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# BANK OF FINLAND DISCUSSION PAPERS

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24/94

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Economics Department  
21.12.1994

## The Indicator of Underlying Inflation: Basic Idea and Use

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# The Indicator of Underlying Inflation: Basic Idea and Use

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## Abstract

In February 1993 the Bank of Finland announced an inflation target the aim of which is to stabilize the inflation rate, as measured by the indicator of underlying inflation (IUI), permanently at the two per cent level by 1995. The IUI is the consumer price index (CPI) from which the effects of indirect taxes, subsidies and housing-related capital costs, i.e. house prices and mortgage interest payments, have been removed.

Removing the effects of housing-related capital costs from the overall CPI simply means that a new consumption basket is constructed without them. The exclusion of the effects of indirect taxes and subsidies is more discretionary. The procedure is the same as in the case of the net price index (NPI). The indicator of underlying inflation is actually a type of net price index. It acts like the NPI and has the same weaknesses as the NPI.

In practice the removal of the effects of changes in the rates of indirect taxes and subsidies is not simple or transparent. The size of the overall effect can be estimated reliably enough on the basis of the effect on the central government revenue for the same year. But, unfortunately, nobody knows how long it will take for this effect to be passed through into consumer prices. All the errors in estimating the pass-through lags are also reflected in the IUI. The IUI remains sensitive to these estimation errors and, hence, some of the monthly changes in the IUI will undoubtedly be difficult to interpret.

The price effects of Finland's EU membership serve as a good illustration of the effects of a structural change on the behaviour of the IUI.

## Tiivistelmä

Suomen Pankin asettaman inflaatiotavoitteen mukaan pohjainflaatioindikaattorilla (PII) mitatun inflaation tulee vakiintua 2 prosentin tasolle vuodesta 1995 alkaen. Pohjainflaatioindikaattori on kuluttajahintaindeksi (KHI), josta on poistettu välillisten verojen, tukipalkkioiden sekä asumisen pääomakustannusten eli asuntohintojen ja asuntolainakorkojen vaikutus.

Poistettaessa asumisen pääomakustannusten vaikutus kuluttajahintaindeksistä konstruoidaan yksinkertaisesti uusi kulutuskori ilman asuntohintojen ja asuntolainakorkojen kulutusosuutta. Sen sijaan välittömien verojen ja tukipalkkioiden kuluttajahintavaikutusta poistettaessa joudutaan käyttämään enemmän tapauskohtaista harkintaa. Menetelmä on sama kuin yleisemmin nettohintaindeksin (NHI) tapauksessa. Itse asiassa pohjainflaatioindikaattori on tyypiltään nettohintaindeksi; se käyttäytyy nettohintaindeksin tapaan ja kärsii samoista heikkouksista kuin nettohintaindeksi.

Käytännössä välittömien verojen ja tukipalkkioiden kuluttajahintavaikutuksen poistaminen ei ole kovin yksinkertaista tai läpinäkyvää. Kokonaisvaikutus kunkin vuoden aikana voidaan arvioida varsin luotettavasti verojen ja tukipalkkioiden muutosten aiheuttamien valtiontaloudellisten vaikutusten avulla. On kuitenkin vaikea arvioida, kuinka kauan vero- tai tukipalkkiomuutosten vaikutusten siirtyminen kuluttajahintoihin kestää. Viipeiden pituuksissa tehdyt arviointivirheet heijastuvat aina myös pohjainflaatioindikaattoriin. Koska pohjainflaatioindikaattori reagoi herkästi mahdollisiin arviointivirheisiin, sen kuukausittaiset muutokset ovat ajoittain vaikeasti tulkittavia.

Suomen EU-jäsenyyden hintavaikutukset kuvaavat hyvin rakenteellisten muutosten vaikutusta pohjainflaatioindikaattorin käyttäytymiseen.



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# 1 Introduction

In February 1993 the Bank of Finland announced an inflation target the aim of which is to stabilize the inflation rate, as measured by the indicator of underlying inflation, permanently at the two per cent level by 1995. The purpose of announcing an explicit inflation target was to promote the credibility of monetary policy and the favourable development of the real economy<sup>1</sup>.

This paper discusses the measurement of inflation, and more specifically, the indicator of underlying inflation (IUI). Particular attention is paid to the construction of the indicator and its behaviour attributable to that construction. In section 2, the basic idea behind the indicator is described. Section 3 concentrates on the technical implementation of the idea by presenting the exact structure and calculation of the indicator. In section 4 we analyse why the indicator behaves as it does, i.e. at times clumsily. In section 5 the assumed price effects of Finland's EU membership are used as an illustration of the effects of a structural change on the behaviour of the IUI. Section 6 concludes by addressing some issues worth keeping in mind in connection with monitoring the indicator and forecasting its value.

## 2 Why the IUI?

The central banks of several countries have committed themselves to an explicit inflation target<sup>2</sup>. The targets have usually been specified as the 12-month change in a headline consumer price index (CPI)<sup>3</sup>. The headline consumer price index is reliably calculated, widely understood and commonly used. In this sense it is quite natural to choose it as a target for monetary policy. The CPI, however, includes certain elements which can obscure the underlying inflation trends. Temporary exemptions from the target would have to be allowed e.g. in the case of a change in monetary or fiscal policy. In such circumstances justifying monetary policy actions based on realized and/or expected consumer price inflation would be either counter-productive or would require a lot of explaining.

The government influences price developments through both indirect taxes and subsidies. Changes in taxes and subsidies, however, fall into the category of fiscal policy measures, beyond the control of the Bank of Finland. Their effects on prices do not normally call for a change in the stance of monetary policy.

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<sup>1</sup> To get a comprehensive picture of the significance of inflation targeting in formulating a sound monetary policy, the interested reader should see the very informative articles of Pikkariainen and Tyrväinen (1993) and Lahdenperä (1994).

<sup>2</sup> Besides Finland, such a target has been announced in Sweden, the United Kingdom, Canada and New Zealand. Commitment to a low but not explicit rate of inflation has been adopted as a target of monetary policy in Germany, Switzerland, the United States and in virtually all member countries of the European Union.

<sup>3</sup> In the United Kingdom the targeted inflation is measured by the retail price index, i.e. the CPI, from which the effect of mortgage interest payments has been removed. In Canada the all-items CPI is the official target, but a measure that excludes food and energy is used for operational targeting.

The Finnish CPI includes mortgage interest payments as one element of housing costs. Therefore, if accelerating inflation makes it necessary to tighten monetary policy, the ensuing rise in interest rates results in a rise in the CPI. This, however, is not an adequate reason for a further tightening of monetary policy.

If interest rates and indirect taxes and subsidies were included in the targeted measure of inflation, actions taken by the Bank of Finland and the Finnish government to contain inflationary pressures would, as a first result, actually increase the measured rate of inflation. The policy effects would be counter-productive. It is obvious that in this case the increase in consumer price inflation would not trigger a further tightening of monetary policy, and this might require some explanation on the part of the monetary policy authorities.

The need for frequent explanations may erode efforts to strengthen credibility; explanations can readily be interpreted as excuses for not being able to achieve the target. In the case of strong credibility temporary deviations from targets neither erode credibility nor call for excessive explanation. If credibility is not adequate, deviations, as temporary or as explainable as they might be, unavoidably complicate the process of building up credibility.

The exclusion of dwelling prices from the targeted inflation measure also serves this purpose. The treatment of dwelling prices in the Finnish CPI differs from international practice. They are included in housing costs as an imputed depreciation, which emphasizes the treatment of housing as an investment rather than as a commodity. Alchian and Klein (1973), and more recently Goodhart (1993), have argued that, theoretically, asset prices should be included in the targeted measures of inflation. In practice the method of inclusion is, unfortunately, far from unambiguous. Widely fluctuating housing prices would also hamper international comparison.

With the above argumentation in mind a clear-cut rule was considered to be more effective than repeated explanations. The need for discretionary exemption clauses had to be avoided as far as possible. Therefore, the Bank of Finland chose the indicator of underlying inflation as its targeted measure of inflation. The IUI is the consumer price index from which the effects of indirect taxes, subsidies and housing-related capital costs, i.e. house prices and mortgage interest payments, have been removed.

### 3 How is it constructed?

In principle the idea of how to form a "peeled" price index, which would measure underlying inflationary trends more precisely than the CPI itself, seems quite straightforward. Next we take up how this has been done in Finland.

In table 1, the structure of the CPI<sup>4</sup> is presented. The weight structure is based mainly on the Household Survey which was carried out in 1990. As can be seen, dwelling prices (depreciation) and mortgage interest payments account for 9.98 per cent of total household consumption in 1990. Removing the effects of these items from the overall CPI simply means that a new consumption basket, CPI\*, is constructed without them. This new basket is exactly 9.98 per cent smaller than the original one. This means that the weight of each remaining item is larger in the CPI\* than in the

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<sup>4</sup> For further details, see Consumer Price Index 1990 = 100, Methodology and Practice, Statistics Finland, Studies 200, Helsinki 1993.

original CPI. The price changes of each remaining item have a larger effect on the CPI\* than on the overall CPI.

Table 1  
**Consumer Price Index (1990 = 100)**  
**– items and their weights**

	Item	Weight (%)
0	Food	15.51
1	Beverages and tobacco	7.23
2	Clothing and footwear	6.02
3	Housing, heat and light	19.77
	depreciation	5.29
	interest	4.69
4	Household furnishing, equipment and services	6.09
5	Health and medical care	3.34
6	Transport and telecommunications	18.23
7	Education and recreation	10.08
8	Other goods and services	13.74
	<b>TOTAL (0+1+2+3+4+5+6+7+8)</b>	<b>100.00</b>

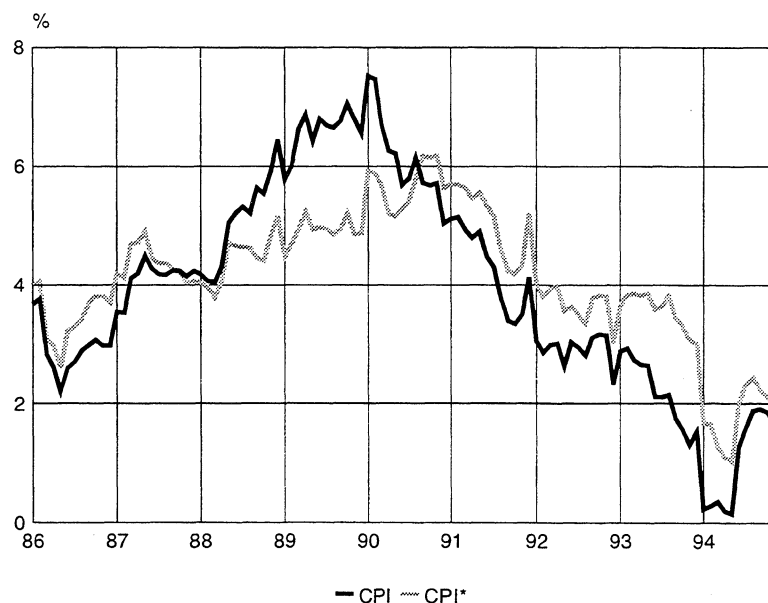
Source: Statistics Finland

The year-on-year rates of consumer price inflation measured by the CPI and the CPI\* are shown in figure 1. In the late 1980s the difference between the CPI and the CPI\* rates of inflation was due to soaring dwelling prices. In the 1990s the CPI\* inflation rates have been higher than the CPI inflation rates. Falling dwelling prices had a restraining effect on the CPI rates, but as their decrease was not as rapid as their earlier increase, the difference between the CPI\* and the CPI rates was now smaller. In 1993 the difference widened substantially as a result of the dramatic fall in interest rates. This year the difference has narrowed again. After bottoming out in early 1993 dwelling prices have been increasing slowly. The decline in interest rates has also come to a halt.

A further remark on the interest rate component of the CPI is appropriate. Mortgage interest payments are measured by the average interest rate on outstanding housing loans. This means that short-term interest rate fluctuations have only minor – if any – effects on consumer prices. One should also keep in mind that as long as the average interest rate on new loans is lower than the average interest rate on outstanding loans, the latter will decline. In Finland the average interest rate on new housing loans has been increasing since March 1994 but it is still below the rate on outstanding housing loans. Even if the fall in the average interest rate on the outstanding loans has now stopped, the restraining effect on the CPI will vanish only gradually from the 12-month change.

Figure 1

### Consumer price inflation 12-month percentage change



Excluding the effects of indirect taxes and subsidies is more subtle and discretionary. The procedure is the same as in the case of net the price index (NPI)<sup>5</sup>, i.e. the consumer price index from which the effects of indirect taxes and subsidies have been removed. Clearly, the indicator of underlying inflation is a type of net price index for which the reference index is the CPI\* defined above.

Changes in the rates of indirect taxes and subsidies affecting household consumption expenditure are measured by a tax rate index (TRI). The tax rate index covers both direct effects on commodity prices and indirect effects via the use of intermediate products. The weight structure of the TRI (1990 = 100) is based on the input-output tables of the 1990 national accounts, on the 1990 financial accounts of the central government and on the value weights of CPI (1990 = 100). The data have been harmonized with the aid of statistics from the National Board of Customs and the National Board of Agriculture.

The interpretation of the net price index (or the indicator of underlying inflation) and the tax rate index differs from that of the consumer price index. The CPI (or CPI\*) is a relative measure of what the consumer has to pay for the base year commodity basket. At the same time, this payment is the revenue received by the producers and sellers of that basket. The NPI (or IUI) measures the change in producers' and sellers' revenues and the TRI the change in the central government revenues. The CPI is a weighted average of the NPI and TRI and the CPI\* is a weighted average of the IUI and TRI.

In table 2, the consumer price index is divided into components. Housing-related capital costs account for 9.98 per cent of the overall CPI. Indirect taxes increase and subsidies decrease the cost of the consumption basket. Together they account for 23.03 per cent of the overall CPI. The rest is the indicator of underlying inflation and its share being 66.99 per cent of the overall CPI.

<sup>5</sup> For further details, see Lehtinen (1994): Net Price Index and Tax Rate Index 1990 = 100, Statistics Finland, Memo 139, Helsinki.

Table 2

**Consumer price index\*, tax rate index and indicator of underlying inflation as per cent of consumer price index (1990 = 100), June 1994**

CPI		100.00	
	housing prices	5.29	
	mortgage interest payments	4.69	
CPI*		90.02	100.00
TRI	indirect taxes	27.45	
	subsidies	-4.42	23.03
IUI		66.99	74.42

Source: Statistics Finland

The last column on the right shows the weight structure of the CPI\*, which is used in calculating the IUI. It must be kept in mind that the weight structure changes as the structure of indirect taxes and subsidies changes. The above-mentioned figures apply to the period following the VAT reform, from June 1994 onwards. Membership in the European Union will change the whole system of indirect taxes and subsidies at the beginning of 1995. New weights will be needed as from January 1995.

As mentioned earlier, the CPI\* is the weighted average of the TRI and IUI:

$$\text{CPI}^* = 0.7442 \cdot \text{IUI} + 0.2558 \cdot \text{TRI} \quad (1)$$

Therefore, the formula for the IUI is

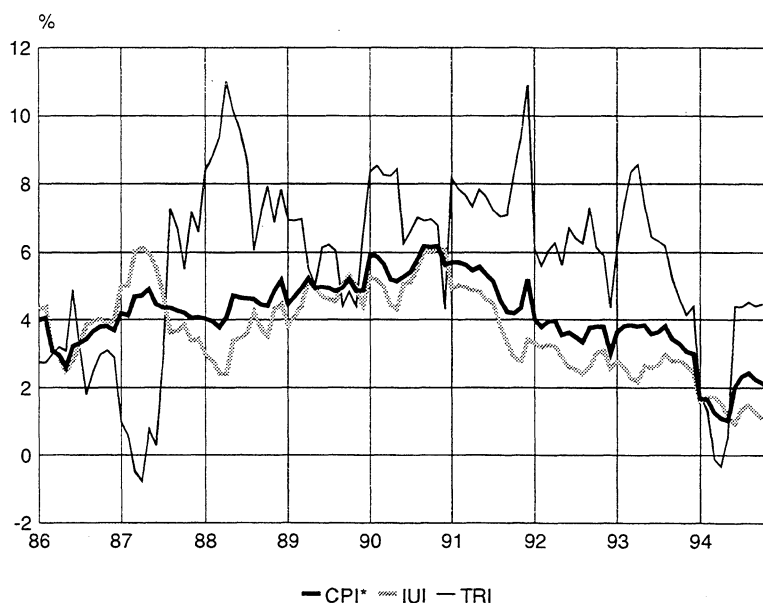
$$\text{IUI} = 1.3437 \cdot \text{CPI}^* - 0.3437 \cdot \text{TRI} \quad (2)$$

The 12-month percentage changes in the IUI, CPI\* and TRI are shown in figure 2. The characteristics of the IUI are analyzed more thoroughly in the next section. Movements in the CPI\*, TRI and IUI as well as the previous weight structures are described in detail in the appendix.

The net price index (1990 = 100) and tax rate index (1990 = 100) figures are published in the Bulletin of Statistics issued by Statistics Finland. Statistics Finland calculates and publishes the indicator of underlying inflation (1990 = 100) figures in connection with the consumer price index (1990 = 100) on the 15th of each month. The CPI figure is for the previous month and the IUI for one month earlier. The additional time lag is due to the calculation of the TRI.

Figure 2

### Consumer price inflation 12-month percentage change



## 4 How does it behave?

In examining the characteristics of the IUI, it is useful to consider the characteristics of the sub-indices involved as well as the characteristics of a mean value in general. This is the case for all net price indices.

First, the prices in the CPI\* are observed prices collected from department stores, auto dealers, supermarkets, specialty stores and mail-order catalogues whereas the pass-through of changes in the rates of indirect taxes and subsidies into consumer prices is evaluated on the basis of their effect on annual central government revenue. The prices in the IUI are not observable. Second, because the IUI is the weighted average of the CPI\* and TRI, the direction of the change in the IUI depends on the relative sizes of changes in the CPI\* and TRI.

Table 3 clarifies the second point. The figures have been calculated by using formula (2) above. If the monthly<sup>6</sup> change in the TRI is smaller than in the CPI\*, the change in the IUI must be larger than in the CPI\*. And conversely, if the change in the TRI is larger than in the CPI\*, the change in the IUI must be smaller than in the CPI\*.

<sup>6</sup> Formula (2) can be written in time differences as long as the weight structure of the TRI remains unchanged. The structure cannot change within a month but can, of course, change within e.g. a year.

Table 3

**Some examples showing the behaviour of the IUI**

change in TRI	change in CPI*	change in IUI
-2.00 %	+2.00 %	+3.37 %
+10.00 %	+2.00 %	-0.75 %
+2.00 %	+2.00 %	+2.00 %

As can be seen in figure 2, the tax rate index has always been subject to considerable change. In principle, the effects of changes in the rates of indirect taxes and subsidies are not included in the indicator of underlying inflation. In practice, however, the removal of these effects is not simple or transparent. The size of an overall effect can be estimated reliably enough on the basis of the effect on government revenue, i.e. on the basis of the TRI for the same year. But, unfortunately, nobody knows how long it will take for this effect to be passed through into consumer prices. As a result, Statistics Finland has to make more or less subjective estimates as to when to include these changes in the TRI.

All the errors in estimating the pass-through lags in the TRI are also reflected in the IUI. For example, if a tax increase is included in the TRI but the actual consumer prices do not increase or firms' margins do not decrease accordingly the IUI will be biased downwards. Even though the error occurred in only one month the bias would remain in the measurement 12-month changes for a whole year.

Normally, most of the total effect is passed through into consumer prices instantaneously and the lag for the rest is short. In this situation there is not much room for error. The problems arise when the size of the total effect is large and the lags are for some reason expected to be long. As a result of the increased interest in the calculation of the TRI, Statistics Finland has begun to use more sophisticated lag structures. The IUI, however, will remain sensitive to errors in the TRI and some of the monthly changes in the IUI will undoubtedly be difficult to interpret also in the future.

## 5 An illustrative example

In connection with Finland's EU membership there will be price changes which have different effects on the consumer price index and the indicator of underlying inflation. This example will serve as a good illustration of the effects of a structural change on the behaviour of the IUI. Though the figures are presented as exact figures, they must be considered as illustrative and by no means as a forecast.

When Finland becomes a member of the European Union, agricultural producer prices will be lowered to the same level as producer prices in the EU. The reduction of producer prices and increasing import competition are likely to have a quick effect on consumer food prices also. As reductions in the value of stocks are compensated against receipts, it may be assumed that the price reductions will pass very quickly through the processing chain into consumer prices.

At the same time, some indirect taxes and tax reliefs aimed at agricultural products and food — the most important being the primary product allowance — will be removed. Irrespective of EU membership, the beginning of 1995 will also



see an increase in tobacco and fuel taxes, and some services that have been tax exempt will become subject to the value-added tax.

Table 4 **Impact of EU membership on the CPI\*, TRI and IUI**

	Dec 1994	Jan 1995
indirect taxes	100.0	96.6
subsidies	100.0	75.0
TRI	100.0	102.3 <sup>1</sup>
CPI*	100.0	100.0
IUI	100.0	99.3 <sup>2</sup>

$$^1 \text{ TRI} = 1.263 \cdot (\text{indirect taxes}) - 0.263 \cdot (\text{subsidies})$$

$$^2 \text{ CPI}^* = 0.2437 \cdot \text{TRI} + 0.7563 \cdot \text{IUI}$$

Table 4 gives the net effects of all changes in indirect taxes, subsidies and consumer food prices on the components of the IUI. For convenience, the reference month is December 1994 and the reference level of all indices is 100. It is assumed that all effects will pass through to consumer prices in January 1995. It should be noted that a structural change in taxes and subsidies alters the weight structure of the TRI and IUI. The estimated weight structures in January 1995 are shown in the lower part of table 4.

The net effect of the decrease in indirect taxation due to EU membership and the increase in indirect taxation due to the broadening VAT base and rising tobacco and fuel taxes is negative; it is assumed that indirect taxation is reduced by 3.4 per cent. At the same time, however, the removal of primary product allowances for foodstuffs is assumed to reduce subsidies by approximately 25 per cent. This results in a rise in the tax rate index as a whole according to the weight structure of the TRI.

The Consumer Research Centre (Pohjonen 1994) has estimated that — as a result of the reduction in agricultural producer prices and changes in indirect taxes and subsidies directed to agricultural products and food due to the EU membership — the decrease in consumer food prices might total 9.5 per cent on average at the beginning of 1995. This alone implies about a one per cent fall in the level of the CPI\*. At the same time, however, the increase in tobacco and fuel taxes and the broadening of the VAT base are estimated to raise the CPI\* by approximately one per cent. As a result, the CPI\* is assumed to remain roughly unchanged, *ceteris paribus*, in the early months of 1995 compared to its level at the end of 1994.

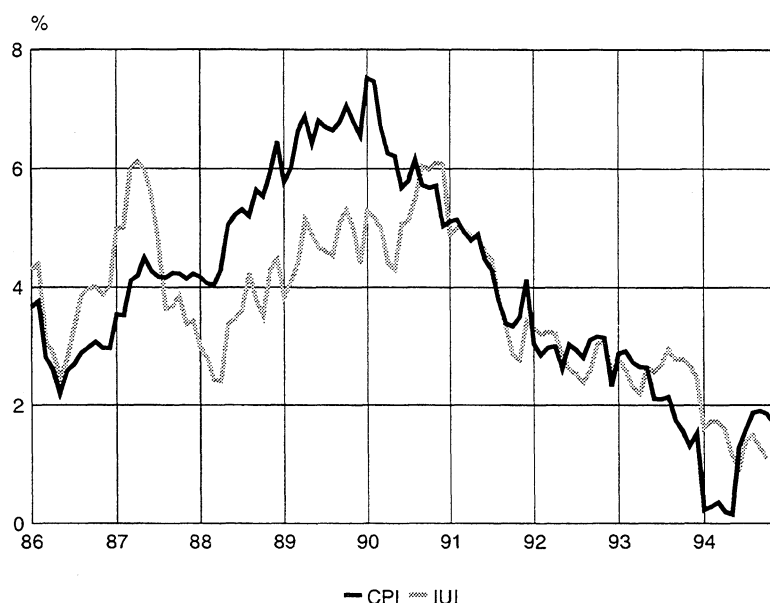
The calculation of the IUI in January 1995 is now straightforward as can be seen in table 4. Changes in indirect taxes and subsidies are not included in the IUI, where the decrease in consumer prices of food is evident as a discrete step downwards.

## 6 Summary — facts to remember

The 12-month percentage changes in the consumer price index and the indicator of underlying inflation are shown in figure 3. These are the two main indices extensively monitored by the markets and the public in Finland. References are rarely made to the sub-indices, i.e. the tax rate index and the consumer price index excluding housing-related capital costs. However, if we want to fully understand the development of the IUI these indices must be taken into account. Figure 3 makes one ask the essential questions but does not provide the answers.

Figure 3

### Consumer price inflation 12-month percentage change



It is important to realize that the indicator of underlying inflation is an applied net price index. It acts like the NPI and has the same weaknesses as the NPI. The IUI is not something new but rather something old with a new label.

The objective of monetary policy is to attain stable monetary conditions, i.e. a low and stable rate of inflation. By announcing an inflation target the Bank of Finland has stated this objective explicitly. The target is measured by the indicator of underlying inflation. The special role of the IUI in the formulation of monetary policy makes excessive demands on the monitoring and especially on the forecasting of the IUI. The special features of the sub-indices and the calculation of the IUI have to be thoroughly understood. The importance of understanding is emphasized in the case of large structural changes in taxation like the VAT reform in 1994 and EU membership in 1995.

The purpose of this study is to present the indicator of underlying inflation in some detail. The use of the IUI in various contexts is an important issue but beyond the scope of this study. The importance of the IUI will motivate work in this area. Some statistical and econometric analysis has already been done (see e.g. Peisa 1995). Further studies should also examine the accuracy of the IUI in measuring the economy's underlying inflationary trends.

## Appendix

Consumer price index (1990 = 100) from which housing related capital costs have been removed

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1990	97.67	98.15	98.61	99.21	99.58	100.04	100.06	100.56	101.29	101.63	101.58	101.52
1991	103.24	103.75	104.16	104.63	105.12	105.39	105.21	105.17	105.58	105.88	106.00	106.81
1992	107.38	107.69	108.27	108.79	108.86	109.21	108.89	108.69	109.56	109.92	110.03	110.03
1993	111.30	111.80	112.44	112.94	113.05	113.12	112.85	112.84	113.31	113.55	113.41	113.34
1994	113.17	113.65	113.87	114.18	114.22	115.39	115.47	115.59	115.85	115.97	115.64	

Tax rate index (1990 = 100)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1990	98.31	98.73	99.14	99.53	100.13	99.83	100.24	100.55	100.69	101.31	100.73	100.79
1991	106.35	106.48	106.73	106.82	107.98	107.44	107.49	107.63	107.83	109.74	110.15	111.77
1992	112.85	112.45	113.17	113.53	114.05	114.65	114.39	114.37	115.70	116.49	116.66	116.64
1993	119.82	120.68	122.62	123.25	122.45	122.04	121.63	121.45	121.74	121.89	121.49	121.78
1994	121.96	122.30	122.48	122.84	123.15	127.42	126.95	126.95	127.10	127.34		

Indicator of underlying inflation (1990 = 100)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1990	97.47	97.96	98.45	99.11	99.40	100.11	100.00	100.56	101.48	101.73	101.85	101.75
1991	102.25	102.88	103.34	103.93	104.21	104.73	104.48	104.39	104.86	104.65	104.67	105.23
1992	105.63	106.17	106.70	107.28	107.20	107.47	107.13	106.88	107.59	107.83	107.90	107.92
1993	108.56	108.94	109.16	109.62	110.03	110.23	110.00	110.05	110.57	110.84	110.78	110.60
1994	110.30	110.82	111.04	111.34	111.30	111.26	111.52	111.69	111.99	112.06		

The weights of TRI and IUI:

	TRI	IUI
01–12/1990	0.2419	0.7581
01–12/1991	0.2419	0.7581
01–12/1992	0.2423	0.7577
01–05/1993	0.2437	0.7563
06–12/1993	0.2451	0.7549
01–05/1994	0.2466	0.7534
06/1994–	0.2558	0.7442

Source: Statistics Finland

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