

## ARTICLE – High energy prices – how will other consumer prices be affected?

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During the initial stage of the pandemic, inflation in Sweden was mostly affected by measurement problems and changed consumption patterns. During 2021, the focus was on bottlenecks, rising freight costs and higher commodity prices. Many of these problems remain to some extent, but most recently, it has primarily been higher energy prices, and electricity prices in particular, that have impacted inflation. CPIF inflation, which has risen rapidly, is expected to be close to 4 per cent during the first quarter. This article discusses how, and to what extent, energy prices can affect other consumer prices. As the rise in energy prices has been both larger and more prolonged than the Riksbank estimated earlier, the contagion effects are expected to be somewhat larger than has been assumed so far.

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### How do higher energy prices affect other prices?

Changes in energy prices have contributed to an increase in CPIF inflation from 0.5 per cent in December 2020 to 4.1 per cent in December 2021. Never since the introduction of the inflation target in 1995 has CPIF inflation been higher. Prices for fuel and household electricity are included in the normal measures of inflation and consumer prices for these products are changing more frequently than other prices. However, it is not only households that consumes energy; companies do it too. The question is how much the high energy prices are affecting corporate costs and thus how much other prices are also being raised afterwards. These delayed effects are very difficult to measure.

An example of such an *indirect effect* is when rising fuel prices affect bus companies' costs and, in the next step, their ticket prices. Other examples are when higher electricity prices affect the total expenditure item for farmers, who must then compensate by raising food prices, or when higher costs for running and heating properties result in higher rents. In all cases, it is a question of higher costs for companies gradually being passed on to consumers.

When energy prices rise, this can also affect inflation expectations and thus inflation via higher wage demands, for example. This type of delayed effect is normally referred to as a *secondary effect*.

The Riksbank and other analysts have tried to estimate the magnitude of the indirect effects of changed energy prices with the help of econometric analysis tools that take historical correlations between variables into consideration. Secondary effects have

also been studied in various scenarios. This article discusses the results from these analyses.

### **The contribution of energy prices to inflation is at an all-time high**

Energy prices, which is to say both fuel prices and electricity prices, rose rapidly in 2021 and their contribution to CPI inflation amounted to 2.5 percentage points in December (see Figure 53).<sup>25</sup> The contribution from fuel prices was 0.6 percentage points, while electricity prices contributed 1.9 percentage points.

Fuel prices are affected by the price of oil, which has increased by just over USD 30, or 60 per cent, to almost USD 90 a barrel since January 2021. This development has affected fuel prices in both the United States and Europe.<sup>26</sup> In Sweden, the price of a litre of 95-octane petrol has risen by more than 30 per cent, or almost SEK 4 per litre during the same period. The price of diesel has risen even more. The price increase on oil is due to the supply not having increased as quickly as the demand. Prices for natural gas and coal have also risen sharply.

Electricity prices have developed even more dramatically and this is due to several factors. Abnormally low water levels in Nordic reservoirs and little wind have contributed to rising electricity prices in Sweden. Supplies of natural gas from Russia have been limited, which has affected electricity prices in Europe. In December 2021, market prices of electricity had risen by almost 400 per cent in Germany and France on a yearly basis. They have fallen slightly in January 2022 but are still high. Since the Swedish electricity market has become more interconnected with the continental market over time, Swedish electricity prices have also been affected, particularly in southern Sweden.

According to forward prices, the oil price is expected to fall by close to USD 15 per barrel during the forecast period. Electricity prices in Europe and Sweden will also fall after the winter, according to forward pricing. However, the short-term movements in the electricity price are difficult to foresee with any great precision, as they to a large extent depend on the weather, although there is a clear seasonal pattern in these prices, which are normally lower in the summer than in the winter.

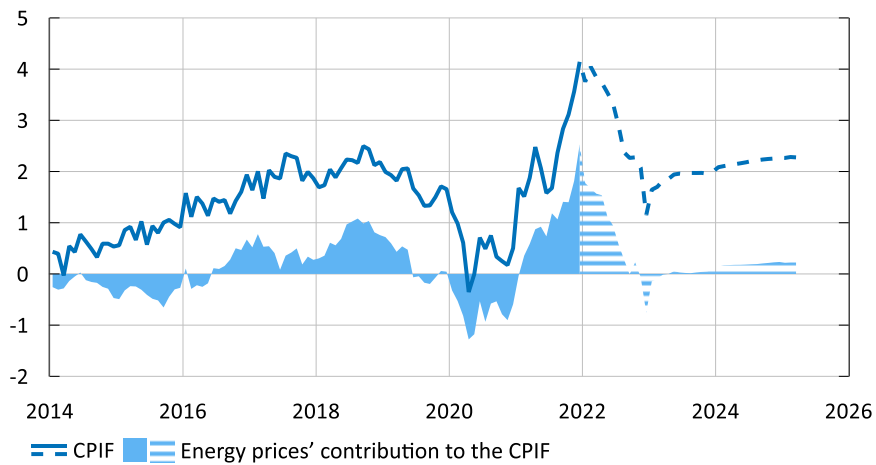
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<sup>25</sup> The weights of fuel and electricity prices in the consumption basket amount to 2.4 and 4.2 per cent respectively. Energy prices also include heating excluding electric heat (weight = 0.5 per cent), which includes fuel oil, for example.

<sup>26</sup> Fuel prices in Europe are also being affected by the dollar exchange rate.

**Figure 53. The CPIF and contributions from energy prices**

Annual percentage change and percentage points



Note. The contribution of energy prices to the CPIF in the forecast is calculated as the annual percentage change in energy prices multiplied by their current weight in the CPIF. Solid line refers to outcome, broken line represents the Riksbank's forecast.

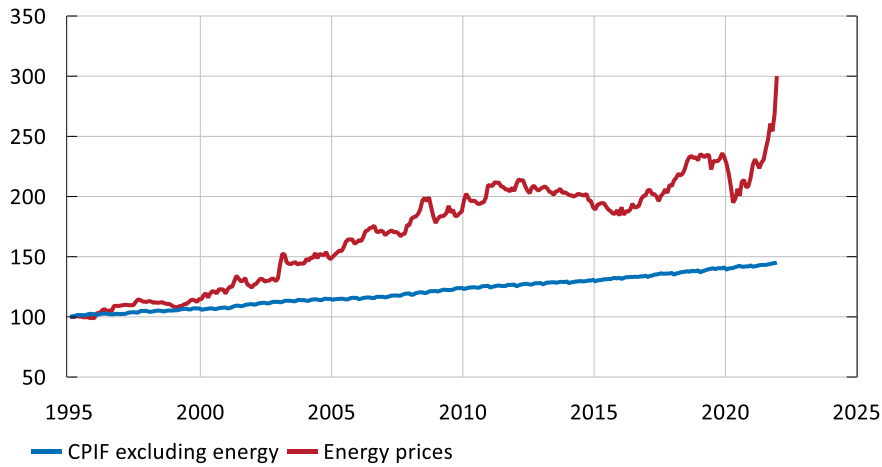
Sources: Statistics Sweden and the Riksbank.

Energy prices rising more rapidly than the CPIF, i.e. the relative price of energy increasing, is no new phenomenon. In Sweden, it is partly due to a trend increase in tax on energy. Energy prices are usually volatile and have quite a considerable effect on inflation, despite their relatively limited weight in the consumer basket. As Figure 54 shows, they increased considerably faster than other prices in Sweden from the end of the 1990s up until around 2012. The figure also shows how energy prices have increased unusually rapidly in the recent period.

During the 2000s, however, inflation in terms of the CPIF has not been particularly high. If anything, inflation has tended to be below the target of 2 per cent. The fact that energy prices have risen faster than other prices has thus not given rise to excessively high total inflation.

**Figure 54. CPIF excluding energy and energy prices in levels**

Index, January 1995 =100

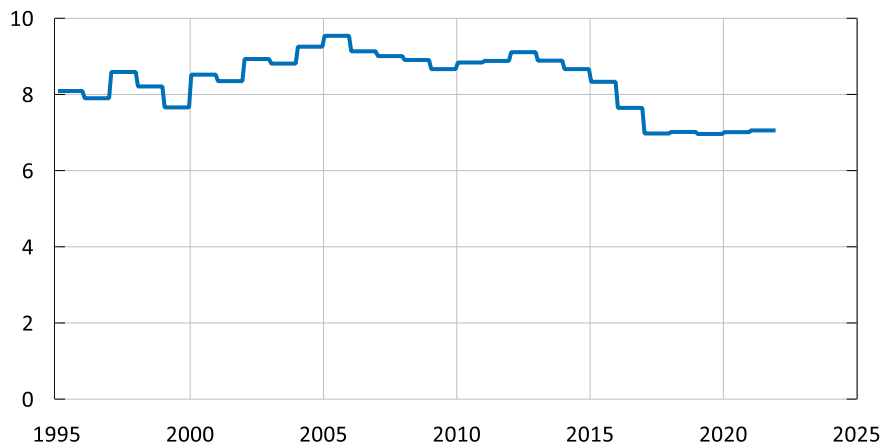


Sources: Statistics Sweden and the Riksbank.

Despite the rising energy prices, the weight for energy in the consumption basket has been relatively constant at 7–9 per cent (see Figure 55). The cost of the average consumer’s energy consumption has thus not increased in relation to the cost of other products – it does not constitute a greater share of the consumption basket over time.

**Figure 55. Weight for energy in the CPIF**

Per cent



Source: Statistics Sweden.

One explanation for this is that producers and consumers are constantly striving to produce and buy products and technology that save increasingly expensive energy, such as ground-source heating and fuel-efficient cars, as these have been profitable for both companies and consumers. Higher energy prices have increased the incentive to invest in energy-saving technological development.

### **Which prices are normally affected by energy prices?**

Recently, there have been several news reports and articles about corporate cost increases and expected indirect price effects. In many cases, the increased costs are entirely or partially linked to higher energy prices. The trade association the Swedish Food Federation has reported that many Swedish farmers and food producers have very squeezed margins, where higher electricity and fuel prices, especially the higher diesel price, have had an impact on their expenditure. They have also indicated that this should lead to significant price increases on food. One example is bread companies that are letting rising costs for electricity impact retail prices. At the same time, one of the world's largest furniture companies, IKEA, is referring to higher costs for transport and logistics and has announced an increase in the prices for half its range by an average 9 per cent. Cost increases have also been reported in the services sector as a result of higher energy prices, for instance for hotels and conference centres.

As early as last autumn, costs had risen in almost all sectors, partly due to energy prices, according to the Riksbank's Business Survey.<sup>27</sup> Other indicators also point to more consumer prices will be raised in the near term. Producer prices have risen, which is expected to affect consumer prices with a certain time lag. According to the Economic Tendency Survey, the share of companies wanting to raise prices has increased rapidly, especially in the retail sector.

One can thus assume that the higher costs, which are to a fairly large degree affected by energy prices, may lead to indirect effects in several sectors. This, in turn, can lead to a relatively broad upturn in inflation. The Riksbank's assessments in the forecasts done in 2021 was therefore that various indirect effects would contribute to higher inflation.

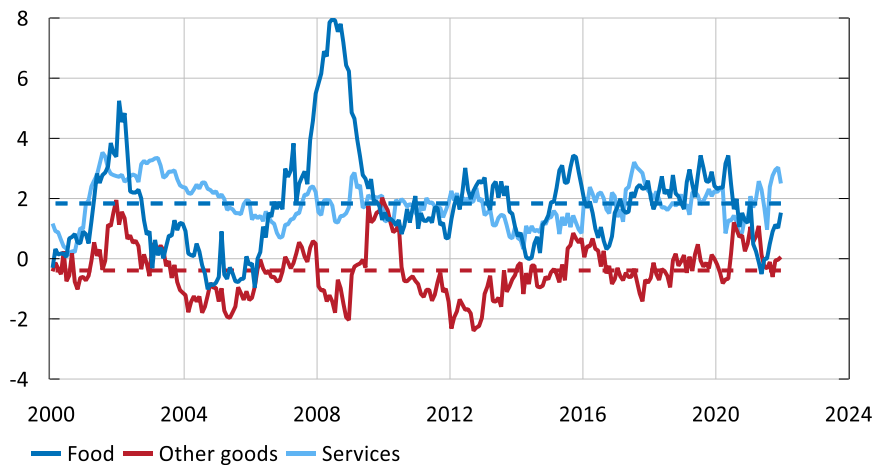
So far, however, inflation outcomes show no clear indirect effects of the higher energy costs. Figure 56 shows the annual rate of increase in prices for food, other goods and services. The rate of increase has not risen markedly and is still close to a historical average in all cases.

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<sup>27</sup> See "As soon as you find one component, you realise you're missing another", *The Riksbank's Business Survey*, September 2021, Sveriges Riksbank.

**Figure 56. Food, other goods and services in the CPI**

Annual percentage change



Note. Broken lines refer to average rate of change in the period 2000 up to and including the most recent outcome. The mean values of the rate of increase for food prices and service prices are close and thus cannot be told apart in the figure.

Sources: Statistics Sweden and the Riksbank.

### Model estimates of indirect energy price effects

The Riksbank has previously tried to estimate the magnitude of potential indirect effects in the event of a higher oil price. A study from 2008 shows that the indirect effect on inflation is approximately as large as the direct effect, but that it impacts with a time lag and is distributed over a longer period. The estimate shows that, if the price of oil were to rise by 10 per cent and then remain at that level, after one year, CPI inflation would be about 0.2 of a percentage point higher than if the price had remained unchanged.<sup>28</sup> If energy prices rise sharply over a longer period of time, as has been the case over the past year, the analysis shows that the indirect effect may be significant.<sup>29</sup>

In another analysis by the Riksbank from the same year, a similar approach is used to study the indirect effect of higher electricity prices.<sup>30</sup> The model is expanded in this case to include producer electricity prices, which are assumed to rise by ten per cent and then remain at that level. The results indicate that the indirect effect is almost as large as in the case of a permanently higher oil prices.

<sup>28</sup> The direct effect on CPI inflation via higher fuel prices was calculated at about 0.15 of a percentage point. The estimates were produced using econometric analysis tools and the period studied was 1990–2005. See also M. Bjellerup and M. Löf (2008), “The effects of the oil price on inflation in Sweden”, *Economic Commentary* no. 4, Sveriges Riksbank.

<sup>29</sup> In an analysis by the National Institute of Economic Research, a similar model was estimated, see “Råoljeprisets betydelse för konsumentpriserna” (only in Swedish - Significance of crude oil price for consumer prices) in *Konjunkturläget (Swedish Economic Report)*, March 2016, National Institute of Economic Research. This analysis reaches similar conclusions.

<sup>30</sup> The period studied is 1985–2007. See the article “Energy prices and Swedish inflation” in *Monetary Policy Report*, February 2008, Sveriges Riksbank.

It should be stressed that this type of estimate is extremely uncertain. The results depend on which variables are included in the specification and which period is studied. The estimates can only capture an average effect on inflation caused by changes in energy prices. It is not difficult to imagine that a large number of factors, such as the general economic situation and resource utilisation in the economy, play a role and can affect companies' pricing when energy prices change. How inflation is ultimately affected depends of course also on how monetary policy is designed.

The model results above are based on energy prices rising initially and then remaining at the new, higher level. According to the above estimates, this would lead to large indirect effects. If the direct effect contributes 2.5 percentage points to the rate of inflation now, the indirect effects will contribute roughly the same amount, but divided over 3 years.<sup>31</sup> However, in the Riksbank's forecast, the prices of oil and electricity are expected to fall back, in line with forward pricing, so that the indirect effects according to this rule of thumb should be lower.

Estimates based on newer data also indicate that the impact from energy price changes has declined. It is often difficult to find any clear historical covariation between energy prices and other prices at all.<sup>32</sup> One possible explanation for the indirect effects appearing to have declined over time is that production is more energy-efficient now than it was before. Another explanation could be the time period studied. The earlier analyses included a period with very high energy prices around 1990 in the data material. If the fluctuations in energy prices are minor, or judged to be temporary, then companies may allow them to impact profits instead of adjusting their selling prices.

### **How have the higher energy prices been considered in the inflation forecast?**

However, although more up-to-date estimates of the average indirect effect suggest that it has decreased, it cannot be ruled out that the impact on other consumer prices may be significant this time, as the energy price increases have been very substantial.

The Riksbank's assessments from 2021 expected various indirect effects to lead to a somewhat higher rate of inflation, particularly in 2022. It was then also assumed that the rising inflation would lead to some, very limited, secondary effects via higher inflation expectations and higher wages.

Now that energy prices have risen an unusually large amount, and caused CPIF inflation to rise to a good 4 per cent, the risk of larger indirect effects and larger secondary effects has increased. This has been taken into consideration in this report.

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<sup>31</sup> This would give an indirect contribution of 0.8 of a percentage point per year for three years (the years 2021–2023).

<sup>32</sup> The Riksbank's studies of the correlation imply that the average indirect effect is at most around half as large as in the analyses from 2008. And according to new analysis from the National Institute of Economic Research, the long-term aggregate effect on the CPI, if the spot price of electricity is permanently 10 per cent higher, will be 0.21 of a percentage point if the costs have their full impact. Of this, 0.16 of a percentage point is a direct effect and 0.05 of a percentage point is an indirect effect via higher production costs in Sweden and abroad.

Compared with the latest assessment in November, inflation has been revised upwards by about 0.1 of a percentage point due to indirect effects over the last two years. The secondary effects are also expected to become somewhat larger now than in the last projection. However, these are expected to affect inflation slightly further ahead.

### **Alternative scenario with greater second-hand effects**

It is difficult to forecast the size of both the indirect effects and the secondary effects. The forecast of indirect effects can be supported by the above-mentioned model estimates but there are no equivalent empirical underpinnings for the secondary effects. Instead, alternative scenarios are used here to illustrate what the consequences of secondary effects may be for the inflation forecast following different monetary policy decisions. One such scenario is presented below.<sup>33</sup>

As secondary effects are based on changes in inflation expectations, assumptions of how these will develop are important. Inflation expectations on different horizons have risen gradually since the second half of 2020. The overall view of long-term inflation expectations is that they are close to the inflation target, but the rise in more short-term expectations has been rapid and can become even higher.<sup>34</sup> The correlation between actual inflation and inflation expectations is high, particularly in the short term, and it is easy to find results indicating that higher actual inflation leads to higher inflation expectations.<sup>35</sup> It is also reasonable to assume the reverse causal relationship: that higher inflation expectations lead to higher actual inflation, which is to say that secondary effects arise.

The temporarily high inflation could thus cause inflation expectations to rise further. This, in turn, could lead to wage earners demanding higher wages as a way of retaining unchanged real wages. Companies may then be forced to compensate for their higher costs by raising prices further, and so on. It is difficult, overall, to determine the size of secondary effects and large changes in inflation may make this even more difficult. The unexpectedly rapid upturn in inflation since November may therefore give reason to study an alternative scenario with greater secondary effects than in the main scenario.

In a preliminary stage, inflation expectations for two years ahead are assumed to rise further from the current levels and then be above the inflation target over the entire forecast period. This, in turn, is assumed to lead to wage demands being higher and nominal wages rising more rapidly. Corporate costs thereby rise more than in the

<sup>33</sup> The scenario has been constructed using the Riksbank's general equilibrium model, MAJA. For a description of the model, see V. Corbo and I. Strid (2020), "MAJA: A two-region DSGE model for Sweden and its main trading partners", *Working Paper* no 391, Sveriges Riksbank.

<sup>34</sup> Some expectations, such as households' expectations according to the National Institute of Economic Research, are at historically high levels.

<sup>35</sup> Inflation expectations covary particularly clearly with the rate of price change in various energy components. See, for example, L. Kilian and X. Zhou (2020), "Oil Prices, Gasoline Prices and Inflation Expectations: A New Model and New Facts", *Working Paper* No 2025, Federal Reserve Bank of Dallas.



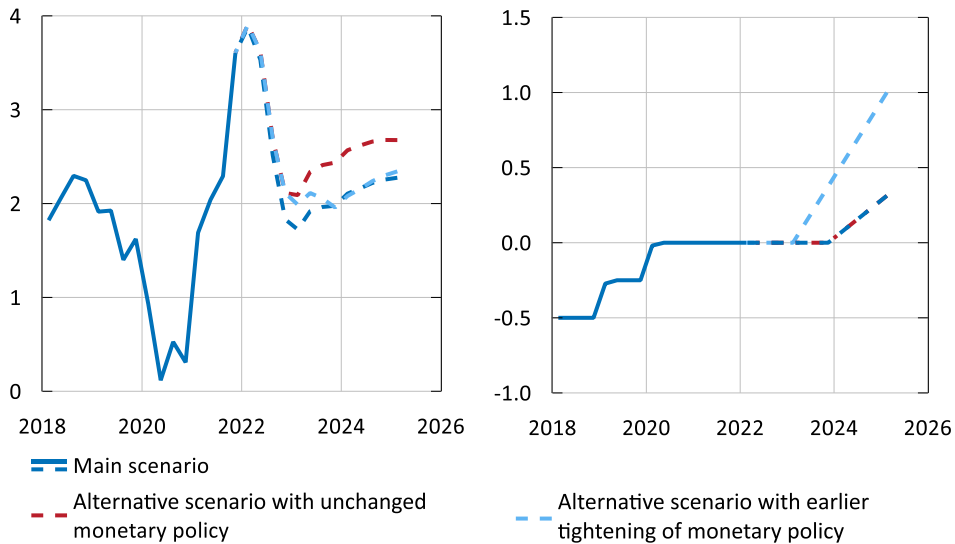
main scenario and, as the higher costs are passed on to consumers in the form of higher prices, the rate of inflation rises.

If monetary policy is not adjusted to the higher inflationary pressures, wage rises and CPIF inflation become higher than in the main scenario and the inflation target is exceeded clearly over the entire forecast period, as shown by the red curve in the left image in Figure 57. Monetary policy would therefore need to be tightened.

An alternative with an earlier tightening of monetary policy is that the repo rate starts to rise in the second quarter of 2023, when inflation increasingly starts to deviate from the main scenario and is on the way to starting to rise over 2 per cent (see the light blue curves in Figure 57). To bring inflation down to the level of the main scenario, the repo rate would then have to rise at a rate equivalent to two increases of 0.25 percentage points per year, instead of one such increase per year, as in the main scenario. When corporate and household expectations are adjusted to the tighter monetary policy, inflation will slow down so that it is in line with the main scenario during the latter part of the forecast period. One of several sources of uncertainty over these effects is how highly-indebted households and companies can be expected to react to interest rate rises that not only come sooner but proceed more rapidly. The monetary policy response may in practice be different to that anticipated in the scenario, once all of the specific circumstances prevailing at the time the decision is made have been taken into consideration.

**Figure 57. The CPIF and repo rate**

Annual percentage change (left-hand graph) and per cent (right-hand graph)



Sources: Statistics Sweden and the Riksbank.