates between the U.S. and the EU since 1997 can basically be explained in terms of changes to deflation methods that have been introduced in the U.S. after 1997, but not – or only to a very limited extent – in Europe.[16] It is hoped that this finding will inform forthcoming reform debates.

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[16] There are known issues other than differing deflation methods that impair transatlantic comparability of National Accounts data, such as the treatment of 'Financial intermediation services indirectly measured' or the expenditures for military equipment in the respective accounts. But evidence exists that, although these differences bias the comparison of GDP-levels, their influence on GDP-growth rates is negligible (cf. HARTWIG 2005 for more detail).

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