Commercial property prices: What should be measured?

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1 Introduction and motivation

The real estate sector plays an important role for the real economy, the financial system, financial stability and not least the monetary transmission process. However, unlike the case of residential property, official data on commercial property markets is hardly available. This asset class is usually defined through the intention to generate profit from its possession. The focus is thus more investment-oriented than in the case of owner-occupied residential property. Commercial objects are frequently categorised by their main forms of usage. Common clusters include: office property, retail property, industrial property and – if held for commercial purposes – residential property. Roughly 34% of all fixed assets of German non-financial corporations were classified as real estate in 2010 (Deutsche Bundesbank 2012). Naturally, commercial property often serves as collateral; around 50% of all loans in Germany are secured by mortgages.[2] According to BulwienGesa AG, a German real estate consulting firm, total market value of commercial property excluding residential property held by investors accounted for over €2.2 trillion in 2011 – almost the same size as the economy's activity in terms of gross domestic product at current prices. The largest share is represented by industrial real estate amounting to €1.1 trillion. Retail and office properties correspond to another roughly 50% of total commercial property value.

The IMF included commercial property prices in its Financial Soundness Indicator set (IMF 2006). In spite of this, due to limited data availability and methodological difficulties, official indicators on commercial property have hardly been published yet. The IMF and the Financial Stability Board brought up this issue again in their report on the financial crisis and information gaps to the G-20 finance ministers and central bank governors and recommended the collection of price indicators on commercial property (FSB 2009). As one result, an international conference on commercial property price indicators was jointly organised by the BIS, the ECB, Eurostat, the IMF and the OECD in June 2012 (ECB 2012). Eurostat envisaged the compilation of a "Handbook on Commercial Property Price Indicators" with the intention of defining the methodological framework for reconciling the efforts towards an indicator set at an international level, in order to eventually bridge the data gap.

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[1] This paper represents the author's personal opinions and does not necessarily reflect the views of the Deutsche Bundesbank or its staff. The author would like to thank Jens Mehrhoff for valuable comments. All remaining errors are, of course, the author's sole responsibility.

[2] The ratio is calculated as mortgage loans by banks in Germany to domestic non-financial enterprises and households over total lending.

This paper argues that, despite the quest for swiftly disseminated indicators, it is of utmost importance to set up a valid and reliable methodological framework first. The various data users make substantially different demands on the index concepts. These, in turn, need to be tailored for the distinctive purposes. In what follows, different approaches to the measurement of commercial property prices are presented. Furthermore, the paper seeks to work out a stylised framework for assessing performance-based measures in comparison to price measures. Available price indicators for Germany are discussed and classified according to statistical criteria in a separate section. The analysis then turns to gauging the distortion that arises from treating performance based measures as price measures. Selected data uses are briefly reviewed thereafter. The final section concludes and outlines the challenges ahead.

2 Measurement aims

A (commercial) property is a bundle of goods. To determine its value, one can take different vantage points (Rosen 1974). From a producer's perspective, the property value is driven by the costs of purchasing the land and building the structure on that lot. From a purchaser's view, the value of a property is the sum of his willingness to pay for each component, i.e. the land and the structure. From a commercial bank's view, properties are valued as collateral in order to reduce credit risk. Various professions and stakeholders observe real estate. The perspectives vary and, therefore, property price indices need to be tailored to the needs of data users. First, however, it is necessary to analyse the composition of real estate prices and possible indices derived from a land-structure split and the decomposition of values into price and volume components.

2.1 Land-structure split

At the beginning we concentrate on two main components of any (commercial) real estate. A developed property's value is determined by the cost of the land and the cost of the structure – the building itself. For example, for the purpose of National Accounts, land values are commonly excluded since land does not represent a produced asset (Lequiller and Blades 2006). Hence, a land-structure split as in Equation (1) is applied.

$$\text{Property value} = \text{Land value} + \text{Structure value} \tag{1}$$

Values of land and structures are driven by various factors and types of use. To begin with, indicators based on the value of land are largely governed by location characteristics. A specific lot obtains its value from various determinants such as the proximity to the city centre, the economic structure of the surrounding area or its shape and size (Özdilek 2011). In comparison, the value of the structure is defined by the costs of producing the characteristics such as office and retail space, technical facilities or logistic areas.

However, both components are rather difficult to separate in practice. The value of commercial property is determined by the (expected) income stream, i.e. the sum of the discounted cash flow of the rents. Should this approach be applied to the structure value one ignores that rents, too, are driven by location. Hence, a structure value thus determined will also be influenced by land-specific characteristics. The issue of whether or not the land value should be part of an index has also been addressed for owner-occupied housing as well (Eurostat 2011a).

In order to answer the question for the measurement aim, “what should be measured?”, and to categorise available information on commercial property into a statistical framework, it is not sufficient to differentiate between the land and the structure value. In fact, it is necessary to reconsider implications from index theory for discriminating sharply between the value, the price, the volume and the quantity of commercial property.

2.2 Components of an index

The market value provides a nominal measure for commercial property. In what follows, values might refer to those of structure and land, respectively, or both, i.e. the whole property. If quantities (floor space or lot size in square metres, say) are available, dividing the value in euro by that quantity yields a so-called unit value in euro per square metre. Thus, the value can be split up as follows:

$$\text{Value} = \text{Unit value} \times \text{Quantity}. \tag{2a}$$

However, the unit value in Equation (2a) depends on the quality of the building and not just on floor space, or the location of the lot and not only its size. Since price indices aim for a quality-adjusted indicator prices here denote a constant quality numéraire.[3] As will be discussed at great length in the next section, it is possible to decompose the value into a constant-quality price and a volume measure that inherits quality changes:[4]

$$\text{Value} = \text{Price} \times \text{Volume}. \tag{2b}$$

Therefore, an index for property prices in its pure form will reflect movements in prices that are stripped of quality changes. The latter are included in the volume as shown in Equation (2b). Eventually, the ultimate statistical goal is splitting up the value into a qual-

[3] Valuers, however, have a different notation of the terms used in official statistics. The Royal Institution of Chartered Surveyors, for example, makes the following distinction between values and prices (RICS 1997): Where the value indicates an estimate of the obtainable price in the event of a transaction, the price reflects the actually observed amount of money at the time of the transaction.

[4] At a given point in time, constant quality means some sort of average quality at a building level. For intertemporal price comparisons, this means that the quality of a particular building is held constant.

ity-adjusted price, the quality component itself and a quantity measure independent of quality.

$$\text{Value} = \underbrace{\text{Price} \times \overbrace{\text{Quality} \times \text{Quantity}}^{\text{Volume}}}_{\text{Unit Value}} \tag{2c}$$

Following Equation (2c), the value is obtained via multiplying the constant-quality price of a unit by a dimensionless mark-up (or mark-down) for the desired level of quality and the nominal quantity of the structure or the land. This mark-up can reflect characteristics such as the age of the building or its year of construction.

2.3 Aggregation of values and prices

So far the basic components of a specific property's value (land and structure on the one hand – price, quality and quantity on the other) have been introduced. The next step towards the compilation of an index is the aggregation of values and their (price) components. The first half of this process is described in Equation (3). For each time period *t*, the summation runs over the distinct properties *i*.

$$\sum_{i \in I} \text{Value}_t^i = \sum_{i \in I} \text{Price}_t^i \times \text{Quality}_t^i \times \text{Quantity}_t^i \tag{3}$$

This sum can be calculated over two different populations, denoted by the index set *I* in the equation. Firstly, this is the building stock, i.e. all commercial properties in an economy are at the centre of interest. Secondly, building flows, i.e. transactions of newly built, or used and transferred commercial property, may be relevant for market analysis. The distinction between the two is essential. While flows tend to better depict market activity and movements, stock-based figures reflect the endowment of the economy with commercial property. In a stringent system of accounting the nominal stock at the beginning of the period plus the net flow in this period yield the stock at the beginning of the subsequent period. In order to obtain such equality, gross flows need to be adjusted for depreciation or demolition of buildings, and for appreciation, i.e. renovations.

Then again, changes in nominal values of either the stock or flows are not the same as changes in real terms. The difference is the price component – the second half of the aggregation process. Yet, the construction of the price index at the aggregate level from individual data depends on its use. A Paasche-type price index will be the appropriate measure for deflating value aggregates yielding Laspeyres-type volume measure, e.g. in National Accounts in Europe (in the framework of chain indices). In spite of this, a Laspeyres-type price index, as displayed in Equation (4), is more appropriate for analys-

ing “pure” price developments (European Commission 1995). Therefore, and in line with other statistical price indices, a CPPI should adequately follow this method.

$$P^L = \sum_{i \in I} \left(p_t^i \,/\, p_0^i \right) \times w_0^i, \quad \sum_{i \in I} w_0^i = 1 \tag{4}$$

The choice of what should be used for weighting price information (the *w*'s) has to be governed by the actual application of the index. Transactions at market values can serve as weights for a price index based on flows in order to reflect market movements across regions, say. Transaction-weighted indices place a higher weight on more liquid markets. Weights derived from economic activity such as regional income or output figures can step in if information on transactions is not provided in sufficient detail. In contrast, for price indices relating to the building stock weights linked to the nominal stock or the number of enterprises (in absence of precise data on the stock) will generally be more appropriate.

The observation of values and prices generally yields different results. The change in market values between two consecutive periods does not necessarily reflect the pure, i.e. quality-adjusted, change in prices. It is rather a mixtum compositum of quality changes due to depreciation and renovation as well as the quality-adjusted change in prices; if quantities remain the same. Let, for example, the population be equal in the two periods under consideration. Due to depreciation the quality of all buildings will be lower on average. Ceteris paribus, it follows that in such a situation values decrease although quality-adjusted prices have remained constant. The concepts developed in this section are summarised in Table 1 (in the subsequent section).

2.4 Performance measures

Investment performance indicators serve the specific purpose to provide a benchmark for investors and fund managers for commercial property investment portfolios. This is a very different purpose than measuring the price changes of commercial property. In order to clarify terminology and concepts this paper now turns to a definition of the key figures at hand. The treatment here closely follows Investment Property Database (2011).

Departing from a real estate portfolio the capital growth (*CG*) between two periods is defined as:

$$CG_t = \frac{V_t - V_{t-1} + \text{Receipts}_t - \text{Expenditure}_t}{V_{t-1} + \text{Expenditure}_t}, \tag{5}$$

where V_t represents the portfolio value at time *t*. It is therefore the change in values plus the sum of capital receipts from sales minus capital expenditures (e.g. for new objects)

divided by the capital employed (calculated as the value of the portfolio in period *t-1* and capital expenditure in period *t*).

The income return at a given period in time equals the net income, I_t, divided by the portfolio value at time *t-1* (again corrected for capital expenditure in period *t*).

$$IR_t = \frac{I_t}{V_{t-1} + \text{Expenditure}_t} \tag{6}$$

The total return (*TR*) is the sum of the two components:

$$TR_t = CG_t + IR_t . \tag{7}$$

The ongoing discussion on commercial property price indicators has brought to light that different actors in the market have preferences regarding the measurement aim that poles apart. While a substantial share of faction is in line with the well-reasoned tradition of official statistics to measure pure price changes, another part of the interest group has suggested performance indicators being most suitable for tracking the phenomenon at hand. However, it appears that the pros and cons are not fully understood yet. Table 1 summarises the measures outlined and provides uses for the distinctive concept.

Table 1: Different aggregates and the respective uses

Measurement aim	Aggregate type	Use for the concept
Value	Transaction-based	Nominal wealth traded on the market
	Stock-based	Nominal wealth in the whole economy
Price	Transaction-based	Pure price movements
		Deflation
	Stock-based	Pure price movements
		Deflation
Volume	Transaction-based	Real wealth traded on the market
	Stock-based	Real wealth in the whole economy
Quantity	Transaction-based	Number of transactions
	Stock-based	Physical stock of the economy
Performance	Total Return	Benchmarking of return on investments
	Cash Flow Return	Benchmarking of return on investments

Strictly speaking the two “worlds” of price and performance figures are mutually exclusive. There is no such thing as performance in the realm of prices; vice versa, prices only very indirectly or only partly influence measures such as total return. Notwithstanding, the next section provides a simplified model which formally treats prices and performance indicators in a single, unified framework. This will allow a better understanding of the links between the two indicators and, most particularly, the limitations of performance measurement.

3 A stylised framework

In the eventual case of the absence of price indicators the legitimate question arises whether these performance indicators might be regarded as a “second best” approach to price measurement. Assume, for the sake of exposition, that no change occurs in the “quantity” component of commercial property. This means that the same objects can be observed over time. This implies that neither new buildings are constructed nor that old objects are demolished. It should be noted that this by no means rules out the cases of depreciation due to ageing or appreciation in the form of investments in the stock. This setup establishes the basis for what follows.

Let P_t be the price of a given building at time *t* – stripped of any quality change – and let prices evolve at the time-varying asset inflation rate π_t:

$$P_t = P_{t-1} \cdot (1+\pi_t). \tag{8}$$

On the other hand, capital values are influenced by quality change in addition to pure price change. Hence, define the growth of the capital value V_t at time *t* as the difference between price change and net depreciation. The rate d_t mirrors depreciation net of appreciation and, thus, its sign is not necessarily determined a priori:

$$V_t = V_{t-1} \cdot (1+\pi_t) \cdot (1-d_t). \tag{9}$$

In the long run, the capital consumption should be amortised. Accordingly, the cash flow I_t at time *t* of an object is linked to its value at time *t-1* via the income return r_t:

$$I_t = V_{t-1} \cdot r_t. \tag{10}$$

It immediately follows that:

$$r_t = \frac{I_t}{V_{t-1}} = IR_t. \tag{11}$$

While it is obvious that the price index captures π_t, what information can be revealed from performance measures? An index based on the growth of capital values (*CG*) gauges

$$CG_t = \frac{V_t}{V_{t-1}} - 1 = (1+\pi_t)\cdot(1-d_t) - 1 \approx \pi_t - d_t. \quad (12)$$

Using capital values, therefore, introduces quality aspects that, in turn, may lead to a biased measure of pure price change.

The total return (*TR*) is frequently used to assess the performance of an investment. Since it assumes the cash flows being reinvested, the total return is sum of the capital growth (capital gains/losses corrected for expenditures and capital receipts) and the income return:

$$TR_t = CG_t + IR_t = (1+\pi_t)\cdot(1+d_t) - 1 + r_t \approx \pi_t - d_t + r_t. \quad (13)$$

Depending on the prevailing circumstances, the total return can overshoot or undershoot the true price development. What makes it even worse is its architecture being a mixture of three independent measures. This will render it very hard for economic analysts – who are used to price indices – to understand. As the empirical section shows, the picture drawn from prices and performance indicators can be fundamentally different. Eventually, this will lead to the wrong conclusions being drawn for policy making. Given the importance of the real estate sector for the economy and financial stability, the stakes at risk are potentially high for experiments.

4 Sources

The conceptual approach provided in the previous sections is confronted in practice with available data sources. Data on commercial real estate is rather sparse and hardly available for some property types such as industrial property. This section seeks to classify the data provider's approaches within the taxonomy derived in sections 2 and 3. A straightforward categorisation is not always feasible since methodology for some indices is not disclosed and the terminology differs between official statistics and real estate professionals.

For Germany, three index providers publish data at a national level. BulwienGesa AG, a German real estate consulting firm, builds upon various data sources such as media coverage, valuers and brokers. A second index is provided by vdp, the association of German mortgage banks. They compile indices from transaction data enclosed to credit applications. Investment Property Databank (IPD) delivers so-called performance indices from data supplied to their data base by institutional investors. The index approaches differ across the firms and the nomenclature used cannot be seamlessly integrated into the concepts discussed in section 2.

To begin with, vdp provides an index with a hedonic quality adjustment which is labelled as capital value index. In the terminology of official statistics, however, it could be treated as a price index. BulwienGesa AG offers data on capital values from a stratified sample. Therefore, this indicator can also be compared to a constant-quality price index. Unfortunately, the weighting schemes are not fully disclosed and the weighting methodology cannot be classified into a standard framework. IPD compiles the indicator in its current form from their data base with a changing composition via chaining and no quality adjustment. Sticking to the methodology developed above this resembles an index for values but it is based on a changing composition of the sample. Table 2 summarises the three data providers along with the main attributes of the respective indices.

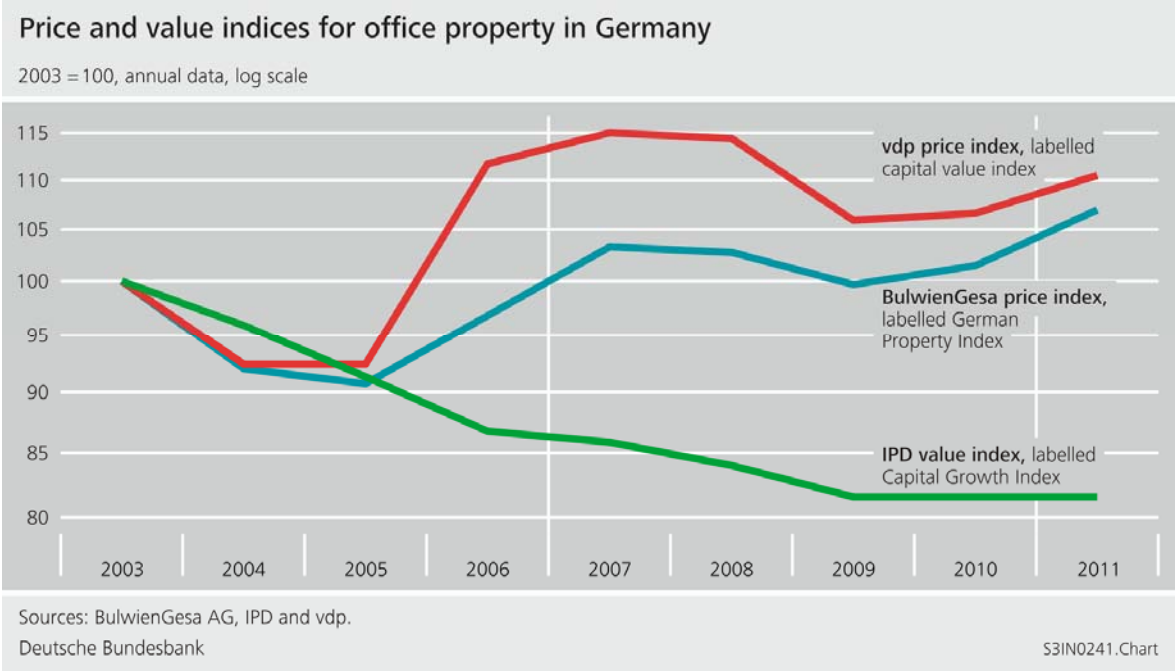
Table 2: Data providers in Germany and the characteristics of their aggregates

	BulwienGesa AG	**vdp**	**IPD**
Provider's label	German Property Index	Capital value index	Capital Growth Index
Coverage	125 cities	Germany, roughly 40% of market value	Germany, roughly 14% of market value
Quality adjustment	Stratification	Hedonic	None
Property types	Office, residential, industry, retail	Office, residential (upcoming), retail (upcoming)	Office, residential, industry, retail
Aggregation	Weighted average over regions	Not applicable[a)]	Unweighted average of sample
Frequency	Annual	Annual/quarterly	Annual
Time series start	1991	2003/2008	1995
Timeliness	*t*+15 days	*t*+40 days	*t*+90 days
Transparency	Limited	Higher	Lower
Origin of data	Various sources[b)]	Transactions	Valuations
Classification	Constant-quality price index type	Constant-quality price index type	Chained nominal value index type

a) The indices are constructed from time dummies. This method does not rely on weighting schemes and aggregation.
b) BulwienGesa AG uses various sources such as media coverage, market reports, valuers, internet platforms and others.

Thus, all three indices vary inter alia in market coverage and origin of data. Furthermore, all providers construct their indices in a different way. In order to inspect the differences between the index construction types further, Figure 1 depicts the three annual indices for office properties. Regarding growth rates, the BulwienGesa AG price indicator and the vdp time series show the same sign of change in almost every year over the whole 2003-2011 period. However, during 2006, for example, the BulwienGesa AG time series still shows

an upswing, while vdp figures flatten. Also the absolute magnitude of vdp growth rates often exceeds those reported by BulwienGesa AG. The IPD index on a changing portfolio, in comparison, shows a steady decline up to 2011. The diversity in operationalisation complicates the comparison, particularly between IPD on the one hand and BulwienGesa AG and vdp on the other. Price indices by BulwienGesa AG and vdp have an inherently different interpretation than IPD's value index. Due to depreciation without renovation, nominal values from a constant sample are prone to show negative rates of change on average. In contrast, price indices are not determined by age effects. This mechanism may help exploring the patterns observed in the figure. Furthermore, the results emphasise the importance of index construction methodology.



A valuable source, though with less detailed data, is provided by the National Accounts. National wealth accounts in Germany provide data on the nominal and real building stock at replacement costs (Schmalwasser and Schidlowski 2006). By applying the perpetual inventory method, the net stock at the beginning of the period is obtained as the sum of the net stock from the beginning of the period before and the net fixed capital formation during this period. National wealth accounts offer data on the gross and net stock of dwellings and other buildings and structures. This source, therefore, does not allow a breakdown into types of usage. Aggregates include forms of usage such as undeveloped land and property holders (e.g. the public sector) that may not be in the main focus of a CPPI.

5 Interpretation issues regarding the use of "total return" as a price indicator

Section 3 has provided a formal treatment of performance based indicators. With this framework at hand it is straightforward to analyse the components of the total return

based on the data illustrated in Section 4. The key ratios are presented in Table 3. Evidently, the capital growth does not reflect pure price movements, since quality changes (such as depreciation) are not excluded. As a consequence, the same holds for the total return. In order to grasp the empirical magnitude of conceptual differences it is possible to solve Equation 13 from Section 3 for the net depreciation rate d_t – provided a measure for the price movement is available. This yields:

$$d_t = \frac{TR_t - \pi_t - r_t}{1 + \pi_t}. \tag{14}$$

The BulwienGesa price index offers a measure for π and enables to retrieve the left hand side variable – displayed in Table 3 as well. From this calculation we infer that, on average, office buildings (including land) are depreciated at a net rate of 1.5 per cent a year. After 50 years the object loses only a little more than 50% of its value based on this simply derived depreciation rate. It should be noted that the calculation averages the depreciation of the land (being in most cases 0% per definition) and the depreciation of the imposed structure. Such a weighted average does not represent the actual depreciation rate from accounting which refers to buildings only. For retail property, *d* almost doubles. Generally speaking, retail property has shorter life spans and is therefore subject to higher write-offs.

Of course, a calculation based on this highly stylised mode will and must neglect several aspects. Nevertheless, the results from these calculations emphasise the influence of depreciation on capital value based indices and of course – being a linear combination – the total return. As the theoretical treatment already has shown, both, the total return as well as the capital growth index are not capable to assess pure price movements. From depreciation the capital growth is bound to underestimate asset inflation. For the total return, the addition of cash flow returns causes it to overshoot true price developments. In sharp contrast, a price index allows for a direct judgement and reveals market movements stripped of quality related influence.

Table 3: Key figures for IPD data and BulwienGesa price development in per cent (2001-2011 average)

Variable	Office	Retail
π[1)]	–1.0	1.5
d	1.5	2.9
CG	–2.4	–1.4
r	4.9	5.2
TR	2.4	3.7

[1)] Derived from the BulwienGesa price index

6 Selected data uses

Data analysts eventually have to choose the most suitable aggregate by purpose of their research. Nominal aggregates – such as aggregated values – are probably best for comparison with other figures in current prices. Nominal stock may best be compared to other economies at this level. Loan-to-value measures will be most appropriately calculated in nominal terms since loans are secured with buildings at market values. The nature of nominal values proposes the use of these figures for users such as banking supervisors. An economy's real wealth development will be reflected with volume measures since these depict building values adjusted for price effects. Price developments are naturally reflected in the constant-quality price component. Indices constructed from this part will most probably be used by monetary transmission analysts. The challenge of separating fundamentally justified changes in prices from price bubbles is key for financial stability.

7 Conclusion

It has become evident that different uses (e.g. monetary transmission analysis or banking supervision, National Accounts and Financial Accounts) require different concepts (unit value indices, nominal stocks, pure price indices). The question for the measurement aim matters greatly. Substantially different market movements are observed for Germany depending on whether prices or values are analysed (both are confusingly termed capital values by commercial data providers). Growth rates between 5% and 10% or declines of over
15% over an eight year period up to 2011 are currently being reported. In such a surrounding, statistics need to appropriately classify and describe existing indicators offered by real estate professionals. The detailed description of metadata enables data users to make informed choices on the most suitable indicator for the respective analysis.

For international comparisons a stock-taking of existing sources and a classification according to common terms from index theory (price, unit value, value, volume) would be useful. Based on this inventory of indicators international aggregates can be calculated in the future. In conjunction with further information on statistical quality (coverage and the like) it might be possible to describe these indicators along with the relevant metadata. Testing the time series and comparing their features e.g. with macroeconomic developments is indispensable. All in all, there is still a lot of hard work to do for statisticians in this field, but the way forward seems as promising as challenging.

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9 Annex I: Origin of data

IPD data

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