Stefan Linz, Andrea Röper, Peter Taschowsky

The debate on hedonic price measurement – a never ending story?

1. Motivation

Although discussions on quality adjustment in consumer price statistics mainly took place at the end of the 1990's and at the beginning of the last decade, the usefulness of hedonic price measurement is still frequently challenged, even by professional users and within the statistical system.

Two aspects might keep the discussion going: First, the strong price reductions which are sometimes resulting from the application of hedonic quality adjustment (especially in the IT domain) do not always match perceptions of users of statistics and statisticians themselves. Second, the theoretic concepts in quality adjustment can not always be adapted one-to-one in practice and do in this way leave much room for interpretation in terms of implementation and application.

Both aspects may be connected to a basic approach usually applied in official price statistics, characterised by dividing goods into relatively tightly specified product groups and tracing prices within these categories separately. Aggregate price changes are then calculated as weighted averages of the price developments observed for individual product groups, which might not be adequate for complex markets such as the IT sector.

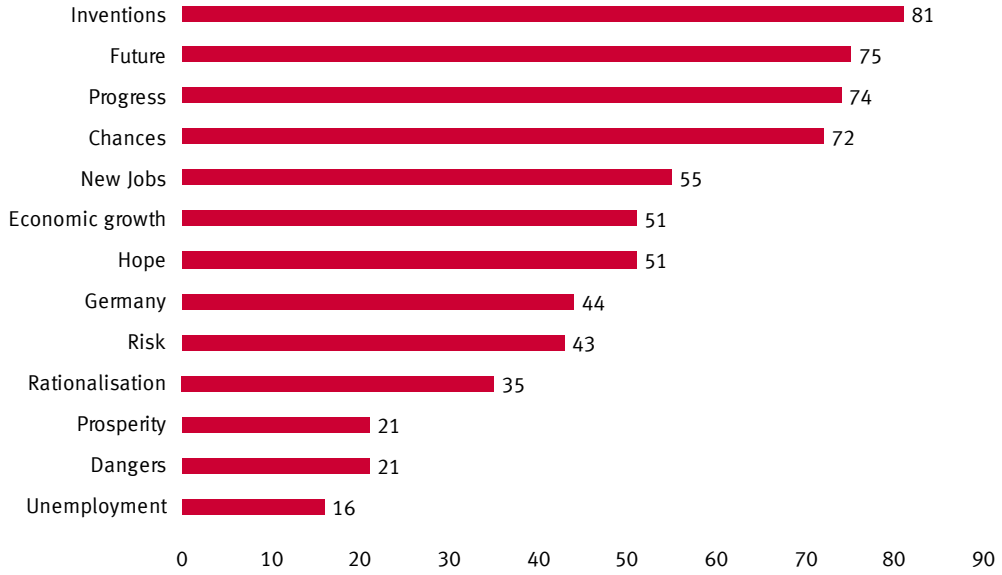
In a computer magazine, the technical development was recently described as follows: If in the year 1985 someone wanted to transport 9 gigabyte of data in digitalised form – roughly the content of a movie DVD – he would have needed a minibus to load 450 of the formerly typical storage discs of 20 megabyte. Today, twice this amount of data – for example a private music collection – can be transported on a MicroSD Card of the size of a thumbnail in a mobile phone.

The technical development is enormous, but why does this narrow comparison of storage space seem inappropriate? In 1985, movies or music were of course not transported on digital storage units but on video cassettes or records. The utility of a digital storage of movies or music would have been minimal at the time, if only because there were no appropriate playback devices. On the other hand, the rapid technical progress, which is represented by the development of storage media, has brought along innovations which generate utility in other (and partly new) areas. It is only because of enormous decreases in size and price of storage units, of fast processors and strong rechargeable batteries that a mobile phone can nowadays be used as a mobile music playback device. Further, equipped with a highly developed display it also serves as photo and video camera, navigation system, via the internet it offers access to complete encyclopaedias, dictionaries and daily newspapers – and you can use it to telephone.

The evolution of information technology is a pacemaker for many developments, but they often unfold their relevance to consumer utility in interaction only. Also, technical progress may rather be reflected in the appearance of new products than in improvements of the existing ones. Obviously, there is a relation between technical progress and utility, but it is hardly

ever monotonous and often indirect. In a recent survey, German respondents were asked what they associate with innovation. Prosperity was only associated by about one in five respondents.[1] The benefit from innovation and technical progress appears to be less clear-cut than perhaps assumed in our statistical concepts.

Figure 1: Associations of respondents in Germany with innovation



Source: Institut für Demoskopie Allensbach (2009), IfD-Umfrage 10035

Which conclusions can be drawn from the point of view of a Statistical Office, committed to the delivery of monthly inflation figures with a restricted budget of time and workforce? As consumer utility is unobservable, statisticians have to confine themselves to referring to measurable proxy variables which are expected to be roughly associated to changes in utility and the consumer costs of creating it. A brief overview of currently applied approaches and basic developments in the month-to-month calculation of quality adjusted price indices in the European Union and Germany is given in section 2 of this paper.

In parallel to the monthly index calculations, research should address the correlation of current results of compiling consumer price indices with postulated or perceived changes in costs and benefits of technical developments from the consumer perspective.[2] The problem of complementary products, the appearance of new products and the conditions relevant to the use of a product should be accounted for. Such in-depth studies could be conducted within research projects with limited durations and in parallel to the monthly price statistics production. Consumer surveys on perceived utility might play a role in such projects. A number of issues and some possible approaches to tackle them are outlined in section 3.

The focus in this paper is on technical products like consumer electronics since hedonic methods are mainly applied in this domain. Some aspects discussed here may however be transferable to other areas like clothing for example.

[1] See Institut für Demoskopie Allensbach (2009), IfD-Umfrage 10035.
[2] A consumer perspective has also proposed in Sellwood, D. (2010), On a Process for the Determination of Quality Change in the Harmonized Indices of Consumer Prices, paper prepared for the HICP Working Group meeting 21-22 June 2010 in Newport.

2. Month-to-month production of quality adjusted indices in the EU and in Germany

The basic objectives of price measurement in the EU and in Germany (as well as in many other countries) are defined in consideration of practical aspects. The Harmonised Consumer Price Indices (HICPs) for example, which are calculated for inflation measurement in the EU do explicitly "not aim at measuring the change in costs necessary to maintain a constant standard of living".[3] Bearing in mind fundamental problems of observing and aggregating consumers' utilities, for example such as dealt with in this paper, price measurement sets in on a more practical level. The Laspeyres-type index itself is defined as being the fundamental concept of calculating Consumer Price Indices (CPIs) in the EU and in Germany. Following this principle, the universe of goods and services is divided into product groups and the prices are traced within the groups. CPIs are calculated as average price developments, weighted according to previously established expenditure patterns which are kept fixed for a certain time period.

In order to adapt the Laspeyres principle in practical CPI compilation, so-called "consumption segments by purpose" are defined, which build the notionally fixed objects in the indices.[4] A consumption segment is a relatively wide product specification which remains constant throughout an index period; within this segment usual selection procedures (mainly purposive sampling or cut-off-sampling) are applied to select a set of representative products. Over time, the products within a certain consumption segment can be replaced in a flexible manner in order to adequately reflect current market conditions. For the HICPs, regulations lay down that products losing their representativity have to be replaced in due time in order to ensure that the sample of products remains representative of their respective consumption segment at any point of time.[5] Since the Laspeyres principle requires excluding price effects due to changed products, quality adjustment procedures are applied in the case that the replacement products are not directly comparable to the initially chosen products. The observed current or reference prices are reduced or increased by a factor or an amount equivalent to the "value of the quality change". According to the EU regulation, the value of quality changes should be based on explicit estimates.[6] Where no estimates are available, price changes should be estimated as the whole difference between the price of the substitute and that of the replaced item.

The underlying economic rationale of this kind of index calculation and quality adjustment within a product group may be described by the following very simple model – although such a model is not explicitly described or mentioned in any regulations or basic documentations. According to this model, the price, which can be realised by a certain product supplier, may be thought as being composed of two elements: A basic price which is relevant for all products belonging to the common product variant and a price-premium, which can be realised by a supplier due to specific product features, and which is different for different product variants {A, B, C,...}.

P^A = basic price + premium (A)

For example, the basic price may be an average of the prices observed for a standard product variant available on the market. It is assumed that a realised positive premium for the average prices of other product variants would mean that the specific features of these products constitute each a certain "unique selling proposition" and allow the respective suppliers to raise their

[3] See Ahnert, H. and G. Kenny (2004), Quality Adjustment of European Price Statistics and the Role for Hedonics, ECB occasional paper series No. 15, p. 7.
[4] See European Commission (2007), Commission Regulation (EC) No 1334/2007, amending Regulation (EC) No 1749/96, Brussels, article 2a (4).
[5] See ibidem, article 2a (8).

prices above the basic level. The premium thus reflects the willingness of the consumer to pay for certain product features – or the additional consumer value as perceived by the buyers of the product. The amount of *premium* is thus a measure for *product quality*. On the other hand, the development of the *basic price* over time determines the overall *inflation* in this product group.

A prerequisite for the use of this model in price statistics is that quality differences as perceived by consumers are reflected in measurable variables or are at least correlated with such variables. Here, it does not matter if products really differ in technical features or just in form, colour or brand name, as long as these attributes can be objectively observed and measured. Likewise, the measurable attributes do not have to be deemed relevant by any kind of institution such as for example consumer protection services. The only thing that matters is that consumers have revealed different levels of willingness to pay for the different product variants. Thus, there has to be a measurable relation between the product variants {A, B, C,…} and the average product prices $\{P^A, P^B, P^C, \ldots\}$ which are paid at one point of time. In case there are no such price differences between product variants, the product variants might be regarded as economically equivalent.

However, there might be quality differences between the observed product variants, which cannot be allocated to measurable attributes but to latent characteristics such as fashion or design. Those attributes are not only relevant for clothing or furniture, but play an increasingly important role also for technical goods. Nowadays, technology has become an integral part of consumers' lifestyle, and as with other lifestyle categories, rapid shifts in usage preferences are occurring.[7] This kind of quality cannot be tackled in this model. Another and in some respect similar issue of unobservable variables is the expected lifetime of products. Technical durables are expected to have a certain lifetime in which they are of benefit. The shorter the lifetime, the higher are the user costs for example of a dishwasher or a washing machine. Parts of the problem could be tackled within the "premium model", when certain brand names may hint at certain attributes. In Germany, higher life expectancies may be associated by consumers with brand names like "Miele" or "Mercedes". This is however a very uncertain relation. An even worse problem occurs when there is a general trend towards shorter product lifetime in the sector, which is relevant for all product variants. In this case, the model fails to capture the implicit price increase.

A further prerequisite of the "premium model" is that the spread of different prices due to different premiums, as observed in a previous period of time for the product variants, can be carried over into the current period. This suggests that the model should rather be applied for the measurement of inflation in situations with only slight product changes. The practice of chaining quality adjusted indices which compare changes in short periods is not a real solution here as chaining rules out the price effect coming with the introduction of new product variants. Thus, any major technical developments and their effects on consumer price developments cannot be handled within the model.

But within the limitations mentioned above, the "premium model" can be applied in practice for the calculation of quality adjusted price indices. Different methods have been developed and tested for their practicability in month-to-month price measurement, as described in the European "Handbook on the application of quality adjustment methods in the Harmonised Index of Consumer Prices".[8] Hedonic methods allow a very consistent technical operationalisation of the

[6] See ibidem, article 5 (6). See also Eurostat (2011), Statistics Explained, HICP Methodology.
[7] See Accenture (2011), Finding Growth: Emergence of a New Consumer Technology Paradigm, p. 3.
[8] See Linz, S. et al. (2009), Handbook on the Application of Quality Adjustment Methods in the Harmonised Index of Consumer Prices, Wiesbaden.

premium model and can be applied in a universal way, but are expensive with respect to data requirements and knowledge of statistical methods. Other explicit quality adjustment methods, which also implicitly refer to the premium model, are "option pricing" or the use of so called "comparable models" in expert judgement.[9]

Not all markets for consumer durables are characterised by technical progress and continuous quality improvements over time, by which more or less all models are affected in a similar way. In this case, it is justifiable to further narrow down the range of product variants coming into consideration for replacements in order to reduce the scale of quality changes connected with replacement. The use of such "tight product specifications" in combination with "direct price comparison" between replaced products and their replacements is a cost-efficient way of dealing with the problem of quality changes in practice, as long as the preconditions are fulfilled.

However, several fields in the calculation of quality adjusted CPIs in the EU and in Germany still need further development. The appropriate definition and harmonisation of "consumption segments by purpose" is still an issue. A further question is the appropriateness of quality adjustment methods in different situations. Price determining characteristics need to be identified for the particular products for the establishment of tight product definitions and for consideration in case of replacements. It might be possible to manage these issues with the help of standardised product data bases, in which the individual important characteristics of the different product groups and their functions are transparently displayed and explained. Finally, certain situations exist in which explicit quality adjustment methods are not applicable since measurable characteristics are not available. As a last resort overlap linking might be used in such situations, but this is rather similar to assuming that price differences are just equal to quality differences. For all these approaches applied in CPI compilations, a transparent documentation of the individual proceedings is important and should be expanded further.

The development of quality adjustment methods in European and similar in German consumer price statistics may be summed up in the following way: The discussion during the last ten years focused on the question what can be seen as monetary value of the quality difference between two products, and how this difference can be measured precisely. Within the given conceptual framework, the development of quality adjustments led to higher accuracy, transparency and comparability of procedures than ten years earlier. Considerable effort has been allocated to carry out more accurate estimates of the monetary value of quality differences using relative prices instead of rough judgements, as practised ten years before. With regard to transparency underlying methods are by and large well described and fundamental procedures are clear by now. Detailed product specific descriptions still have to be developed. Due to EU regulations and the development of methods in European Task Forces, harmonisation is progressing well, notwithstanding the remaining fields of development.

But the proceedings in quality adjustment are still frequently questioned by some users or statisticians themselves. This suggests that the *relevance* or *validity* of the quality adjustment concepts should be examined more thoroughly. A look beyond the currently applied concepts is therefore proposed in the next section to complement the methods currently applied in CPIs.

[9] Ibidem, pp. 36-39.

3. CPI and beyond?

3.1 Some discarded aspects

It seems that in the currently compiled CPIs, some aspects are measured quite accurately, while other important aspects, for example the complementary nature of products of different categories and changes in the circumstances of consumption, are widely out of the picture. The more these ignored factors play a role for the utility perceived by consumers, the more the results of our measurements might turn out to be of little relevance for some users of our statistics. In the following paragraphs, a range of those aspects is pointed out.

New goods

The term "new good" or "new product" is not always precise. In particular, there is no sharp dividing-line between new models and varieties of previously existing products and genuinely new innovative products which fulfil needs that could not be fulfilled before.

In the CPIs in the EU and in Germany, new varieties are mostly introduced as replacements and the prices are then subject to quality adjustment – as described in the previous section. With regard to the "premium model", it was pointed out that the product under consideration should not underlie extensive changes in order to be able to carry over a past premium structure into the current period. Consequently, the degree of innovation attached to new product varieties the "premium model" is able to tackle is limited.

Genuinely new goods are introduced into the HICPs and the German CPI by addition as soon as they are relevant for consumers. The price of the new good is collected in addition to the products already observed and the weights for the relevant consumption category are adjusted. In this way, possible price effects coming with the first introduction of new goods cannot be included into the index compilation. Neither the formulae used to calculate the index nor the frequency with which the basket of goods and services is renewed can fully address the basic problem: the risk of bias if the introduction of new goods is used as an opportunity to increase or decrease prices.[10]

Complementary goods

Technical goods are characterised by manifold complementarities. In these cases, the consumer value of one good is directly connected to the consumption of other ones. Computers are not useful for themselves; they unfold their usefulness with software packages, internet access, printer devices and so on. These components may be seen as input factors, which together are able to create a certain utility for consumers. The interaction is relevant for pricing. For example, if software places increasing demands on hardware, the additional costs of faster computers should be considered as a quality decline for the software. Thus, the consumer value of a good depends on many factors and interactions and not only on the specifications of the respective good itself.[11]

Network goods

Many products in the field of information and communication technology are in some respects what are called network goods, which means that the purchasing patterns of con-

[10] See http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/HICP_methodology

[11] The issue of complementarities and network goods has already been addressed in a previous Ottawa Group paper. See Linz, S. (2006), Hardware, Software, Network Effects – What is the Price We Pay for Using a Computer? Paper prepared for 9th Ottawa Group meeting in London.

sumers influence the benefits for other consumers.[12] Thus, utility for one consumer often depends on the behaviour of other consumers. The relationship between the individual users is not necessarily of a physical nature, but may exist in abstract terms only. For example, the fact of how many application programs and peripheral devices are available a relevant computer system in the market plays an important role to all of them. In turn, the range of application programs and peripheral devices offered depends on the number of users applying the given operating system. The surrounding conditions of consumption are in these cases intrinsically tied to the dispersion of the consumer goods themselves. Empty roads and parking lots increase the utility of going by car or the number of users of online social networks may determine their utility. The usefulness of a TV set heavily depends on the quality of the broadcasted programs. [13]

Social standards

Another important factor related to the measurement of quality changes might be social standards. The demands that consumers place on certain products may be heavily influenced by their social surroundings. Seeing that a friend likes or uses a product can make consumers more prone to like or use that product themselves.[14] But also the ways of usage of a product and hence the technical requirements which are deemed important may differ by social groups. Social standards may be just as important for users as technical aspects, and interactions between social standards and technical as well as latent aspects such as fashion are also very likely.

Complementarities, network effects and social standards can significantly influence the utility stemming from the consumption of goods. A product may have been very useful in the past, but changed technical or social surrounding conditions can reduce its value. A "virtual depreciation rate" as a result of technical progress – on the other side of the coin. While physically, products can be still usable, their usefulness might be considerably reduced due to the mentioned effects and consumers are more or less forced to purchase new products or new product variants.

3.2 Indicators on costs and benefits of improved consumer goods

Considering the above mentioned limitations of current CPIs, which rule out manifold effects determining quality as perceived by consumers, one should think of alternative approaches. In the following, some thoughts on possible alternatives are outlined. They aim at contrasting the developments of costs and benefits of improved products from a user perspective instead of the product-based view taken in CPIs. The suggestions should not be regarded as a call for alternative measures of inflation but rather as a proposal of additional indicators, which could supplement the monthly calculation of quality adjusted price indices in the CPIs. They may be seen in analogy to the "GDP and beyond" discussion, which does not aim to replace the GDP but to add supplementary indicators of well-being for example on environmental or social aspects besides the GDP development, in order to improve the relevance of the figures.[15]

[12] In the context of information economics, the term network stands for a group of consumers using a given product or technology. See Katz, M. and C. Shapiro (1985) Network Externalities, Competition and Compatibility, The American Economic Review 75, No. 3, pp. 424-440.

[13] See Linz, S. (2006), Hardware, Software, Network Effects – What is the Price We Pay for Using a Computer? Paper prepared for 9th Ottawa Group meeting in London.

[14] For an empirical study regarding social networks and communication technologies, see Fulk, J. (1993), Social Construction of Communication Technology, Academy of Management Journal, No. 5, pp. 921-950.

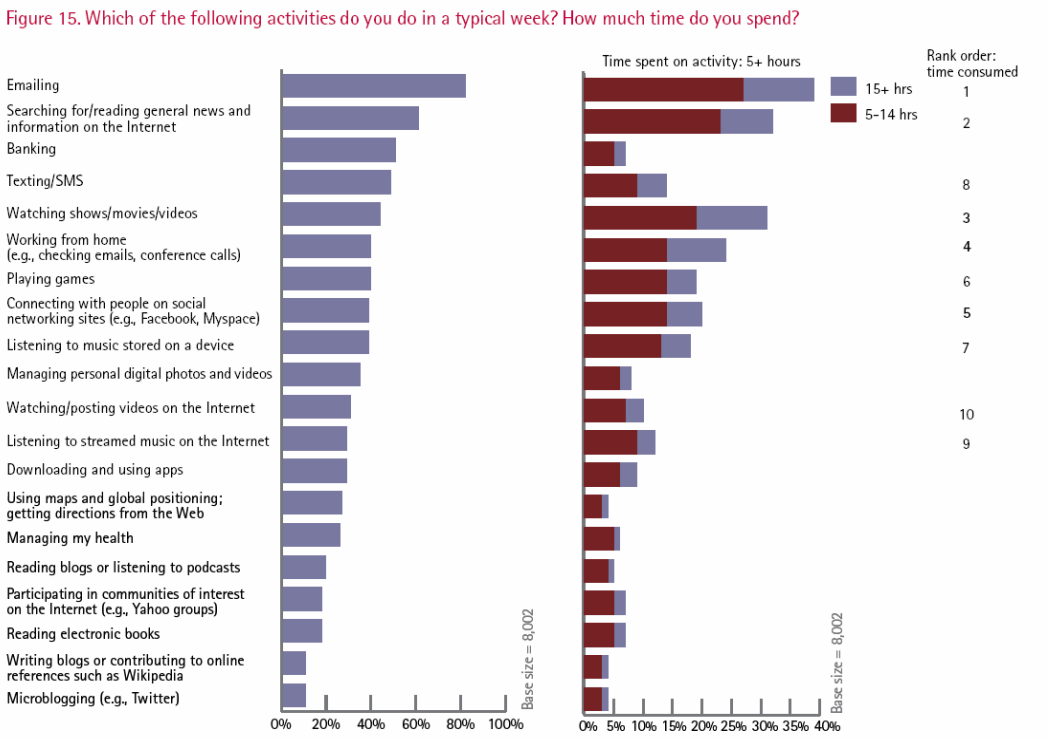
[15] See the European Commissions project www.beyond-gdp.eu and the so-called Stiglitz-Sen-Report, outcome of the Commission on the Measurement of Economic Performance and Social Progress initiated by the French President Sarkozy (J. Stiglitz, A. Sen and J.-P. Fitoussi (2009), Report by the Commission on the Measurement of Economic Performance and Social Progress). See also Thomas, J.

One possibility to derive additional indicators, which are closer to the real world of consumers, could be to start from user activities instead of relying on product groups as initial elements. In the field of information and communication technology, user activities could for example be "online banking" or "connecting to people in a social network". The activities should be the notionally fixed elements for the assessment of costs and benefits. As one and the same activity can be carried out using different combinations of consumer durables and services, the activity-based view would allow incorporating the effects of new goods or substantially changed products. Further, indicators on the development of user-costs generated by using these goods should be developed and confronted with the benefit of the products as perceived by the consumers. The proposal follows three basic steps:

(1) Activities as starting points

In an activity-based approach, activity bundles should form a starting point and set the framework for the construction of supplemental indicators. For example, in an online study by a consultancy company, consumers have been asked which activities they carry out using information and communication technologies. Figure 2 displays the results of these interviews.

Figure 2: Typical activities using technical goods



Source: Accenture (2011), Finding Growth: Emergence of a New Consumer Technology Paradigm , p. 23

For instance in 2011, the consumers involved in the above mentioned study spent most time emailing, surfing the internet, watching shows or movies. But also connecting with people on social network sites and playing games is important. In order to calculate additional indicators on costs and benefits of using information and communication technology, a bundle of the most important activities should be defined for the base period. This selection could be made based on the frequency of carrying out each activity, or the bundles could be ranked according to the time spent; further selection criteria might be suitable.

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and J. Evans (2010), There's more to life than GDP but how can we measure it?, Economic & Labour Market Review, Vol. 4, No. 9, pp. 29-36

Other domains of goods could be addressed by other activities. Cars and related goods and services may for example be connected to activities like shopping trips, commuting to work, holiday travels etc. but perhaps also purposes like representing oneself by a car.

(2) User costs incurred for the activities

In a next step, bundles of products and services which are typically used by consumers for the afore-defined activities need to be identified. Here it would be important to include all devices and services, which are typically used or needed to carry out the activities defined above. Follow-up costs caused by complementarities (for example WLAN connection, ink cartridges or electricity) should be included.

Typically used devices and services should be selected once in the base period and again in the current period, for example three years later. The aim is to trace the development of actual and realistic expenses over time, which each represent frequently observed consumption patterns in their respective periods. Product substitutions can and should be included. So between the two periods, the selected bundle of goods and services serving to carry out the above defined activities might change considerably. The table below gives examples for possible elements in two bundles.

Table 1: bundles of goods and services

Bundle in period 1	**Bundle in period 2**
Desktop PC	Notebook
Operating system	Operating system
Data usage contract, flat rate	Data usage contract, flat rate, wireless LAN
Mobile phone	Smart phone
TV set	Mobile data usage contract, flat rate
Electricity	TV set
...	Electricity
	...

The bundles should be selected in accordance to certain user profiles. For example, it should be avoided to compare a bundle deemed typical for more conservative users in the base period to the products typically used by “computer freaks” in the current period.

For each period, user costs of the equipment combinations should be calculated. Besides acquisition costs of devices, fixed costs of services and variable costs need to be taken into account. Acquisition costs need to be spread out across the period of usage. For watching movies/shows/videos for instance, the costs of the acquisition of the TV set could be spread across 8 years, if it is assumed that a typical TV set lasts for this time. As mentioned above, the typical lifetime is hard to estimate and often based on additional assumptions. However, it might be possible to use information from existing consumer surveys in ex-post studies.

Indicators on the development of user costs can be informative standing on their own. They point out how much money is needed to participate in certain activities in a way which is usual or “up to date” in each period. Such information might be important for questions of welfare or compensation. A significant or increasing spread between the developments of user costs for contemporary bundles of technical goods, and the prices measured in CPIs for similar goods, might cause a difference between perceived and measured inflation in this sector. Thus, tracking the costs for activities may also yield important and relevant information for the general public and might help explaining perception gaps. Observing simple average expenditures as recorded in household budget surveys would be far less explanatory since consumer profiles and activities are not kept constant here.

(3) Changes in utility caused by market developments

An issue with tracing changing consumption patterns over time, each being typical for their period of time, is that different levels of utility or living standards can be attached to the bundles observed in the respective periods. The problem of changing goods and services is already reduced by selecting bundles with respect to predefined consumer profiles. However, the crucial question is: have technical progress and the changes in products typically used for certain activities induced an increase in well-being or prosperity? Do consumers actually perceive an additional utility attached to more modern bundles of goods and services? Do substitutes generate equal levels of utility?

Real market assessments like in the "premium model" are hard to implement for whole bundles of products.[16] Thus, consumer interviews would have to be carried out to assess the usefulness of the bundles for the defined activities. [17] For each activity, for example, emailing, internet banking, connecting with people on social networks, consumers could be asked whether they find that the activity can be carried out better, or worse with the new devices and services in the current period, compared to using the old products from the previous period. A first intention is to evaluate the functionalities which are valuable for consumers. It may also be the case that new devices may open up new activities, which have not been defined in the previous period. These could also potentially increase utility and should be considered in the assessments. The result would be a set of indicators which describe the changing utility and costs for different bundles. These indicators may at first be only available on an ordinal scale.

In further steps, possibilities of valuating the improved or declined utility arising from the predefined and new activities should be scrutinised. The willingness to pay for an improvement in each activity could be enquired in interviews as a proximate monetary measurement of utility.[18] This may also allow to aggregate the utilities of various activities and to derive an overall indicator of utility changes.

The outlined process, which focuses on activities rather than consumption segments, is certainly not easy to implement. In general, consumer studies asking for the willingness to pay are subject to diverse methodological effects, like for instance social desirability, learning effects in repeated studies or different spending patterns with game money. However, it seems to be the only way to overcome the problem that in reality, utility is not an additive function of consumer value derived from individual, unconnected products. Consumer do not compare like-with-like, they chose bundles of products being appropriate to allow intended activities, irrespective of minor or major changes in the composition or technical specifications of the bundles.

4. Conclusion

The major advantage of the CPIs compiled in the EU and in Germany is the application of clearly defined measurement methods which allow a precise measurement of inflation within product groups. Due to harmonised methods, the HICPs facilitate international comparisons and offers essential information with regard to price developments. These clear benefits of the currently

[16] Further research could investigate in how far the premium model may be applicable to product bundles. In general, market-based assessment should be preferred to consumer interviews.
[17] Consumers' valuations of quality changes are also addressed by Sellwood, D. (2010), On a Process for the Determination of Quality Change in the Harmonized Indices of Consumer Prices, paper prepared for the HICP Working Group Meeting 21-22 June 2010 in Newport.
[18] For an introductory overview in consumer interviews in price research, see Diller, H. (2000), Preispolitik, pp. 193-195; 197-200; 202-207.

calculated CPIs have to be retained since there are no other indicators which could replace them entirely. However, especially the principle of dividing products into relatively narrow defined groups and aggregating group specific inflation rates discards a range of aspects which may be important from consumers' perspectives. New goods, complementarities, network effects or social standards may play an important role for consumers. Other aspects, like fashion or the lifetime of durables cause further measurement problems. In order to shed more light on these aspects, the calculation of supplementary indicators is proposed, which should explore costs and benefits of technical developments. These indicators could help to put the debate on quality adjustment methods on a more evidence-based fundament. The strengths and weaknesses of methods like hedonic pricing may become clearer against this background.

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