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Producer price index for services

Rental PPI's: quality adjustment for changes in the goods rented

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1. Outline of the problem.

Price statisticians strive to compile price indices that reflect only price change. It is important for this goal to 'price to constant quality'. This means that the products of which the prices are compared over time have to have the same quality in each period. If the quality of a product changes, a quality adjustment has to be made. In many industries, it is clear of what product the quality is to be held constant. However, this is not the case for rental, where the question arises whether a PPI has to be adjusted for quality changes in the goods rented. For instance, is, *ceteris paribus*, rental of a better car a better rental service?

2. Options for defining the rental product.

In addressing this problem, it is useful to start with the basics. A price index reflects the price change component of a value change according to the following formula.

$$\Delta v = \Delta(p * q)$$

in which

Δ denotes change,
v = (nominal) value,
p = price and
q = quantity (also called volume).

From this equation it is clear that a price index is inextricably tied to a value (aggregate). If we want to know what products a price index reflects, we look at what is included in the value and what is not. Pricing to constant quality means that the quality of all products included in the value have to have the same quality. If quality of a product changes, quality adjustment is necessary. On the other hand, a quality adjustment in a price index for changes of products that are not included in the value is wrong.

For rental, there are three options conceivable for choosing the product of which value and subsequently price and quantity are estimated:

1. The product is the rental service.
2. The product is a bundle of the good rented and a rental service.
3. The product is the good rented.

The **first option** can be typified as the 'net approach'. It corresponds to treating the rental industry as a margin industry like trade, of which production (value) is determined as the intermediation service only. The lessee or renter, the final client, acquires two separate products: the intermediation service and the good rented. The intermediation rental service consists of making it possible for the client to avail of the good at specified conditions and for a specified period. The good rented has to be recorded as if it were supplied directly by the manufacturer or trade firm to the final client. This corresponds neither with how payments flow, nor how the different market parties perceive the business model. It provides, however, a workable and consistent view on the industry, as will be shown.

The **second option** regards the product of the rental industry as a combination of the goods rented and the rental services. This concords with the usual treatment in national accounts, where the output is measured

as gross production. Hence, this option can be called the 'gross approach'. This view also concords with practice in the real world: one payment reflects both the value of the good, or its depreciation, and the rental service that makes it possible for the client (the lessee) to avail of the good at specified conditions and for a specified period. Conclusively, this gross approach has preference over the net approach (first option).

The **third option** assumes that the rental industry delivers only one of its inputs, namely the goods bought, as its only output, without adding change or value to it (Eurostat 2001). This denies a function to the rental industry[i]. Consequently, this option is not good.

The first and second options are illustrated in figures 1 and 2.

Figure 1. Schematic representation of the business model for rental in the view that the rental industry is a margin industry, like trade. The production is determined as the services part of rental only, an intermediation service. The clients (lessees) acquire two products: the intermediation service and the good rented. This view can be called the 'net approach'.

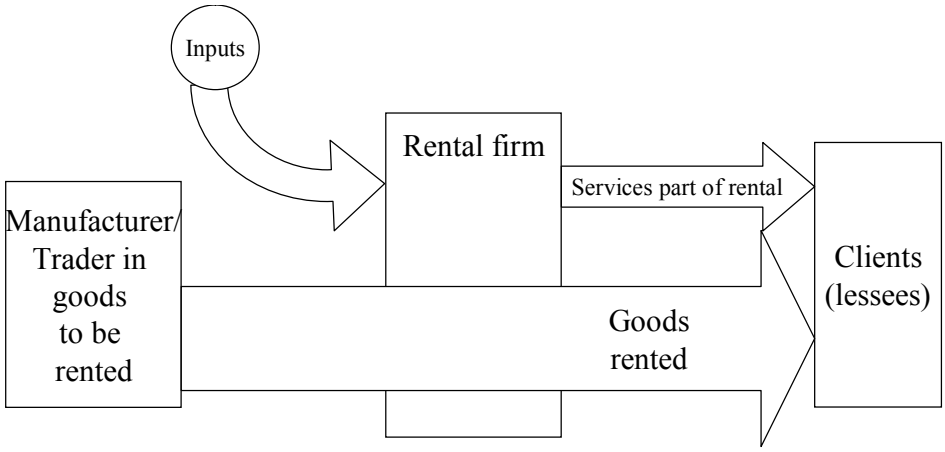
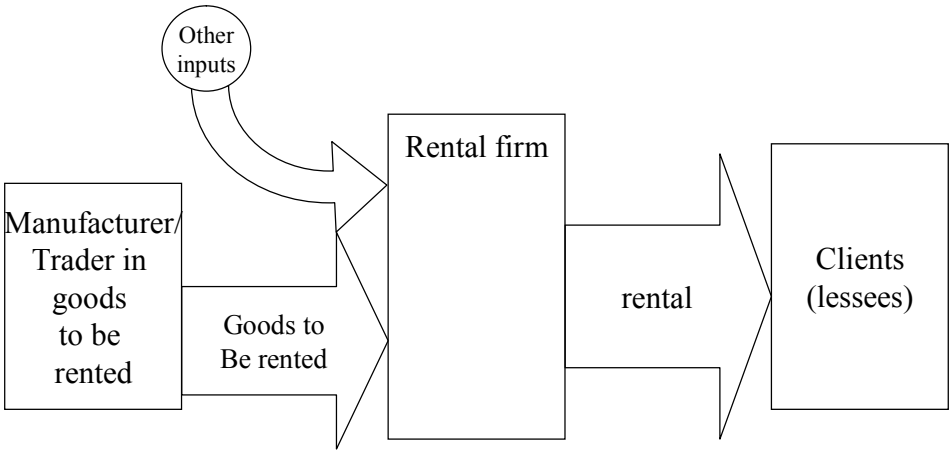


Figure 2. Schematic representation of the business model for rental in the view that the value of goods rented and the rental services together are combined into one rental product. This view can be called the 'gross approach'.



3. Price measurement in the net and gross approaches.

Price measurement in the **net approach** has to amount to surveying rental prices of which the value of the good has somehow been taken out. For instance, the price of a one day car rental has to be calculated as the total rental price, say $ 70, of which depreciation of the car is subtracted, say $ 60, resulting in a price for the services part of the rental of $ 10. If in a later period these amounts are $ 75 and $ 60 respectively, the price for the services part of the rental is $ 15, a 50% increase.

The problem of this measurement may be that in practice the good's component of the total rental price (the depreciation of the good) is probably hard to survey. The net approach is possibly in practice easier for trade than for rental, as purchase prices (costs for the trade firm) are more easily available than precisely allocated depreciation of goods rented.

Price measurement in the **gross approach** is basically easier, as the rental prices are surveyed which are true transaction prices. In the car rental example above, the rental price changes from $ 70 to $ 75, a 7% increase.

4. Accounting in the gross and net approaches with different treatments of the quality change of the goods rented out.

Now we can address the question of correcting a rental PPI for quality change of the goods rented.

In the **net approach**, the rented good is not a part of the product and therefore quality changes of the rented good should not have an influence on the PPI for rental. As soon as an other treatment is used, erroneous effects result. For instance, if in the net approach the service output is considered better because the good rented is better, volume or quantity growth occurs, which does not have a source; it comes from nowhere.

Box 1. The relation between the good rented and the intermediation part of rental

In the net approach, the question remains how to deal with a specification change of the good rented, which changes nominal rental (margin) prices.

For instance, a PC rental firm requests to change the product on its PPI survey form to rental of a PC with improved quality. This PC has a 1 % higher nominal purchasing price for the rental firm and a 1 % higher nominal rental (good + intermediation) price, including a 1 % higher nominal service price (intermediation). The price change is obviously not a pure price change, as the new PC is of higher quality.

It seems best to carry out a quality correction of which the magnitude is based on the *change in value* of the PC, *not on change in the deflated value* of the PC. If due to the quality improvement the PPI of the PC drops by 10%, the best quality adjustment for the price of the services part of rental is the 1 % increase in PC value, not the 10 % lower PPI of the PC.

Consequently, the product definition of the services part of rental in the net approach has to be formulated in 'quality neutral' terms. For example, "rental for two weeks of a $ 50.000 car" is a good product description in the net approach, not "rental for two weeks of a four door car with a 2 litre motor, four doors, air-conditioning and automatic gear".

Conversely, in the **gross approach**, the rented good is part of the product and therefore the product has a different quality if the quality of the rented good differs from before. In the gross approach, weird figures result if the rental service is not quality adjusted for the quality of the goods.

It is important to note that the quality adjustment for a quality change of the good rented belongs only to the "good's part" of the rental service. If for example a quality change of a good is valued at 50%, the quality adjustment is not 50% to the rental price, but only 50% to the part of the rental price that belongs to the good. The service (intermediation) part of rental does not have a different quality if the good has a different quality[1]. Quality change in the intermediation part of rental consist of a change in the activities that make the good available to the client, like delivering the rental equipment to the client's premises instead of having the customer come to the outlet.

In summary, the two approaches (gross and net) and two options for either quality adjusting the rental PPI for quality change of goods rented, or not, result in the following four combinations:

	Net approach	Gross approach
No QA of the rental PPI for quality change of goods rented	Right (table 1)	Wrong (table 3)
QA of the rental PPI for quality change of goods rented	Wrong (table 4)	Right (table 2)

5. Fictitous examples of accounting according to different treatments.

Hereunder these four different treatments are illustrated in the tables 1 to 4 with a fictitious example. The base data are the same in all four tables, only statisticians' treatment differs.

As can be seen in table 3, the gross approach goes wrong if there is no quality adjustment of the rental PPI for quality change of goods rented, because the rental firm would record sharply increasing inputs in real terms, but no concordant increase in the output in real terms. As an undesirable consequence, value-added (and productivity) of the rental firm collapses, and the economic gains in real terms of the goods are 'lost', they disappear from the accounts.

The net approach goes wrong (table 4) if there is a quality adjustment of the rental PPI for quality change of goods rented. The rental service is an intermediation service in this approach. The service does not have much relationship with the goods, and not at all with the quality change of the goods. Therefore, quality change of the rented goods is not a valid cause for quality adjustment in the PPI. Nonetheless, the rental firm has sharply increasing output in real terms and consequently in value-added and productivity.

[1] Other intermediation services do also not change quality if the assets change for which an intermediation in, change. Consider for instance mortgaged loans (a financial intermediation service). Obviously, the net financial intermediation service is not a different service if a house bought has a different quality or if (more generally) the purchasing power of the money provided changes.

Table 1. A hypothetical example of PC rental in the net approach, in which no quality adjustment is carried out in the PPI for the services part of rental for the quality improvement of the PC's rented. This approach corresponds to figure 1. To limit the complexity of the example, PC's are recorded as intermediate consumption of the final client; they are not treated as investment. Quantity is an abstract measure; it does not correspond consistently with a straightforward physical count of a variable, like the number of PC's.

	Base period (bp)			Comparison period (cp)			Index numbers, base period = 100			Value in cp in prices bp
	quantity	price	value	quantity	price	value	quantity	price	value	
Manufacturer/trader in goods rented										
Output										
PC's	400	75	30.000	600	50	30.000	150	67	100	45.000
Rental firm										
Input										
Total	200	15	3.000	200	15	3.000	100	100	100	3.000
Output										
Services part of renta	400	7,5	3.000	400	7,5	3.000	100	100	100	3.000
Clients (lessees)										
Input										
PC's	400	75	30.000	600	50	30.000	150	67	100	45.000
Services part of renta	400	7,5	3.000	400	7,5	3.000	100	100	100	3.000
			33.000			33.000				

Table 2. A hypothetical example of PC rental in the gross approach, in which a quality adjustment is carried out in the rental PPI for the quality improvement of the PC's rented. This approach corresponds to figure 2. To limit the complexity of the example, PC's are bought by the rental firm as intermediate consumption; they are not treated as investment.

	Base period (bp)			Comparison period (cp)			Index numbers, base period = 101			Value in cp in prices bp
	quantity	price	value	quantity	price	value	quantity	price	value	
Manufacturer/trader in goods rented										
Output										
PC's	400	75	30.000	600	50	30.000	150	67	100	45.000
Rental firm										
Input										
PC's	400	75	30.000	600	50	30.000	150	67	100	45.000
Other interm. cons.	200	5	1.000	200	5	1.000	100	100	100	1.000
Other	200	10	2.000	200	10	2.000	100	100	100	2.000
			33.000			33.000				
Output										
Rental of PC's	400	82,5	33.000	600	55,0	33.000	150	67	100	49.500
Clients (lessees)										
Input										
Rental of PC's	400	82,5	33.000	600	55,0	33.000	150	67	100	49.500

Table 3. A hypothetical example of PC rental in the gross approach, in which no quality adjustment is carried out in the rental PPI for the quality improvement of the PC's rented. **What goes wrong here** is that the rental firm has sharply increasing inputs in real terms (quantity in the comparison period), but no sharp increase in the output in real terms. As very undesirable consequence, value-added of the rental service is negative in real terms in the comparison period.

Value added in constant prices in the comparison period
= output in constant prices -/- intermediate consumption in constant prices
= rental of PC's -/- (PC's + other)
= 33.000 -/- (45.000 +1000)
= -13.000

	Base period (bp)			Comparison period (cp)			Index numbers, base period = 100			value in cp in prices bp
	quantity	price	value	quantity	price	value	quantity	price	value	
Manufacturer/trader										
in goods rented										
Output										
PC's	400	75	30.000	600	50	30.000	150	67	100	45.000
Rental firm										
Input										
PC's	400	75	30.000	600	50	30.000	150	67	100	45.000
Other interm. cons.	200	5	1.000	200	5	1.000	100	100	100	1.000
Other	200	10	2.000	200	10	2.000	100	100	100	2.000
			33.000			33.000				
Output										
rental of PC's	400	82,5	33.000	**400**	82,5	33.000	**100**	**100**	100	33.000
Clients (lessees)										
Input										
rental of PC's	400	82,5	33.000	400	82,5	33.000	100	100	100	33.000

Table 4. A hypothetical example of PC rental in the net approach, in which a quality adjustment is carried out in the PPI for the services part of rental for the quality improvement of the PC's rented. **What goes wrong here** is that the rental firm has sharply increasing output in real terms (quantity in the comparison period) and consequently value-added and productivity, although there is no cause for this.

Value added in constant prices in the comparison period
= services part of rental -/- Intermediate cons.
= 4.500 -/- 1.000
= 3.500
This is extremely high, as it was 2.000 in the base period.

	Base period (bp)			Comparison period (cp)			Index numbers, base period = 100			value in cp in prices bp
	quantity	price	value	quantity	price	value	quantity	price	value	
Manufacturer/trader										
in goods rented										
Output										
PC's	400	75	30.000	600	50	30.000	150	67	100	45.000
Rental firm										
Input										
Intermediate cons.	200	5	1.000	200	5	1.000	100	100	100	1.000
Other	200	10	2.000	200	10	2.000	100	100	100	2.000
			3.000			3.000				
Output										
services part of renta	400	7,5	3.000	**600**	5,0	3.000	**150**	**67**	100	4.500
Clients (lessees)										
Input										
PC's	400	75	30.000	600	50	30.000	150	67	100	45.000
services part of renta	400	7,5	3.000	600	5,0	3.000	150	67	100	4.500
			33.000			33.000				

Literature

Eurostat (2001) Handbook on Price and Volume Measures in National Accounts 2001 edition, Luxembourg: Office for Official publications of the European Communities.

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[i] Eurostat (2001) writes "If no observable price of the rental service exists the price index of the actual product can be considered a[n allowed] method on the assumption that there is a correlation between changes in the price of the item and changes in the rental price of the item." This corresponds with the conception of the product of the rental industry as the good rented. As this statement concerns only use of a price index as deflator, numerical outcome of this method might turn out to be an acceptable approximation of the target variable.