Staff memo

# What is the relationship between Swedish and global inflation?

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April 2024

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**Staff memos**

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# Summary

Inflation in developed countries covaries as a result of global shocks and similar economic policies. The covariation is most evident in global crises such as the 2007–2009 financial crisis or the most recent period of high inflation in many countries, which can be linked to both the 2020 COVID-19 crisis and Russia's invasion of Ukraine in 2022.

This staff memo examines how inflation in Sweden has covaried with inflation abroad from the 1960s to the present day. We show that the covariation between CPI inflation in Sweden and global CPI inflation has been high throughout most of this period, and that the relationship is similar to that of an average OECD country. The corresponding relationship for the CPI excluding energy and food, a measure of core inflation, weakened significantly during the inflation-targeting period, while food and energy price changes in OECD countries became more strongly correlated. The recent period of high global inflation means that the correlations between inflation and its components in different countries are now higher than ever before.

Since 2017, the Riksbank's target variable is the consumer price index with a fixed interest rate (CPIF). The correlation between CPIF inflation and global CPI inflation has been low over the inflation-targeting period, and the same is true for HICP inflation. However, the weak relationship is almost entirely explained by developments in 2009-2012, when rapid movements in interest rates meant that the difference between CPI and CPIF inflation was unusually large. We therefore conclude that the relationships between CPIF and HICP inflation and their global counterparts have also in fact been strong if we exclude this particular period.

Finally, we examine whether global inflation helps us to make more accurate forecasts of inflation in Sweden. We find that this is the case during periods when inflation is high or when it is difficult to forecast inflation, such as in 2022.

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[1] The authors would like to thank Mikael Apel, Mattias Erlandsson, Mårten Löf, David Vestin and Anders Vredin for their valuable comments during the work.

# 1 Introduction

Neither central banks nor other forecasters anticipated the rapid rise in inflation in many countries in 2021 and 2022. This has led to criticism of central banks, including the Riksbank.[2] A key question is what lessons can be learnt and how forecasting methods can be improved. An important aspect concerns the international dependence of Swedish inflation. Both the Riksbank itself and external analysts have emphasised that the analysis of inflation developments abroad and how they affect inflation in Sweden needs to be deepened.[3] Our staff memo can be seen as part of such an analysis - we study the relationships between inflation in Sweden and abroad from the 1960s to 2022.

Inflation in developed countries covaries over time. In Figure 1, we show CPI inflation in Sweden, the euro area, the United States and the median inflation rate for 22 OECD countries over the period 1960−2022.[4] During the 1970s, inflation rose ("the Great Inflation") and from the 1980s, it fell back. The level of inflation in different countries converged and volatility decreased. Rapid changes in inflation have often coincided with turning points in the global economy and movements in oil prices.[5] During the period of inflation targeting and low inflation since the 1990s, the covariation of inflation has been particularly evident in the context of major global shocks or crises. These include the global financial crisis of 2007−2009, the fall in oil prices in 2014−2016, the COVID-19 pandemic of 2020−2021 or the recent high inflation, partly in the wake of Russia's invasion of Ukraine.

[2] See Håkansson and Laséen (2024) for an analysis of a number of central banks' forecast errors for inflation in 2022 and for references to the criticism of central banks.

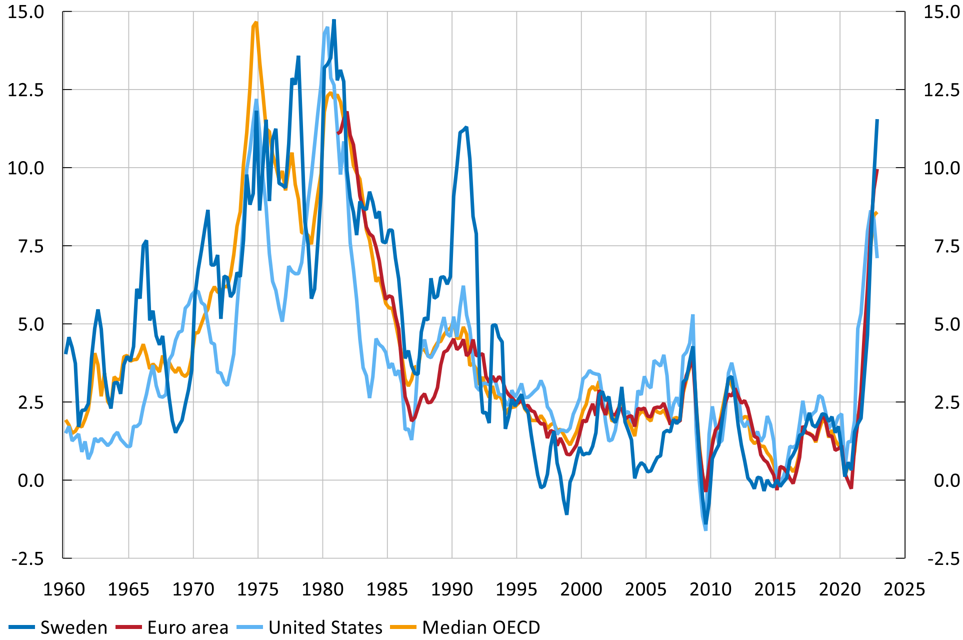
[3] See, for example, Hassler et al. (2023) and Johansson et al. (2022).

[4] The 22 OECD countries are listed in Table 1 in the appendix.

[5] Several of the major increases in oil prices since the 1970s can be linked to various conflicts and wars, see for example Ha et al. (2019b). Ohlsson (2022) discusses four episodes in the 20th century when wars caused high inflation, the First and Second World Wars, the Korean War and the 1970s.

**Figure 1. Inflation in various countries and regions 1960–2022**

Annual percentage change




Note. Refers to the HICP for the euro area and the CPI for others. Quarterly data.

Sources: Eurostat and the OECD.

Previous research has shown that much of the variation in CPI inflation in individual industrialised countries in the post-World War II period can be attributed to common, or global, movements in inflation. This has been succinctly summarised as "inflation is global", meaning that inflation in individual countries is largely explained by common international factors.[6] However, the strength of the relationships between inflation in different countries varies over time and is weaker in studies that also include middle- and low-income countries.[7] The covariation is explained by factors that affect inflation

[6] A good brief summary of this research is given, for example, by Szafranek (2021a) and a concise summary of the results of some key research papers can be found in Ha et al. (2019b). Ciccarelli and Mojon (2010) study the evolution of inflation in 22 OECD countries over the period 1960-2008 and find that on average close to 70 per cent of the variance in inflation across countries is explained by a common global factor. They therefore conclude that inflation is largely a global phenomenon. See also Ferroni and Mojon (2014) for an analysis updated to 2013. Mumtaz and Surico (2012) estimate a dynamic factor model for inflation in 11 advanced economies and find that the level of inflation is captured by a global factor. Neely and Rapach (2011) decompose inflation in 64 countries over the period 1950-2008 and show that global and regional factors together explain on average about half of the variation in inflation across countries.

[7] Parker (2018) studies inflation in 223 countries over the period 1980-2012. For developed countries, the share of the variance in national inflation explained by global factors is around two-thirds. For middle-income countries, the share is 15-20 per cent and for low-income countries it is about 10 per cent. Thus, the share explained by global inflation is significantly lower when virtually all countries in the world are included in the study. Ha et al. (2019a) study inflation in 99 countries over the period 1970-2017 using a dynamic factor model. They find that for the median country, a global factor explains 12 per cent of the variation in the cyclical component of national inflation. Over the period 2001-2017, the importance of the global component increased to 22 per cent, which is explained by the global financial crisis of 2008-2009 and the fall in the oil price in 2014-2016, which had a similar impact on inflation in many countries. The fact that their reported shares are low compared with other studies is partly because they, like Parker (2018), study a larger group of countries, and partly because they allow for group-specific factors in their model, factors that cap-

in many countries at the same time, such as common shocks, e.g. to commodity prices, similarities in monetary policy, and various structural changes, e.g. increased trade and strong cross-country financial links (see further discussion in Chapter 2).[8] Some of the research literature has broadened the investigation to include the impact of global resource utilisation and other external factors on inflation in different countries. An overall conclusion is that external variables can help explain movements in inflation across countries better than if only domestic variables are used but that their importance may vary both across countries and over time.[9] A question in several studies over the last decade is whether globalisation has meant that the role of global factors for inflation in individual countries has increased after, for example, the turn of the millennium.[10]

This staff memo examines the relationships between inflation in Sweden and abroad and how they have changed over the past 50-60 years. Our aim is to compile a number of empirical facts about these relationships. We study different measures of inflation: the Consumer Price Index (CPI), the EU Harmonised Index of Consumer Prices (HICP), the CPI with a fixed interest rate (CPIF) and the CPI excluding food and energy (a measure of core inflation) and different product groups such as goods, services, food and energy. We also study the relationships for the cyclical component of the different inflation measures. By also analysing a group of 22 OECD countries, we can see to what extent the relationships for Sweden differ from those for the other countries. Compared to many other studies on the covariation of inflation across countries, such as Ciccarelli and Mojon (2010), we also give relatively large space to discussions on how the relationships have changed over time. We include data until 2022 and parts of our analysis for a larger number of countries can be seen as an update of the results of previous research studies with similar questions and methods. Two important limitations of our analysis are that it is data-based (we do not use a structural model to interpret our results) and that we only study price data.

Our most important findings on the relationships between inflation in Sweden and abroad can be summarised as follows:

- The relationships between CPI inflation in a sample of 22 OECD countries and global CPI inflation have been relatively strong and stable over time during the period 1955-2022. For Sweden, the relationships are similar to those of

ture the covariation in inflation in countries that are more similar to each other, such as developed economies. Szafranek (2021b) discusses time variation in the relationships and shows, among other things, that the covariation in inflation has increased after the global financial crisis of 2007-2009.

[8] In terms of structural factors, Parker (2018), for example, shows that covariation is higher for rich countries, countries with a developed financial sector and countries where monetary policy is well conducted.

[9] Borio and Filardo (2007) study 29 countries over the period 1980-2005 and show that measures of global resource utilisation increase the explanatory power of traditional Phillips curves for inflation, even when they include import prices or the oil price. Mikolajun and Lodge (2016) estimate Phillips curves with commodity prices and measures of global resource utilisation and inflation for 19 developed countries over the period 1970 to 2014. They find that apart from commodity prices, the value of including global variables is limited. Eickmeier and Pijnenburg (2013) estimate Phillips curves with global measures of output gaps and unit labour costs for 24 OECD countries over the period 1980-2007 and find that the latter has a significant impact on domestic inflation. ECB (2017) finds that the value of including measures of global resource utilisation in the analysis of euro area inflation is limited. See also Forbes (2019b).

[10] See, for example, Ha et al. (2019a) who finds that the importance of global factors has increased since the turn of the millennium.

an average OECD country - around 60 per cent of the variation in CPI inflation can be explained by global inflation.

- The relationships between core inflation, here the CPI excluding energy and food, in OECD countries and a measure of global core inflation weakened markedly in the early 1990s and have been relatively weak during the period of inflation targeting and low inflation in many countries. Again, the relationships for Sweden over time are similar to those for an average OECD country. The weak relationships over this period also apply to the goods and services sub-indices of the HICP, which together constitute core inflation.
- The weakening of the relationships between core CPI inflation excluding energy and food in different countries, while the relationships for CPI inflation have been relatively stable, is related to the observation that the relationships between price changes for food and energy have instead become stronger during the inflation-targeting period.
- The correlations between CPIF inflation or HICP inflation in Sweden and matching measures of global inflation have been weak during the inflation-targeting period. We show that this is largely explained by developments during the period 2009-2012 when CPIF inflation deviated significantly from both Swedish and global CPI inflation due to large interest-rate and exchange-rate movements. Apart from this particular period, the relationships between the two variables − the CPIF and the HICP − with their global counterparts have been quite strong.
- Using a measure of global inflation to forecast Swedish CPI inflation contributes to more accurate forecasts in an evaluation of simple forecasting models for the period 1975−2022. But the value of using global inflation has diminished over time. The value has been greatest when inflation has been high, when the international inflation differential has been large and/or when forecasting has been difficult, i.e. when forecast errors have been large.

As discussed in Chapter 2, a number of factors can explain the covariation of inflation across countries. However, our discussion also shows that the relationships have been influenced by different factors at different times, and that the strength of the relationships has varied over time. With an independent monetary policy and a floating exchange rate, it is not a foregone conclusion that the correlation between inflation in Sweden and other countries must be high. For example, we illustrate how exchange-rate movements weakened the relationships after the global financial crisis of 2007−2009, and a similar example in the near term is provided by the more rapid increase in goods prices in Sweden than in other countries in 2022−2023 as the krona has weakened.[11] During the inflation-targeting period, monetary policy in Sweden and the euro area has been fairly synchronised, which is an important condition for the relationships we discuss (see Figure 18 in the appendix showing policy rates in different countries and regions). With a different monetary policy in Sweden, the relationships could of course have been different. More generally, these relationships will be affected by the shocks that drive economic developments. A greater element of global (country-specific) shocks will mean that the relationships between inflation in Sweden

[11] See the article "The pass-through of the krona to inflation appears to have been larger than usual", Monetary Policy Report, November, Sveriges Riksbank (2023).

and abroad will become stronger (weaker). The similarities between monetary policy in Sweden and abroad (mainly the ECB's monetary policy) during the inflation targeting period then mainly reflect the fact that global shocks dominated economic developments during this period. With this view, the Riksbank has had no reason to deviate clearly from international monetary policy.

# 2 Why does inflation covary across countries?

In this chapter, we outline why inflation covaries in different countries. A natural starting point here is that co-movements in inflation across countries must be due to the covariation of factors affecting inflation. Monetary policy in different countries can strengthen or weaken the covariation depending on how it responds to such shocks. At a general level, four explanations for the covariation of inflation are often discussed[12]:

- Monetary policy is conducted in a similar way in many countries and regions.
- Developments in commodity prices, especially oil prices, have a similar impact on inflation in different countries.
- Covariation in real economic developments across countries means that inflation also covaries (via the Phillips curve).
- Structural factors, such as different aspects of countries' economic openness to the outside world.

In the long run, inflation is determined by **monetary policy decisions and the credibility of the inflation targets reflected by long-term inflation expectations**. The shift in monetary policy that occurred in many countries, including Sweden, from the 1970s to the 1990s meant that trend inflation fell back in a similar way. An expansionary fiscal and monetary policy associated with high inflation (the Great Inflation) was followed in many countries by independent central banks, inflation targeting, low inflation and reduced macroeconomic volatility (the Great Moderation). Since this economic policy regime change was reasonably synchronised in time in several countries, it follows that the correlation between inflation rates in industrial countries is high when calculated for long samples that include data for the 1970s. Thus, a fundamental and synchronised change in economic policy across countries can create inflation trends or regimes that result in a high degree of covariation in inflation in the countries. Below we also discuss how similarities in the monetary policy regime across

[12] Some of the research literature empirically examines the factors that affect the degree of covariation. Szafranek (2021a) studies what explains the covariation of inflation in 139 countries over the period 1999 to 2019. Common shocks, in particular large movements in oil and other commodity prices, are an important explanation for the covariation, as is consistency in the response of monetary policy to the shocks. A higher degree of covariation in the business cycle also contributes to higher covariation in inflation. However, structural factors such as the degree of dependence on commodity imports or global value chains play less of a role though. In a cross-sectional study, Neely and Rapach (2011) find that common shocks, similar monetary policy responses and increased international trade contribute to a higher covariation in inflation. Parker (2018) finds that shocks to the demand and supply of commodities are the main explanation for the covariation.

countries may involve a similar response to different shocks, which may help to amplify the covariation in inflation even at higher frequencies.

In the shorter term, inflation is affected by many different shocks that affect corporate costs and margins.[13] Costs, in turn, are determined by wages, capital costs, prices of imported input goods and productivity, while margins are affected by competition and demand. If such shocks occur simultaneously in several countries, or if, for example, they spill over from a large country to smaller countries, they can lead to covariation in inflation.

Price developments for commodities whose prices are determined in a global market, such as oil and various foodstuffs, affect CPI inflation in different countries relatively quickly and in a similar way.[14] They are therefore particularly important for the covariation of inflation across countries. For example, the war in Ukraine, a major producer and exporter of wheat, has meant that the country's wheat production has been curtailed, leading to a higher world market price, which in turn affected food prices in a similar way in many countries. The prices of imported commodities and other input goods also have indirect effects on producer prices, and thus ultimately on consumer prices.[15] Co-movements in energy prices, or shocks to the prices of other globally traded goods, may also affect inflation expectations in similar ways across countries, giving rise to so-called second-round effects of a similar nature, which may further contribute to the covariation. Price changes for imported consumer goods also have direct effects on CPI inflation, mainly for the goods component.

If central banks in different countries respond to global shocks, such as movements in energy prices, in a similar way, monetary policy helps to amplify the covariation. For example, if different central banks judge that energy price changes are temporary and choose to ‘see through’ them, the impact on inflation should be both greater and more uniform across countries. Shocks that have similar effects on inflation can then also lead to covariation in central bank policy rates (or other policy instruments). During the inflation-targeting period, policy rates in developed countries and regions have been highly correlated (see Figure 18 in the Appendix).

The cost in domestic currency of imported goods is also affected by the exchange rate. Exchange-rate movements dampen or amplify price changes in foreign currency. Larger exchange-rate movements should, all else being equal, be associated with weaker relationships between domestic and global inflation.[16] With a fixed exchange

[13] For a fundamental discussion of the factors affecting inflation, see, for example, Sveriges Riksbank (2013) or the ECB (2017).

[14] For example, the change in oil prices is highly correlated with the change in the energy component of the CPI, while the change in the food component of the CPI is highly correlated with global food price indices. See ECB (2017) for a description of these relationships for the euro area. Choi et al. (2018) study the impact of oil price movements on inflation in 72 countries over the period 1970-2015 and show, among other things, that the impact is similar for developed and developing countries. They also show that the impact is mainly influenced by the share of transport in the CPI and the size of energy subsidies.

[15] For example, a higher oil price means higher prices for transport as well.

[16] Szafranek (2021a) shows that the covariation of inflation is higher when exchange-rate volatility is lower. Lane (2020) discusses how exchange-rate movements can weaken the covariation of inflation in the presence of common commodity price shocks. The purpose of the fixed exchange rate in Sweden in the 1970s

rate between two countries, and in the absence of large movements in the real exchange rate, inflation developments are by definition highly synchronised.

**Covariation in the business cycle** across countries can also give rise to co-movements in inflation. Global resource utilisation affects the demand for and prices of commodities and other internationally tradable goods and thus affects import inflation in different countries in a similar way. It also affects resource utilisation, and therefore inflation, in small open economies such as Sweden via household and business confidence, trade and financial markets.[17] Such synchronisation of the business cycle may also lead to covariation in wage growth. An economic upswing in the euro area could, for example, lead to a tighter labour market and higher wage growth, which could also affect wage growth in Sweden via higher competitor prices[18]

Furthermore, the covariation of inflation in a country with global inflation depends on a number of **structural factors**. Differences in these factors can explain why inflation in some countries covaries more with global inflation than in other countries (cross-sectional differences), and changes in such factors can explain why the covariation changes over time. Globalisation consists of those structural changes that have increased economic integration between countries through, for example, increased trade or greater mobility of factors of production, information and knowledge.[19] The cumulative global effects of these changes have been an increase in production capacity and downward pressure on prices (a persistent positive supply shock).[20] Furthermore, a high level of external trade means a higher share of imports and thus a greater sensitivity to changes in global prices. This is especially true if a country is highly dependent on imports of commodities.[21] At the same time, a higher degree of trade and competition could make prices less sensitive to domestic conditions, as, for example, capacity constraints allow imports to increase rather than prices. [22]

Furthermore, the organisation of production processes across land borders (so-called global value chains) and within multinational companies means that global supply and

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and 1980s was to import low inflation from Germany. If such a policy had succeeded, one consequence would have been that the covariation of inflation would probably have been very high. Below we show that the relationship between CPIF inflation in Sweden and inflation abroad weakened during the years 2009-2012 when there were large movements in the krona exchange rate.

[17] See, for example, Corbo and Strid (2020) and Akkaya et al. (2020).

[18] Westermark (2019) also finds evidence that contractual wages in the euro area have a direct impact on contractual wages in Sweden. The corresponding relationship for German wages, which are often considered particularly important for Swedish wage formation, is somewhat weaker and more ambiguous.

[19] For Sweden, trade (exports plus imports) as a share of GDP has roughly doubled from the early 1970s to 2022 when the share was 103 per cent. Similar trends are seen for most OECD countries. See World Bank, World Development Indicators.

[20] However, a common view here is that increased trade integration mainly affects the relative price of tradable and non-tradable goods while the effect on inflation is limited. Below in Chapter 4, we discuss some research papers that provide empirical support for this view; see, for example, Attinasi and Balatti (2021).

[21] Ha et al. (2019b) show that global shocks are more likely to affect domestic inflation for countries with higher levels of trade, financial integration and dependence on commodity imports.

[22] In the early 2000s, the Riksbank was surprised by unexpectedly low import inflation, which was partly linked to increased competition from low-wage countries such as China and India, see Persson (2005). The integration of these countries into the world economy in the 1990s meant that global labour supply roughly doubled, which has had a dampening effect on relative price developments for globally traded goods for some time, see, for example, Carney (2015).

demand shocks can lead to covariation in inflation across countries.[23] Trade in these supply chains has grown as a share of world trade. In connection with the COVID-19 pandemic, ports were shut down in order to contain the spread of infection in a number of countries, which led to increasing shipping problems with components needed in industrial production globally, such as semiconductors. The problems in global value chains persisted for several years, contributing to collectively rapidly increasing producer prices in the world economy.

There are also structural changes suggesting that the covariation of inflation across countries should decrease rather than increase. The trend increase in the share of services in consumption means that international factors should play less of a role as services are less internationally traded than goods.[24] A declining share of imported energy in both production and consumption also implies that changes in global commodity prices should play a gradually less important role in inflation.[25]

A more formal approach to studying the covariation of inflation across countries is to use an **economic model**. A starting point here is research showing that a standard macroeconomic model for a small open economy (such as Sweden) has difficulty in capturing the effects of fluctuations abroad. This means that the relationships between macroeconomic variables in the small country and abroad, including inflation, are weak in the model, a result that is at odds with empirical studies of these relationships.[26] Such a model therefore needs to be equipped with (for example) global productivity or energy price shocks in order to better capture the relationships between inflation in different countries.[27] The model can also be used to derive a Phillips curve for an open economy, which can be used to forecast inflation.[28]

[23] De Soyres and Franco (2019) show that increased participation in global value chains is associated with a higher covariation between domestic and international inflation. Auer et al. (2017) show that the impact of global resource utilisation on national inflation depends on the degree of integration into global value chains.

[24] The share of services in the CPI in Sweden has increased from 28 per cent in 1980 to 47 per cent in 2023.

[25] For Sweden, the weight of fuel in the CPI was about 4 per cent in the 1980s, 1990s and 2000s, but has since gradually decreased to close to 2 per cent in 2023. The consumption of imported fuel oil has also fallen over time and has been largely replaced by domestically produced pellets and district heating. The weight for heating excluding electricity in the CPI containing these energy types fell from around 1.5 per cent in the early 1980s to an average of around 0.5 per cent from the 1990s.

[26] See Justiniano and Preston (2010) who show this in a standard model for a small open economy calibrated on data for Canada and the United States. See also further discussion in Corbo and Strid (2020).

[27] Henriksen et al. (2013) show in a two-country model that the cross-country spillover of technology give rise to synchronised productivity shocks that create covariation in inflation under the assumption of similar monetary policy. In the Riksbank's macroeconomic model MAJA, the correlation between inflation abroad and in Sweden is mainly explained by global productivity and energy price shocks, and monetary policy abroad and in Sweden is assumed to react to these shocks in a similar way.

[28] Kabukçuoglu and Martínez-García (2018) use a New Keynesian model of two countries trading with each other to derive a Phillips curve for an open economy. They show that a specification where national inflation depends on global inflation and national resource utilisation makes relatively accurate inflation forecasts for several countries, for example compared to a Phillips curve using only national variables.

# 3 Data and measures of global inflation

We use data on the Consumer Price Index (CPI), the EU Harmonised Index of Consumer Prices (HICP), the CPI excluding energy and food (a measure of core inflation), and price indices for goods, services, food, and energy for a sample of 22 OECD countries.[29] For the CPI, we have data from the mid-1950s for most countries, from the early 1970s for the CPI excluding energy and food (and price changes for energy and food) and the mid-1990s for HICP inflation. For Sweden, we also have data on the CPI with a fixed interest rate (CPIF) from 1987 onwards. We have monthly data and study price changes in annual percentage change. A more detailed description of the data, data availability for the different countries and sources can be found in the Appendix (see Table 1 and Table 2 in the Appendix). CPI inflation for all countries is shown in Figure 19 in the Appendix.

We study the relationships between inflation in individual countries, **national inflation**, and various aggregate measures of **global inflation**. We initially focus on CPI inflation and then extend the analysis to other measures of inflation. Global inflation can be measured in different ways, and here we focus on measures that capture the evolution of inflation in developed economies.[30] In Figure 2, we show six different measures of global CPI inflation. A measure of international inflation often used by the Riksbank is trade-weighted inflation (with KIX weights), where countries with which Sweden trades more have a greater weight. The euro area is important for economic development in Sweden, and thus has a large weight in this index, and euro area inflation can therefore be seen as a measure of global inflation from a Swedish perspective. Other measures of global inflation can be seen as more general in the sense that they may be suitable as measures of global inflation for a larger number of countries, including countries outside Europe. In Figure 2, we show the inflation rates for the OECD countries and the G7 countries (weighted by their GDP), and the median inflation rate in the OECD countries.[31] We also show a common component in OECD countries' CPI inflation calculated using static factor analysis.[32]

[29] The reason why we have limited the study to a selection of OECD countries (rather than all OECD countries) is mainly that we want to concentrate the study on the economies that are most comparable to Sweden, and with which Sweden has a relatively large trade. We use the same sample of countries as Ciccarelli and Mojon (2010). Below we compare the results for Sweden with the median of the other OECD countries and the exact OECD countries included in the sample should not have a major impact on these comparisons.

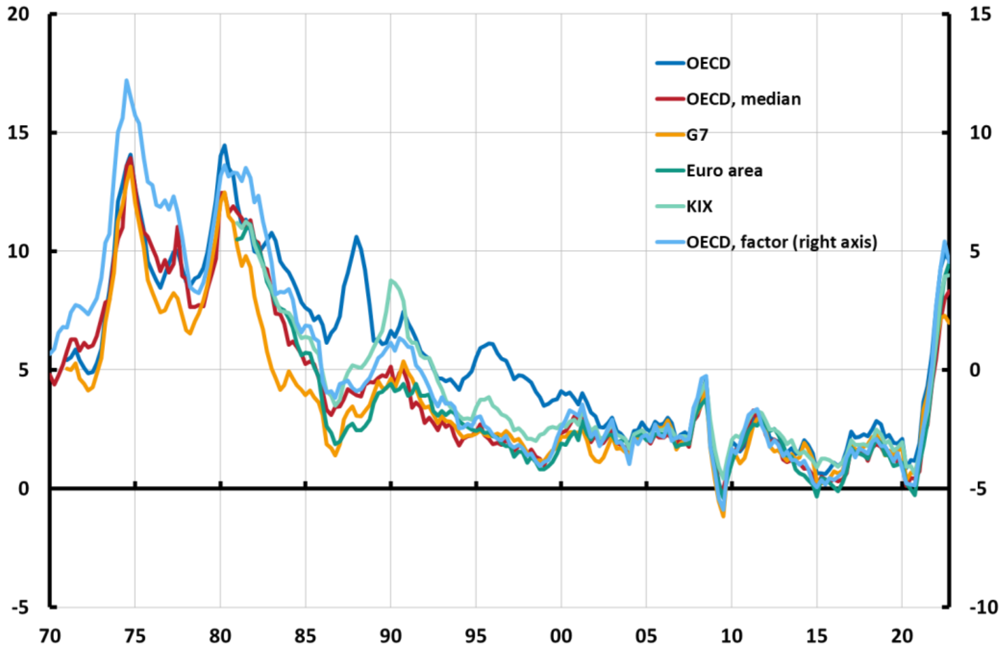
[30] Nevertheless, we use the term 'global inflation' even though we focus on a sample of OECD countries as this is recognised in the literature. Parker (2018) and Ha et al. (2019a) are two studies that examine inflation developments globally, i.e. for a large share of the world's countries.

[31] Here we use the median inflation rate in each country as a measure of 'average inflation'. For CPI inflation over the period 1955M1 to 2022M12, the correlation between the mean and the median of inflation in the 22 OECD countries is 0.99, which means that the use of these measures does not make much difference to the analysis. Inflation in the euro area, OECD countries and G7 countries are weighted measures where the weights are based on the countries' GDP.

[32] See, for example, Stock and Watson (2016) for a description of factor models.

**Figure 2. Measures of global CPI inflation 1970–2022**

Annual percentage change




Sources: OECD, the Riksbank and own calculations.

We first note that the different measures of global inflation shown in Figure 2 are highly correlated and that they provide the same overall picture of the evolution of global inflation from the 1970s to the present day. Put simply, we have a period of high inflation in the 1970s and 1980s (the Great Inflation), followed by a period of low inflation from the mid-1990s onwards. Inflation rose and was high in the 1970s in the wake of the two oil crises and weak productivity growth.[33] The fact that inflation remained high for an extended period was due to the implementation of economic policy that was not compatible with low and stable inflation. In Sweden, for example, this period was characterised by a devaluation cycle where recurrent cost crises due to high wage increases were followed by devaluations of the krona - the economy was caught in a wage-exchange rate spiral. An overly expansionary fiscal policy also contributed to wage and price inflation.[34] A shift in monetary policy in many countries and the inflation targeting implemented by independent central banks from the 1990s then contributed to a fall in inflation starting in the 1980s. The globalisation of trade and production processes has also contributed to a lower trend level of inflation, but

[33] Oil prices rose sharply during the 1973-74 and 1979-80 oil crises, often referred to as OPEC 1 and 2, linked to the 1973 October War and the 1979 Iranian revolution and the 1979-80 Iraq-Iran war. See, for example, Ohlsson (2022). Attinasi and Balatti (2021) decompose the global component of inflation and show that movements in oil prices explain most of the variation in global inflation in the 1970s and 1980s but that other factors have played a greater role since the 1990s.

[34] See Jakobsson (1997) for a description of the devaluation cycle. The goal of economic policy during this period was full employment, and the negative employment effects of excessive wage increases had to be compensated for by an expansionary fiscal policy, which typically involved increased public spending.

its quantitative impact appears to have been limited. One observation here is that inflation had already fallen to low levels before the most intense phase of globalisation began in the 1990s.[35]

We also see that the level of the different measures has converged and that they provide a very similar picture of inflation developments since the turn of the millennium. In the years around the global financial crisis of 2007-2009 and beyond, global CPI inflation is largely influenced by movements in global commodity prices, and in particular the price of oil.[36]

In the analysis that follows, we choose to use the **median of CPI inflation in OECD countries** as the measure of global CPI inflation (red line in Figure 2). For most of the countries in our sample, we have CPI data from the mid-1950s, which means we can study the relationships for more than 60 years. The correlation between this measure and the other measures shown in Figure 2 is in all cases higher than 0.9 when calculated for the longest possible sample period.[37] The strong relationships between the different measures of global inflation mean that the results presented in what follows are robust for the choice of global inflation measure.[38]

We later construct global measures of HICP inflation, core inflation (CPI excluding energy and food) and the various components of CPI inflation in the same way, i.e. as the median of the respective inflation measures for OECD countries.

# 4 The relationship between inflation in Sweden and globally

In this chapter, we study how the relationships between inflation in Sweden and global inflation have developed over time and compare them with similar relation-

[35] Attinasi and Balatti (2021) show that globalisation measured by three variables affects the persistent component of inflation but that the effect has been small. The variables are measures of trade integration, global value chain participation and digital globalisation. See also Forbes (2019a) and Kamber and Wong (2020) for analyses suggesting that the impact of globalisation on persistent inflation has been limited.

[36] Several of the episodes when oil prices have risen or fallen sharply are clearly visible in measures of global inflation. Since 1970, oil prices have risen sharply (more than 20-30 per cent), for example in 1973-74, 1979-80, 1990, 2002-2003, and 2007-2008, and have fallen sharply in 1986, 1990-91, 1997-98, 2001, 2008 and 2014-16.

[37] The correlation between median inflation in OECD countries and inflation in G7 countries and the euro area has been stable at around 0.9 over time. However, the correlation between median inflation in OECD countries and (GDP-weighted) inflation in OECD countries has been weak at times, especially during parts of the 1980s and 1990s.

[38] Ciccarelli and Mojon (2010) use three measures of global inflation, OECD inflation, the median of OECD countries' inflation and a static factor, and conclude that the analysis is not significantly affected by the choice of measure. Also Ha et al. (2019b) note that their global factor is strongly related to the median inflation rate of the countries in their sample. Kabukçuoğlu and Martínez-García (2018) use five different measures of global inflation where the weights are calculated differently: equal weights for all countries (median inflation), trade weights, weights based on geographical proximity, geographical proximity weighted by population size and whether the countries share a common border. They find little impact from the choice of measure, but that median inflation captures international relationships to a slightly greater extent than alternative measures.

ships in other countries. We calculate the **share of the variation in inflation in Sweden and other OECD countries that is explained by global inflation**, and we do this for different measures of inflation. To study how the relationships have changed over time, we calculate the proportion for rolling samples consisting of 15 years of observations (i.e. 180 monthly observations).[39]

We estimate simple regression models with national inflation ($\pi_t^i$, where $i$ denotes the country, in annual percentage change) as the dependent variable and global inflation ($\pi_t^g$) in the same month as the explanatory variable, and with a constant ($\alpha_i$).

$$\pi_t^i = \alpha_i + \beta_i \pi_t^g + \varepsilon_t^i$$

The share of the variation in national inflation explained by global inflation is given by the explanatory value ($R^2$-value) of the regression. This value is equal to the squared correlation between the two variables. The relationships between national and global inflation are typically strongest roughly contemporaneously and we therefore focus entirely on this simple specification.[40]

## 4.1 Strong relationships between Swedish and global CPI inflation

In this section, we show that the relationships between CPI inflation in different countries and global CPI inflation support the view that inflation is very much a global phenomenon. The relationships between inflation in individual countries and global inflation are typically strong and have been relatively stable since the 1960s. The relationship for Sweden has been approximately the same as the relationship for an average OECD country.

We first calculate the share of the variation in national CPI inflation explained by global inflation for a longer sample, from 1960 to 2022. For different measures of global inflation, this share is around 70-80 per cent for our sample of OECD countries, which is in line with the results of previous research studies (see Table 3 in the appendix).[41] The share for Sweden is about the same as for an average OECD country. When the share is calculated over a longer period, it is likely that the high share largely reflects the fact that inflation has trended or moved between different monetary policy regimes in a similar way in many countries.[42]

[39] A similar type of rolling sample analysis is done, for example, by Carney (2015) with the difference that he studies pairwise correlations between inflation in different countries.

[40] We have also tried to lag global CPI inflation, but for the vast majority of countries, including Sweden, the relationship is strongest roughly contemporaneously. If instead we were to consistently use the lag where the relationship is strongest, the results would not be significantly affected. Figure 23 in the appendix shows the R2 value when the regression is estimated for the period 1960M1-2022M12 for the 22 countries and different lags (0 to 24 months) of global CPI inflation.

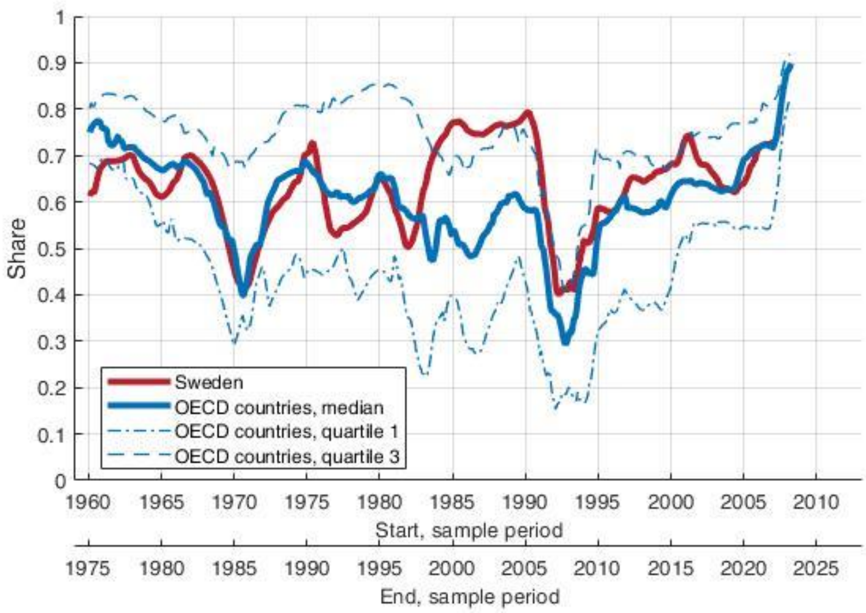
[41] See for example Ciccarelli and Mojon (2010) or Parker (2018).

[42] In a simple model with regime change, it can be illustrated that even if there is no relationship between inflation in different countries within different regimes, movements between regimes can give rise to strong correlations when the samples contain data from different regimes.

In Figure 3, we show how the relationship between national and global CPI inflation has evolved over time. We show how the share of the variation in national inflation explained by global inflation has evolved for a rolling sample. The first sample is for the period 1960-1974 and the last for the period 2008-2022 and the x-axis of the figure shows the start and end period of the sample. We calculate the share for our sample of 22 OECD countries and in the figure, we show the median share for OECD countries (blue line) and the share for Sweden (red line). The former can be seen as a summary measure of how inflation covaries for our sample of OECD countries, or **the relationship between national and global inflation for the average OECD country**. We also show the 1st and 3rd quartiles of the share to illustrate the spread of the 22 countries (dashed blue lines) - the share for half of the countries lies between these two lines. We make the following observations.

**Figure 3. Share of the variation in CPI inflation explained by global inflation over time**

Rolling sample from 1960M1-1974M12 to 2008M1-2022M12




Note. The share of the variation in CPI inflation explained by global CPI inflation is given by the R2 value in a regression of the former on the latter and is the square of the correlation between the two variables. The share is calculated for rolling samples of 15 years duration (180 monthly observations) and the date on the x-axis indicates the start and end points of the sample. The share is calculated between inflation in all countries and global inflation and the median share (blue) and the share for Sweden (red) are shown. The quartiles illustrate the distribution of the share for different countries. 25 per cent of the countries have a share that is lower than quartile 1 and 25 per cent of countries have a share higher than quartile 3.

Sources: The OECD and own calculations.

- The relationships between CPI inflation in different countries and global CPI inflation have been relatively stable over time and typically quite strong (see blue line in Figure 3).[43] The share of the variation in national inflation explained by global inflation is roughly around 60 per cent over time (which means that the correlation between the two variables has moved around 0.8).[44] We also illustrate that there are cross-country differences in the strength of the relationship (see dashed blue lines showing quartiles for the share).

- The relationships between CPI inflation in Sweden and global CPI inflation are similar to that of an average OECD country (see red line). The share of the variation in Swedish CPI inflation that can be explained by global CPI inflation has been around 60 per cent over time.
- The relationships between inflation in different countries and global inflation were at their weakest during the period 1992-2007, but then strengthened again during and after the global financial crisis of 2007-2009.[45] Global movements in commodity prices and synchronised movements in inflation in the context of crises have been important factors behind the covariation during the inflation-targeting period.[46]

One way to understand the variation in the relationships over time is to date different events that have a major impact on the covariation, mainly commodity price shocks and global economic crises. It is beyond the scope of our analysis to provide a complete chronology of national and global events that have affected inflation and its covariation. However, we illustrate this by briefly describing two sub-periods when inflation relationships were relatively strong and weak respectively.[47]

During the period under study, the correlation between Swedish and global CPI inflation reaches its highest level in the period 2008-2022, i.e. the most recent period. The share of the variation in Swedish CPI inflation explained by global inflation is then 0.9, which is a very strong relationship (see Figure 3). This period was characterised by several global shocks that affected inflation in OECD countries in a similar way. Oil and other commodity prices rose in 2008 and then fell in the wake of the global financial crisis; inflation rose in a synchronised manner during the post-crisis recovery and then fell again as oil prices fell in 2014-15; in the late 2010s, inflation rose in the wake of

[43] Forbes (2019a) shows that the importance of the global component of CPI inflation increased from 27 per cent in 1990-1994 to 57 per cent in 2015-2017. This is in line with our results, but we note that the relationships may have weakened temporarily in the early 1990s.

[44] The share of the variation in national inflation explained by global inflation is given by the R2 value in a regression of the former on the latter. The R2 value is the square of the correlation between the two variables. The share is typically slightly lower when calculated for shorter samples.

[45] Shin and Kang (2023) study structural changes in the relationships between inflation in 29 countries and global inflation over the period 2001-2018. They find that the relationships were significantly strengthened in the context of the financial crisis. According to their analysis, the stronger relationships are due to the strengthening of non-commodity price relationships, and one explanation highlighted is unconventional monetary policy by major central banks and its effects on inflation in different countries. Ha et al. (2019b) compare the periods 1986-2000 and 2001-2017 and show that the impact of global inflation on inflation increased in both developed and developing countries. The global financial crisis of 2008-09 and the fall in oil prices in 2014-16 are highlighted as important factors in strengthening the relationships. However, over the longer period 1970-2017, the relationships have been relatively stable for developed countries.

[46] See, for example, Carney (2015) or Lane (2020).

[47] Bylund et al. (2023) present a detailed chronology and our description of the two periods is largely based on their description.

expansionary policies by several central banks, higher resource utilisation both in Sweden and globally, and higher energy prices; during the Covid crisis, demand and inflation fell; and more recently, inflation has risen steeply due to pent-up demand and various supply shocks following the Covid crisis and energy price increases related to Russia's invasion of Ukraine. Thus, this period is relatively rich in global shocks that have affected inflation in many countries in a similar way, while monetary policy has responded in a similar way in several countries and regions.[48]

During the sub-period 1992-2007, the relationships between inflation in Sweden and abroad are instead at their weakest during our study period. The share of the variation in Swedish CPI inflation explained by global inflation is then 0.4, which is still a fairly high figure (see Figure 3). This period is characterised by several domestic events that cause the development of inflation in Sweden to deviate from global inflation to a greater extent than usual. Inflation in Sweden rose in 1993 following a sharp depreciation of the krona and also due to increases in indirect taxes; in the period 1995-1998 inflation fell and became lower than abroad, partly due to changes in indirect taxes and subsidies; in 2004-2005 CPI inflation in Sweden was lower than abroad, which could be linked to positive productivity shocks and a change in the methodology for calculating the CPI. Overall, there are thus a number of domestic events in this period that may explain why the relationship with inflation abroad was weaker than in other sub-periods.

To contextualise the relationships between CPI inflation in different countries and global CPI inflation, we show in Figure 4 the corresponding relationships for GDP growth. We see there that the relationships between GDP growth in different countries and global GDP growth have become much stronger over time.[49] Until the 1990s, the relationships between inflation in different countries were typically stronger than the corresponding relationships for GDP growth, which is emphasised as a stylized fact in some of the research literature. However, during the inflation-targeting period from the mid-1990s, if anything, the reverse has been true.[50] For Sweden, the share of

[48] The increase in the covariation in inflation after the 2007-2009 global financial crisis is also in line with the findings of, for example, Szafranek (2021b).

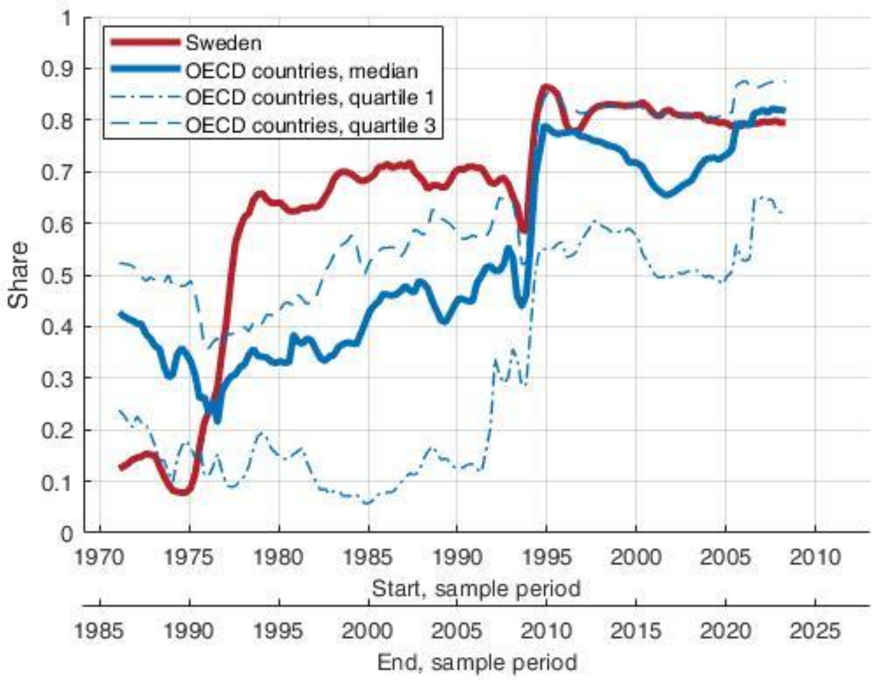
[49] We get roughly the same picture of the relationships if we instead study the cyclical component of GDP growth, where this is obtained with the BP or HP filter.

[50] Some of the research literature compares the degree of international synchronisation for real and nominal variables. Henriksen, Kydland and Sustek (2013) calculate pairwise correlations between the cyclical components of CPI and GDP in nine industrialised countries for the period 1960-2006. They find that the average correlation for CPI is 0.52 while the average correlation for GDP is 0.25. For the cyclical components of CPI inflation and GDP growth, the correlations are 0.43 and 0.29, respectively. The results in Hakkio (2009) for a sample of OECD countries over the period 1960-2008 also suggest that the share of the variation explained by a global component is higher for CPI inflation than for GDP growth. Alvarez et al. (2021) study 24 industrialised countries over the period 1996M1-2018M4 and find, on the contrary, that the covariation is stronger for GDP than for inflation. Differences in the selection of countries and variable transformations may give rise to differences in results, but our results suggest that the choice of sample period is the most important contributor to the differences, as the relationships between GDP development in different countries have clearly become stronger over time. Mumtaz, Simonelli and Surico (2011) study the covariation in CPI inflation and GDP growth in 36 countries on data going back to the 19th century using a dynamic factor model that distinguishes between regional and global factors. They show that regional factors explain most of the variation in both variables for most of the sample period, and in particular for the period 1985-2007. They speculate that increased trade within regions, such as the EU, has increased the importance of regional factors for covariation.

GDP growth that can be explained by global GDP growth has been very high since the 1980s, and higher than for an average OECD country.

**Figure 4. Share of variation in GDP growth explained by global GDP growth over time**

Rolling sample from 1971Q1-1985Q4 to 2008Q1-2022Q4




Note. Annual percentage change for GDP in fixed prices. The share of the variation in GDP growth explained by global GDP growth is given by the R2 value in a regression of the former on the latter and is the square of the correlation between the two variables. The share is calculated for rolling samples of 15 years duration (60 quarterly observations) and the date on the x-axis indicates the start and end points of the sample. The share is calculated between GDP growth in all countries and global GDP growth and the median share (blue) and the share for Sweden (red) are shown. The quartiles illustrate the distribution of the share for different countries. 25 per cent of the countries have a share that is lower than quartile 1 and 25 per cent of countries have a share higher than quartile 3.

Sources: The OECD and own calculations.

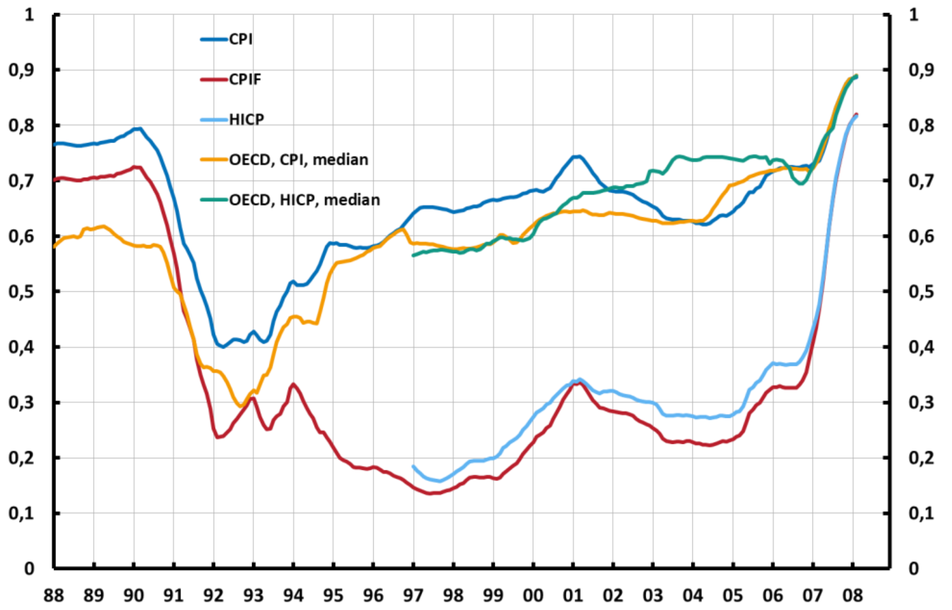
## 4.2 Weak relationships for CPIF and HICP inflation over the inflation-targeting period?

However, the relationship between inflation in Sweden and abroad is different if, instead of the CPI, we study the CPI with a fixed interest rate (CPIF) or the EU-harmonised index for consumer prices (HICP). If we use one of the latter two measures, we instead get a picture of a weak correlation between inflation in Sweden and global inflation during the inflation-targeting period from 1995 onwards. However, this is because the relationships were weak during and after the global financial crisis in 2009-2012, which can be explained by the volatility of interest rates and the krona exchange rate during this period.

Since 2017, the Riksbank's target variable is the consumer price index with a fixed interest rate (CPIF).[51] In Figure 5, we show the share of the variation in CPIF inflation explained by global CPI inflation, calculated for a 15-year rolling sample (see red line). We also show the share of the variation in Swedish HICP inflation explained by global inflation (light-blue lines). We see that both these shares are significantly lower than the corresponding share for CPI inflation when calculated for the inflation-targeting period, from the mid-1990s (see dark blue line in Figure 5, which was also shown in Figure 3).[52] For CPIF inflation and HICP inflation, the relationship with a matching measure of international inflation is thus much weaker than for CPI inflation during most of the inflation-targeting period. We further note that these differences are specific to Sweden. Instead, for the average OECD country, the strength of the relationship between national and global inflation is similar when using the CPI and HICP respectively (compare the yellow and green lines).

**Figure 5. Share of variation in the CPI, CPIF and HICP explained by global inflation over time**

Rolling sample from 1988M1-2002M12 to 2008M1-2022M12




Note. The share of the variation in inflation explained by global inflation is given by the R2 value in a regression of the former on the latter and is the square of the correlation between the two variables. The share is calculated for rolling samples of 15 years duration (180 monthly observations) and the date on the x-axis indicates the starting point of the sample. The CPI and CPIF are related to the global CPI, and the HICP is related to the global HICP. OECD median refers to the median of the share calculated for 22 OECD countries.

Sources: Eurostat, the OECD, Statistics Sweden and own calculations.

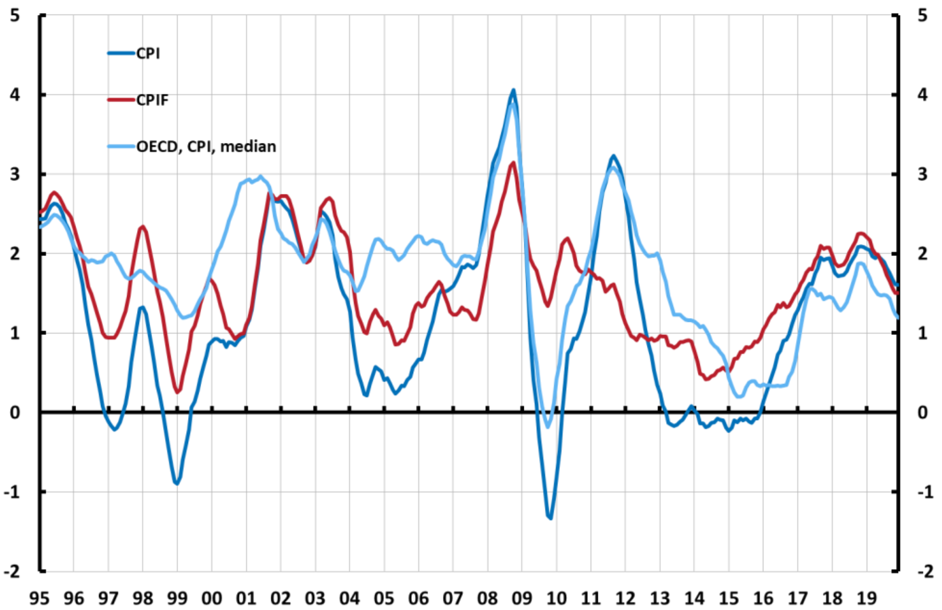
[51] The difference between the CPI and the CPIF is that the rate of increase in the CPIF is not directly affected by changes in household mortgage rates. The HICP is also not directly affected by changes in interest rates. One disadvantage of using CPI inflation as a target variable is that an increase in the policy rate, via housing costs for owner-occupied homes, has a positive direct effect on inflation, i.e. an effect that goes in the "wrong direction". See Sveriges Riksbank (2016).

[52] For inflation, the measure of global inflation is the median of inflation for the OECD countries for which we have data.

To understand why the relationships between inflation in Sweden and international inflation are so different for CPI and CPIF inflation, we show both inflation series from 1995 onwards in Figure 6. We see there that CPI and CPIF inflation in Sweden clearly covary up to 2008, but that the differences between the two measures become clear during the global financial crisis and the period immediately after the crisis, in 2009-2012, when the policy rate was first cut rapidly during the crisis and then raised rapidly during the post-crisis recovery. During this period, CPI inflation in Sweden clearly covaries with global CPI inflation, but this is not the case for CPIF inflation. The differences in the development of the two inflation measures over this period can thus explain the differences in the shares in Figure 5.[53] And while there are computational differences between CPIF and HICP inflation, in practice the outcomes are very similar, meaning that the same explanation for the weak correlation applies to both measures.

**Figure 6. CPI, CPIF and median CPI for a sample of OECD countries, 1995-2022**

Annual percentage change




Sources: OECD, Statistics Sweden and own calculations.

It may seem paradoxical that the relationship between inflation in Sweden and abroad is much weaker for HICP inflation, which is designed to be more comparable between countries, than for CPI inflation. The CPI in Sweden is more sensitive to changes in the policy rate than the corresponding index in other countries.[54] In 2008-2009, for example, policy rates fell and Figure 6 shows that CPI inflation then fell more in Sweden than abroad and even became clearly negative. However, we also see that

[53] To confirm this, we have also calculated rolling correlations for CPIF inflation, replacing it with CPI inflation for the period 2009-2012. The relationships are then very similar to those shown in Figure 3 for CPI inflation. This shows that it is the weak relationship between CPIF inflation and global CPI inflation precisely in the context of the global financial crisis that explains the weak relationships shown in Figure 5.

[54] Housing costs in the CPI are measured in different ways in different countries, which complicates international comparisons of the inflation rate with this measure, see Johansson (2015) and Apel et al. (2016).

during the period of rapid interest rate changes in 2009-2012, there is still a clear correlation between CPI inflation in Sweden and abroad. However, CPIF inflation, which is not affected in the same way by changes in interest rates, does not develop at all in line with CPI inflation abroad during this period. And CPIF and HICP inflation in Sweden are thus in practice very similar, while HICP inflation in the other OECD countries is thus generally more similar to CPI inflation in each country. Therefore, the relationship between HICP inflation in Sweden and abroad is also weak during this period.

A further, complementary perspective on the weak relationship between CPIF (or HICP) inflation in Sweden and international inflation in the context of the global financial crisis is based on the large movements in the krona exchange rate during this period. The krona depreciated rapidly in the context of the global financial crisis in the autumn of 2008, reaching its weakest level against both the euro and the dollar in February 2009, before appreciating sharply in the following years. The weak krona helped to sustain Swedish inflation in 2009, but then contributed negatively to inflation in 2011-2012 when the krona had appreciated.[55] Therefore, a less volatile development of the krona during this period would most likely have meant that the covariation between CPIF inflation and global CPI inflation would have been stronger during this period.[56]

To summarise, we conclude that CPIF and HICP inflation has clearly covaried with global inflation during most of the inflation-targeting period, but that the relationships are thus ‘disturbed’ by the large interest rate and exchange rate movements at the time of and after the financial crisis, 2009-2012, which explain the apparently weak relationships in Figure 5. This illustrates how a few influential data observations can have a large impact on the average correlation between variables in a longer sample. One possible interpretation of this is that empirical models for CPIF or HICP inflation estimated on data for the inflation-targeting period can be said to underestimate the significance of international inflation for the development of inflation in Sweden. One consequence of this is, for example, that the ability of these models to forecast the upturn in inflation in Sweden in 2022 conditional on the development of international inflation should have been worse than if they had been estimated on a sample that excludes data for the period 2009-2012. [57] Although it is not obvious how this should affect the estimation of the forecast models, knowledge of the time variation

[55] At the time of the financial crisis, observers were surprised that inflation in many countries did not fall more – there was talk of a ‘missing deflation puzzle’. For Sweden, the depreciation of the krona can thus be said to contribute to further reducing the effect of the economic downturn on CPIF inflation. Despite a large fall in GDP and a large increase in unemployment, CPIF inflation remained close to the inflation target in 2009-2011.

[56] Exchange rate movements affect CPIF and CPI inflation in the same way. A less volatile exchange rate development during 2008-2012 would probably have led to greater fluctuations in Swedish CPI inflation during the period, but the correlation with global CPI inflation would probably not have been affected much. Szafranek (2021a) shows that the covariation of inflation is higher when exchange-rate volatility is lower. The Swedish experience in 2009-12 can be seen as an illustration of this.

[57] The Riksbank's macroeconomic model MAJA is estimated on quarterly data for the period 1995-2018. The correlation between CPIF inflation and CPI inflation abroad (both in quarterly change) during the sample period is 0.4 and the median correlation calculated for artificial data simulated with the estimated model is 0.3 with a 90 per cent probability interval between 0.1 and 0.5, see Corbo and Strid (2020). The model thus satisfactorily captures the correlation in the data. However, it can be argued that the correlation that is matched should be higher.

in the relationships is important for making adequate judgement-based adjustments to the forecasts.

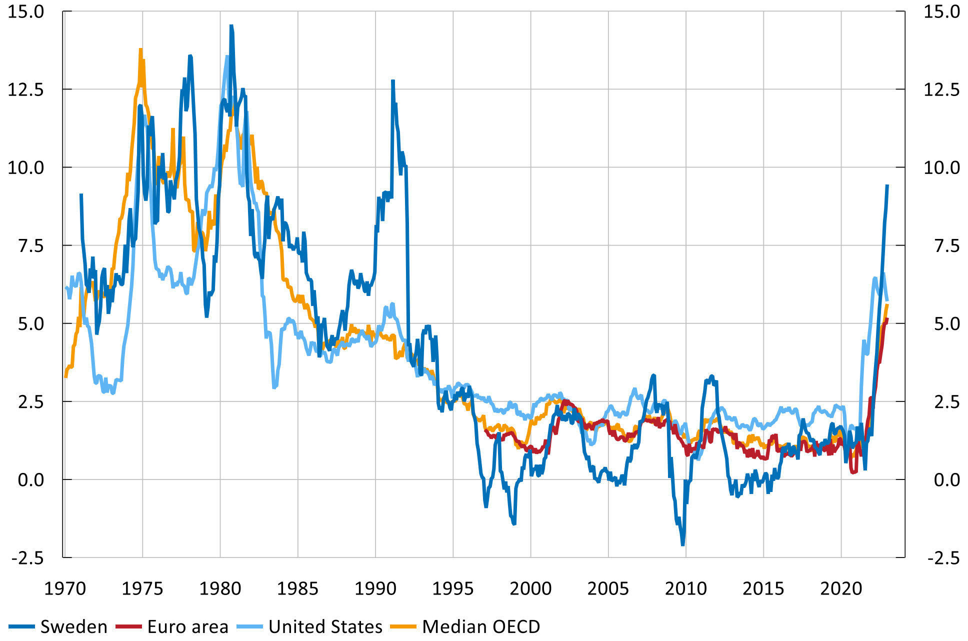
## 4.3 Weaker relationship for core inflation during the inflation-targeting period

In this section, we study the relationship between national and global core inflation.[58] We use the CPI excluding food and energy as our measure of core inflation, as this measure has been available for a large number of countries since the early 1970s. For Sweden, the conclusions are not affected if we instead use the CPIF (or HICP) excluding food and energy as a measure of core inflation. Figure 7 shows core inflation for Sweden, the euro area, the United States and the OECD countries (median). Figure 20 in the appendix shows core inflation for all 22 OECD countries. Global core inflation is calculated as the median of core inflation in the individual countries (see yellow line in Figure 7). The relationship between national core inflation and global core inflation is about as strong as for CPI inflation when we calculate the share of the variation in national core inflation explained by global core inflation for a longer sample, from 1970M1 to 2022M12 (see Table 4 in the appendix). The median share for the 22 countries is 0.8 for both CPI and core inflation. However, for core inflation, the high correlations for the whole sample period hide the fact that the strength of the relationships has clearly weakened over time – below we show that the relationships weakened significantly during the inflation-targeting period.

[58] For a discussion of different measures of core inflation, see, for example, Sveriges Riksbank (2018). The main purpose of studying such measures is to get an idea of the level of the permanent or persistent part of the measured inflation rate.

**Figure 7. Core inflation in various countries and regions, 1970–2022**

Annual percentage change




Note. Refers to the HICP excluding energy and food for the euro area and the CPI excluding energy and food for others. Quarterly data.

Sources: The ECB and the OECD.

In Figure 8, we show how the relationship between national and global core inflation has evolved over time. As above, we calculate the share of the variation in national inflation explained by global inflation for 15-year rolling samples. As we observed for CPI inflation, the share of the variation in national core inflation explained by global core inflation is relatively high until the early 1990s, around 0.6 (see blue line). After that, however, the picture is different for core inflation. During the period of low inflation from the early 1990s, which in many countries is characterised by inflation targeting, the relationship weakened significantly and the share fell to a level around 0.2.[59] When recent inflation observations for the years 2021-2022 are added to the sample, the share then rises steeply. For core inflation, the picture for Sweden is also similar to that of an average OECD country (see red line). We get a similar picture for the period from 1997 if we instead use the HICP excluding food and energy as a measure of core inflation (see Figure 24 in the appendix) or the CPIF excluding food and energy as a measure of core inflation (for Sweden).

Core inflation can be further broken down into price developments for goods and services where we have data on these components of the HICP from the mid-1990s for our sample of OECD countries. The relationships between price changes for both

[59] Alvarez et al. (2021) study the covariation of different inflation measures in 24 advanced economies, which largely overlap with our sample of countries, over the period 1996M1-2018M4. They also find weak relationships for core inflation over this period. The weakening of the relationships between core inflation in different countries since the 1990s is also shown by Carney (2015). Lane (2020) shows that the relationships for core inflation have weakened after the global financial crisis of 2007-09.

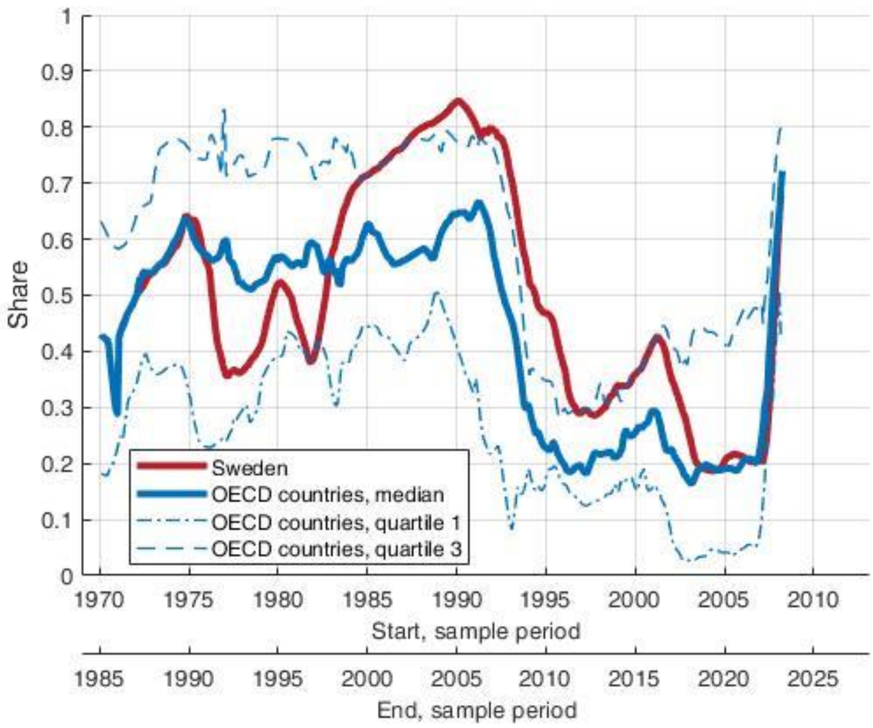
goods and services in Sweden and the corresponding global measures have been weak during the inflation-targeting period, particularly for goods. Again, the relationships for Sweden over time are similar to those for an average OECD country (see Figure 24 in the appendix). The weaker relationship for goods compared to services is remarkable as the share of internationally traded products is higher for goods than for services.[60] One possible explanation for the weak relationship is that even if the law of one price were to hold approximately, large fluctuations in the nominal exchange rate mean that the relationships between price changes in different countries (expressed in their own currency) can be weak.[61]

[60] Ha et al. (2019b) show that the share of the variation in different price indices that can be explained by the corresponding global measure is higher for indices containing a larger share of traded products. The highest covariation is for producer prices (PPI) and import prices.

[61] Alvarez et al. (2021) find, like us, that the relationships are particularly weak for non-energy industrial goods. Their main explanation is that this reflects cross-country differences in the way goods such as clothes, shoes and electronics are marketed and sold, which has a major impact on consumer prices.

**Figure 8. Share of variation in the CPI excluding energy and food explained by global core inflation over time**

Rolling sample from 1970M1-1984M12 to 2008M1-2022M12




Note. The share of the variation in core inflation (CPI excluding energy and food) explained by the global core inflation is given by the R2 value in a regression of the former on the latter and is the square of the correlation between the two variables. The share is calculated for rolling samples of 15 years duration (180 monthly observations) and the date on the x-axis indicates the start and end points of the sample. The share is calculated between inflation in all countries and global inflation and the median share (blue) and the share for Sweden (red) are shown. The quartiles illustrate the distribution of the share for different countries. 25 per cent of the countries have a share that is lower than quartile 1 and 25 per cent of countries have a share higher than quartile 3.

Sources: The OECD and own calculations.

The fact that the relationship between global and national inflation weakened for core inflation from the beginning of the 1990s, but not for CPI inflation (see Figure 3) indicates that the relationships have instead become stronger for the product groups that are not included in core inflation, i.e. energy and/or food, as we also show in the next sub-chapter. In our review of the 2008-2022 period above, we also noted that peaks and troughs in CPI inflation during this period were often associated with large movements in commodity prices.

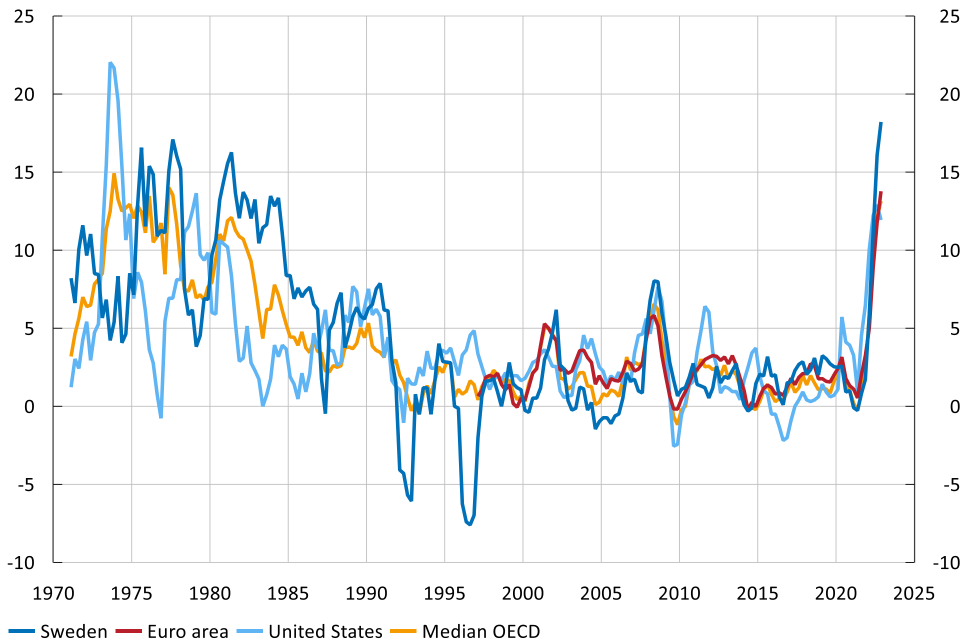
An important explanation for the weakened relationships between core inflation in different countries highlighted in the research literature is the introduction of inflation targeting in many countries. Inflation has fallen and volatility has decreased, and exogenous global shocks to commodity prices have thus become *relatively* more important for the covariation of CPI inflation across countries.[62]. The high credibility of monetary policy has meant that the indirect and second-round effects of such shocks on core inflation have been limited, contributing to low covariation for core inflation.

## 4.4 Stronger relationship between energy price changes in different countries since the 1990s

In this section, we study the relationship between national and global changes in energy and food prices. Figure 9 and Figure 10 show food inflation and energy inflation for Sweden, the euro area, the United States and the OECD countries (median).

**Figure 9. Food inflation in various countries and regions, 1971-2022**

Annual percentage change



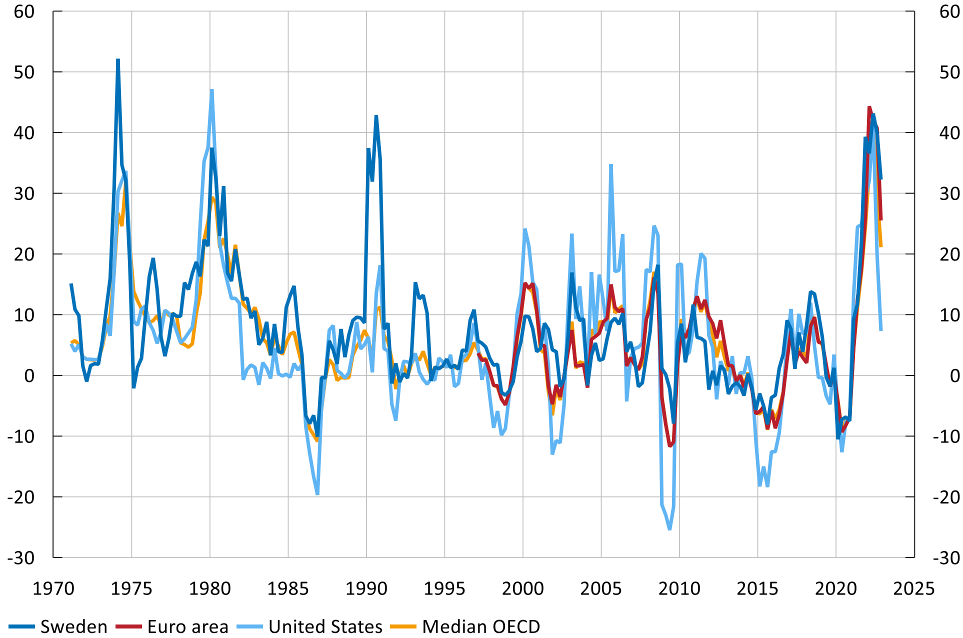

Note. Refers to the HICP for the euro area and the CPI for others. Quarterly data.

Sources: Eurostat and the World Bank

[62] See ECB (2017).

**Figure 10. Energy price inflation in various countries and regions, 1971-2022**

Annual percentage change




Note. Refers to the HICP for the euro area and the CPI for others. Quarterly data.

Sources: Eurostat and the World Bank.

In Figure 11 and Figure 12, we show how food and energy price changes in different countries have covaried with global measures of these price changes. We see that the relationships between energy price developments in different countries have been strong throughout our study period, which is an important reason for the strong relationships for CPI inflation. The relationships between food price changes in different countries have also been quite strong. Furthermore, we see that the relationships between national and global price changes for food and energy have strengthened since the 1990s, when the relationships for core inflation instead weakened.[63]

The proportion of the variation in Swedish food inflation explained by the corresponding global measure has been around 0.5. The clearest differences with the rest of the world were seen in the 1990s, when reductions in VAT on food in 1992 and 1996 meant that food prices in Sweden fell sharply.[64] We also see that the relationships between food prices in Sweden and abroad have been stable and relatively strong since the mid-1990s when Sweden joined the European Union (EU), which affected competition and price formation in the food market.

[63] Altansukh et al. (2017) study how the relationships between CPI inflation, core inflation, energy inflation and food inflation in 13 OECD countries and the corresponding global (trade-weighted) inflation measures have changed over the period 1970-2013. Like us, they find that covariation is weaker for core inflation than for CPI inflation and that covariation in the latter is mainly driven by co-movements in food and energy prices. One of their main findings is that the importance of energy prices in the covariation of CPI inflation has increased since the 1980s. This is in line with what we show in Figure 12.

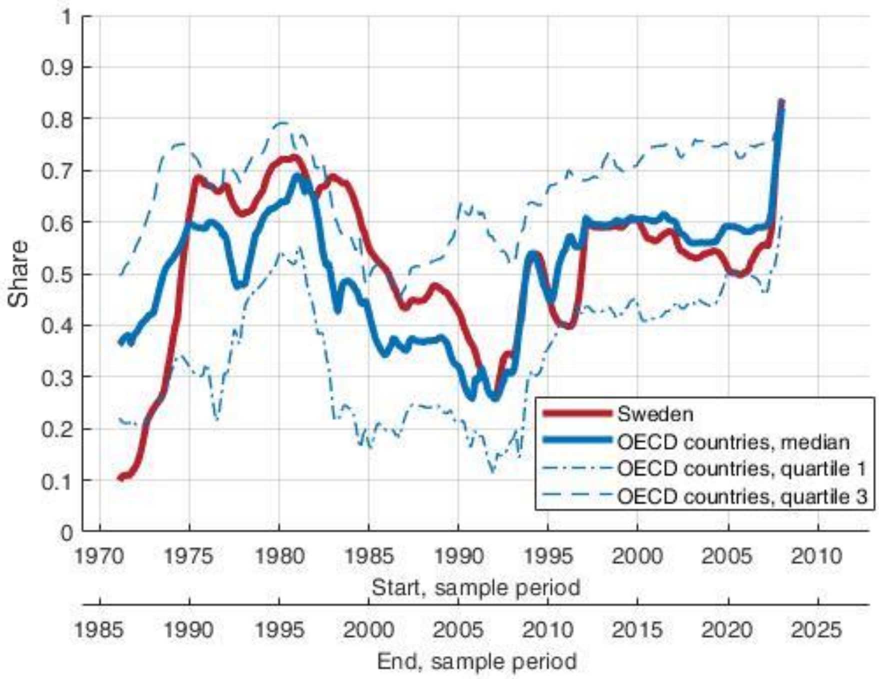
[64] VAT on food was reduced from 25 per cent to 18 per cent in 1992 and from 21 per cent to 12 per cent in 1996.

In Chapter 4.2, we saw that global movements in energy prices have been an important explanation for the strong covariation in inflation across countries in the period since the global financial crisis of 2007-2009. However, the relationship between energy price movements in Sweden and globally has been weaker than for other countries historically. The weaker relationship between Swedish and global energy price changes seems to be due to temporary deviations caused by, among other things, domestic tax changes and large exchange rate changes rather than to consistent differences. For example, energy price inflation was about three times higher in Sweden than globally in 1990, with the Swedish increase coinciding with the introduction of a VAT on fuel.[65] Also in 1993, when the weak krona contributed to high import prices, energy price inflation was significantly higher in Sweden than globally. This also illustrates again how deviations over shorter periods can have a large impact on the estimated relationships. From around the mid-1990s, however, the relationship between the development of energy prices in Sweden and globally is relatively strong.

[65] See, for example, Carpman (2008) or Ekonomifakta (2023).

**Figure 11. Share of variation in price changes on food explained by a global component over time**

Rolling sample from 1971M1-1975M12 to 2008M1-2022M12

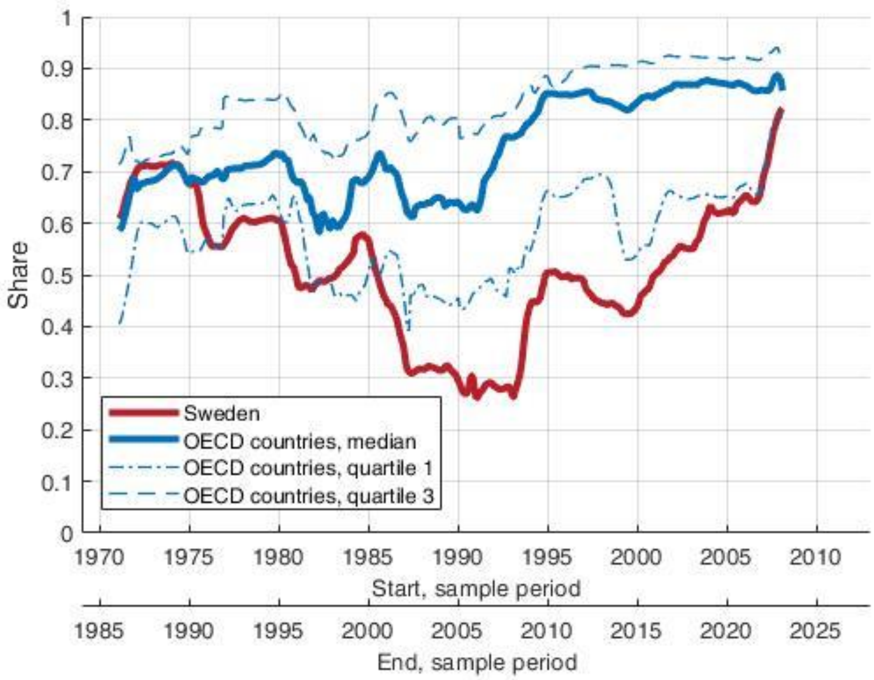



Note. The share of the variation in food inflation explained by the global food inflation is given by the R2 value in a regression of the former on the latter and is the square of the correlation between the two variables. The share is calculated for rolling samples of 15 years duration (180 monthly observations) and the date on the x-axis indicates the starting point of the sample. The share is calculated between inflation in all countries and global inflation and the median share (blue) and the share for Sweden (red) are shown. The quartiles illustrate the distribution of the share for different countries. 25 per cent of countries have a correlation lower than quartile 1 and 25 per cent of countries have a correlation higher than quartile 3.

Sources: World Bank and own calculations.

**Figure 12. Share of variation in price changes on energy explained by a global component over time**

Rolling sample from 1971M1−1985M12 to 2008M1−2022M12




Note. The share of the variation in energy inflation explained by the global energy inflation is given by the R2 value in a regression of the former on the latter and is the square of the correlation between the two variables. The share is calculated for rolling samples of 15 years duration (180 monthly observations) and the date on the x-axis indicates the starting point of the sample. The share is calculated between inflation in all countries and global inflation and the median share (blue) and the share for Sweden (red) are shown. The quartiles illustrate the distribution of the share for different countries. 25 per cent of countries have a correlation lower than quartile 1 and 25 per cent of countries have a correlation higher than quartile 3.

Sources: World Bank and own calculations.

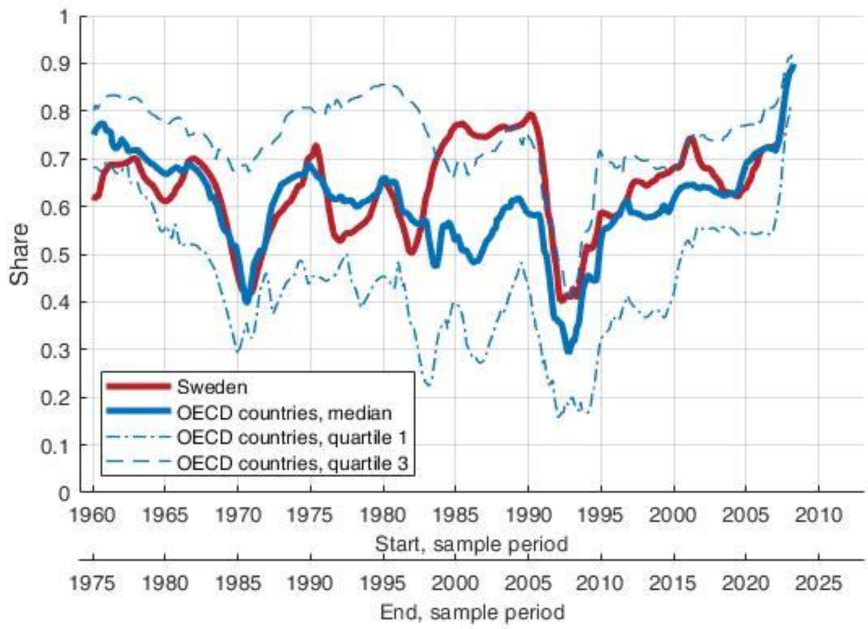
## 4.5 Trend and cycle

Inflation rose in many countries in the 1960s and 1970s and then fell back in the 1980s. It is therefore reasonable to believe that the relatively strong relationships between inflation in different countries documented above are mainly driven by common trends in inflation, or movements between different regimes. This section therefore examines the relationship between the trend and cyclical components of inflation. We show that the relationships between cyclical CPI inflation across countries and globally have become much stronger since the mid-1990s, and that this is mainly driven by strong relationships between the cyclical components of energy price changes. However, the relationships between cyclical core inflation in different countries and globally have been weak throughout the study period.

We divide CPI inflation into trend and cycle using the Hodrick-Prescott filter.[66] In Figure 13, we show the share of the trend component of CPI inflation in each country that is explained by the trend component of global CPI inflation. This image illustrates that trend inflation in OECD countries is largely explained by global factors throughout the period under study. It is likely that these relationships largely capture similarities across countries in the overall direction of economic policy. For example, the monetary policy regime shift from overly expansionary monetary policy to independent central banks and inflation targeting in many countries was a key factor in the decline in inflation in the 1980s and 1990s. Globalisation may also have contributed to some extent (see discussion above).

**Figure 13. Share of the variation in the trend component of CPI inflation explained by the trend component of global inflation over time**

Rolling sample from 1960M1-1974M12 to 2008M1-2022M12




Note. The share of the variation in the trend component of CPI inflation explained by the global CPI inflation trend component is given by the R2 value in a regression of the former on the latter and is the square of the correlation between the two variables. The share is calculated for rolling samples of 15 years duration (180 monthly observations) and the date on the x-axis indicates the starting point of the sample. The share is calculated between inflation in all countries and global inflation and the median share (blue) and the share for Sweden (red) are shown. The quartiles illustrate the distribution of the share for different countries. 25 per cent of countries have a correlation lower than quartile 1 and 25 per cent of countries have a correlation higher than quartile 3.

Sources: The OECD and own calculations.

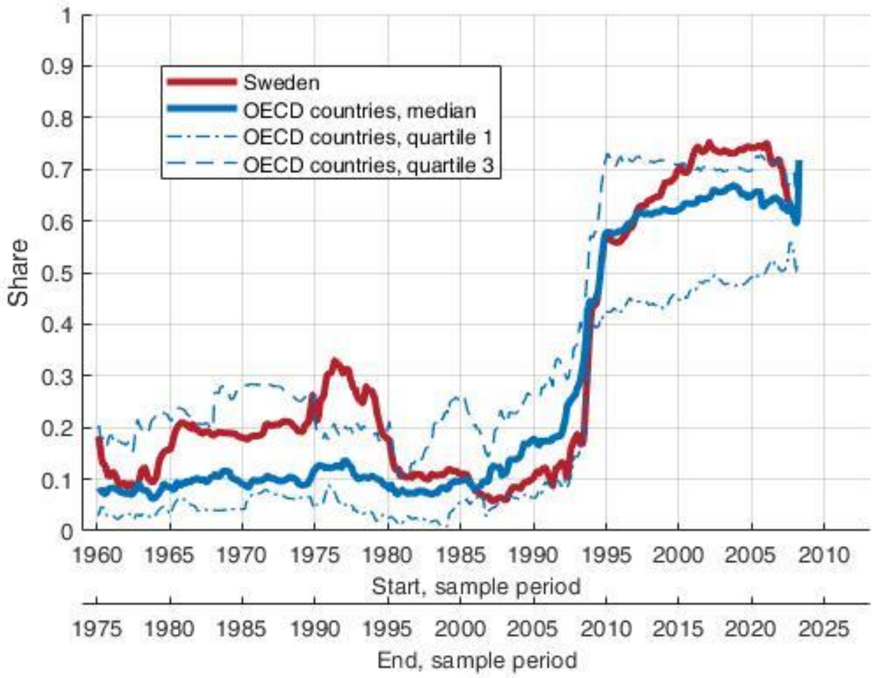
Figure 14 shows the share of the variation in the cyclical component of CPI inflation across the countries that is explained by the cyclical component of global inflation.

[66] The overall conclusions of this chapter are the same if we instead use the Baxter and King band-pass filter that extracts cycles of length 6 to 32 quarters to derive the cyclical component of inflation. See Hodrick and Prescott (1997) and Baxter and King (1999).

We see that the relationships are weak when calculated on samples that do not include the global financial crisis, but that they become stronger when data from this period are included in the samples. The relatively strong relationships thereafter mainly reflect the fact that the rise and fall of cyclical inflation in OECD countries in 2008-2009 was highly synchronised.[67]

**Figure 14. Share of the variation in the cyclical component of CPI inflation explained by the cyclical component of global inflation over time**

Rolling sample from 1960M1-1974M12 to 2008M1-2022M12.




Note. The share of the variation in the cyclical component of CPI inflation explained by the global CPI inflation cyclical component is given by the R2 value in a regression of the former on the latter and is the square of the correlation between the two variables. The share is calculated for rolling samples of 15 years duration (180 monthly observations) and the date on the x-axis indicates the starting point of the sample. The share is calculated between inflation in all countries and global inflation and the median share (blue) and the share for Sweden (red) are shown. The quartiles illustrate the distribution of the share for different countries. 25 per cent of countries have a correlation lower than quartile 1 and 25 per cent of countries have a correlation higher than quartile 3. The cyclical component is calculated using the HP filter with smoothing parameter 1600.

Sources: The OECD and own calculations.

In Figure 15, we show how cyclical core inflation (i.e. the cyclical component of the CPI excluding energy and food) in each country has covaried with a global measure.[68]

[67] The median of the R2 values for the different countries when the regression is estimated on the longest possible sample is 0.2 and the R2 value for Sweden is 0.2. These values are slightly lower than those reported by Ciccarelli and Mojon (2010), who use the band-pass filter, for the period 1961-2008.

[68] Kamber and Wong (2020) study CPI inflation in 28 countries on data from the mid-1980s to 2018 using a FAVAR model. They decompose inflation into trend and cycle and show that external shocks explain a large

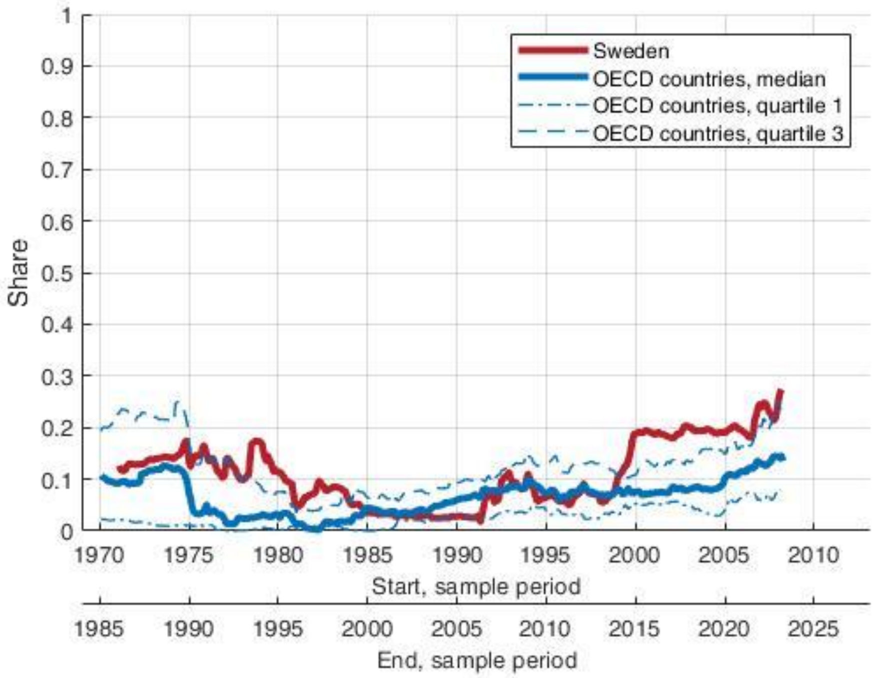
We see that the relationships have been weak throughout the period. [69] Thus, the relationships shown in Figure 8 above for core inflation are almost entirely matched by co-movements in the trend component of core inflation. One explanation put forward to explain the weak relationship between national and global (actual or cyclical) core inflation is that it reflects the success of inflation targeting in keeping inflation expectations anchored (see discussion above). However, we note that the relationships for the cyclical component were already weak in the decades before the introduction of inflation targeting.

part of the variation in cyclical inflation (50-70 per cent for developed countries) but a small part of trend inflation (less than 10 per cent for developed countries). With regard to Sweden, for example, around 70 per cent of the variation in cyclical inflation is explained by external factors, of which around 45 percentage points are due to commodity price shocks.

[69] Ha et al. (2019b) also show that a global factor explains a very small part of the variation in cyclical core inflation - in their case 5 per cent - in developed countries over the period 1970-2017.

**Figure 15. Share of the variation in the cyclical component of the CPI excluding energy and food explained by the cyclical component of global core inflation over time**

Rolling sample from 1970M1-1984M12 to 2008M1-2022M12.




Note. The share of the variation in the cyclical component of core inflation explained by the global core inflation cyclical component is given by the R2 value in a regression of the former on the latter and is the square of the correlation between the two variables. The share is calculated for rolling samples of 15 years duration (180 monthly observations) and the date on the x-axis indicates the starting point of the sample. The share is calculated between inflation in all countries and global inflation and the median share (blue) and the share for Sweden (red) are shown. The quartiles illustrate the distribution of the share for different countries. 25 per cent of countries have a correlation lower than quartile 1 and 25 per cent of countries have a correlation higher than quartile 3. The cyclical component is calculated using the HP filter with smoothing parameter 1600.

Sources: The OECD and own calculations.

The low cross-country covariation in cyclical core inflation implies that the increased covariation in cyclical CPI inflation must be due to stronger relationships between cyclical energy or food price changes in OECD countries. We examine this and find that the relationships have become stronger for both food and energy prices since the 1990s (see Figure 25 and Figure 26 in the appendix). During this period, we have seen a number of major ups and downs in global commodity prices that have increased the covariation in energy and food inflation across countries (see discussion in Section 4.4). For Sweden, the relationships between the cyclical components of domestic and global food and energy price changes have been very strong during the inflation-targeting period, with correlations around 0.8. For the other OECD countries, the corresponding relationships for energy price changes over this period have been even stronger, with correlations around 0.9.

To summarise, the analysis in Chapter 4 indicates that movements in global commodity prices have been the main factor behind the covariation in CPI inflation across countries over the inflation-targeting period. The rise in oil prices was also a key factor in the rise in global inflation in the 1970s. However, in the earlier period from the 1960s to the early 1990s, the relationships between national and global inflation mainly relate to the trend component of inflation. This can be interpreted as suggesting that it was mainly the design of economic policy (an overly expansionary policy in the 1970s followed by a tight policy) that explains the inflation relationships during this period.

# 5 Inflation forecasts

We have shown above that the relationship between CPI inflation in Sweden and abroad has been fairly strong since the 1960s. In this chapter, we examine whether this also means that a measure of global inflation can help us to make better − that is, more accurate − forecasts of Swedish inflation.[70] Previous research shows mixed results on the importance of global inflation for better forecasting of inflation in different countries.[71] Our approach is similar to several of these studies in that we compare the forecasting ability for simple national and global time series models of inflation. However, we also examine the circumstances under which global inflation helps to improve the forecast of national inflation. An obvious limitation here is that we are not looking for the best forecasting model for inflation, which would have required us to examine a larger number of predictors and models for inflation.

We compare the forecast ability of univariate models for national inflation with bivariate models that also use global inflation data. We first estimate autoregressive (AR) models for CPI inflation (in annual percentage change in the CPI) in the OECD countries for rolling samples of 15 years, i.e. 180 monthly observations, over the period 1960M1-2019M12.[72]. For each sample, we then make forecasts for 1 and 2 years ahead.[73] Our first sample is then 1960M1-1974M12 and the first forecast period is

[70] More formally, we examine whether global inflation Granger-causes national inflation. This is the case if forecasts of national inflation based on lagged values of national and global inflation are more accurate than forecasts made with lags of national inflation only.

[71] In a study across 22 OECD countries and for the forecast evaluation period 1995-2008, Ciccarelli and Mojon (2010) show that a simple model that includes a measure of global inflation usually performs significantly better than simple models without such a measure. Gillitzer and McCarthy (2019) support the conclusion that global inflation helps to improve forecasting, but they also suggest alternative simple inflation forecasting models based on Atkeson and Ohanian (2001) that have proved difficult to beat for US data. Medel et al. (2016) evaluate the forecasting ability for another class of simple time series models (SARFIMA) for 31 OECD countries for the evaluation period 2003-2013 and show that global inflation is useful for forecasting inflation in some countries, but not in many others, including Sweden. Hakkio (2009) shows that a measure of global CPI inflation helps to improve forecasts of CPI inflation in countries such as the United States, Australia, Canada and Sweden, but that there are several OECD countries where this is not the case.

[72] We choose to use rolling samples rather than expanding samples as in Ciccarelli and Mojon (2010) because trend inflation has varied over the sample. Gillitzer and McCarthy (2019) show that the forecasts for the AR model are better when estimated on a rolling sample, and thus harder to beat for the global inflation model. We choose the same length as those of the rolling sample, i.e. 15 years (which is also the window length we use throughout the paper).

[73] The forecast ability at different forecast horizons is interrelated, so we choose to focus on the 1-year forecasts.

1975M1-1976M12. For each forecast horizon, we then have a total of 540 forecasts. Previous research has shown that it is difficult to make forecasts of inflation that are much better than those from an AR model.[74]

We then compare the forecasts from the AR models with forecasts made with a "global" model - a bivariate vector autoregressive (VAR) model in which national CPI inflation is joined by global CPI inflation.[75] [76] This model is estimated in the same way for rolling samples and then projected for two years. For the VAR model, we forecast national CPI inflation in two different ways: forecasts conditional on global inflation outcomes over the forecast period, and regular forecasts (i.e. conditional only on the information in the sample). In the former case, we can examine how much the forecasting ability for national inflation could be improved if perfect forecasts of global inflation were available, which can be said to provide an upper limit to what can be achieved with this type of model. The latter case is more like an actual forecast situation.

We select the lag length of the AR and VAR models (lags from 1 to 12) to optimise forecasting ability for each country, model, forecasting method (for the VAR model) and forecasting horizon to compare the best models in each model class. We also compare with a simple forecast that assumes that inflation in the future will be equal to inflation today, a so-called random walk forecast.

For all countries, models and forecast horizons, we calculate the forecast errors, and based on these, the root mean squared forecast error (RMSFE). The forecast errors for the one-year ahead projections for Sweden are shown in Figure 27 in the appendix. The RMSFE is a measure of the average forecasting ability over the evaluation period. To report the results, we use the AR model as a benchmark model, which means that we report the RMSFE of the other models as a proportion of the RMSFE of the AR model - and we call this measure *normalised RMSFE*. A value below 1 for the VAR model then means that the model has a lower RMSFE than the AR model, which can be interpreted as global inflation helping to improve the forecasting ability for national inflation. Conversely, a value above 1 means that global inflation does not contribute to improving the forecasting ability for national inflation.

The overall results of the forecast evaluation for the 22 OECD countries are shown in Table 5 in the appendix.[77] We make the following observations:

- For an average country, the forecasts are not improved by using global inflation data - the median normalised RMFSE across countries is close to 1 for

[74] See, for instance, Faust and Wright (2013).

[75] We assume that the latter model is exogenous, i.e. the parameters in front of the lags in national inflation in the global inflation equation are assumed to be zero. We have also estimated the VAR model without these restrictions and obtain results similar to those reported here. The similarity of the results can be interpreted as meaning that national inflation is not important for forecasting global inflation.

[76] Kabukçuoglu and Martínez-García (2018) use a New Keynesian open economy model to illustrate that global inflation should be a good predictor of national inflation based on economic theory. They also show that the value of including global resource utilisation alongside global inflation in an empirical model of national inflation is limited.

[77] In the appendix, we also make a comparison with the forecast evaluation in Ciccarelli and Mojon (2010).

both 1 and 2 year forecasts. However, if the forecasts are conditional on outcomes for global inflation during the forecast period, the forecasts are somewhat better; the median of the normalised RMFSE is then around 0.9 for both the 1 and 2-year forecasts.

- We see a difference between larger and smaller countries. For smaller countries, such as Denmark, Ireland, Portugal and Sweden, global inflation contributes to better forecasts. For example, for Sweden, the normalised RMSFE for the projections one-year ahead is 0.9 for the VAR model (and 0.8 if we condition it on outcomes). However, for a number of larger countries - Japan, Germany and the United States - the forecasting ability does not improve (normalised RMSFE is 1 or higher for the forecasts 1 and 2 years ahead).

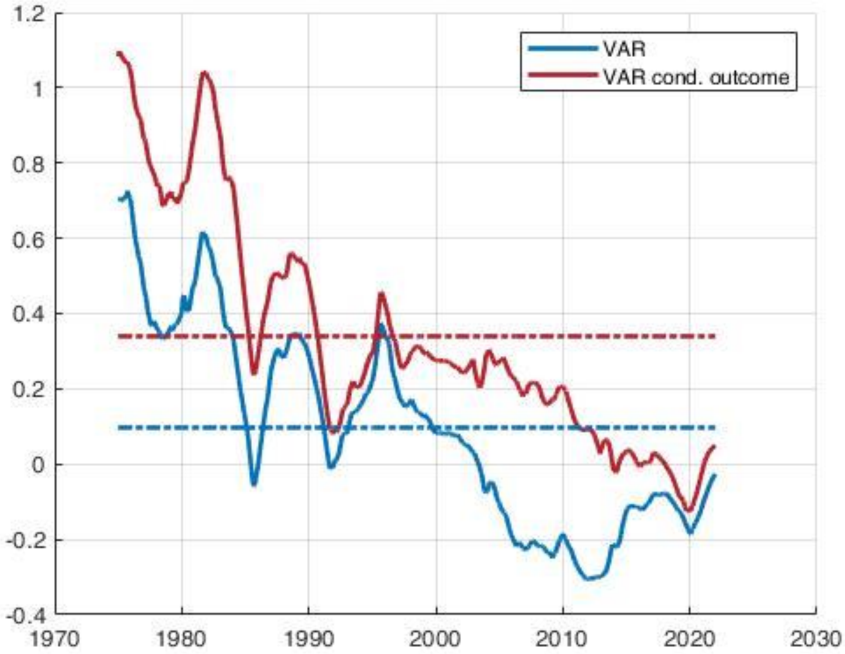
We now focus the discussion on Sweden and examine how the relative forecast ability of the models has changed over time. In Figure 16 we show a time series of the difference in the absolute forecast error for CPI inflation in Sweden for forecasts one-year ahead made with the AR and VAR models - we call this difference the *relative forecast error*. A positive value (>0) here means that the forecast error with the AR model is larger than for the VAR model, which means that global inflation contributes to improving the forecasts for Swedish CPI inflation. And the larger the relative forecast error, the more global inflation helps to improve the forecasts. We make the following observations:

- The relative accuracy of the two models varies over time - in some periods global inflation contributes to better forecasts, in other periods it does not (see blue line). However, for most of the period and on average, global inflation helps to improve the forecasts - the average relative forecast error is greater than zero (see dashed blue line). If the forecasts are conditional on outcomes for international inflation, the difference between the global and national models is naturally greater (see red line).
- We can see that the value of including global inflation was greatest in the 1970s and 1980s (when the relative forecast error was clearly positive), but that it did not contribute to better forecasting ability in the 2010s (when the relative forecast error was negative instead).[78] The value of using global inflation to forecast Swedish inflation thus appears to have declined over time.

Whether global inflation helps us make better forecasts depends on two factors. Firstly, how well the model captures the relationships between inflation in Sweden and abroad, and secondly, the quality of the forecasts for international inflation. We interpret the results as suggesting that the relatively strong relationships between the variables in the data can *potentially* be exploited to make better forecasts of Swedish inflation, as shown by the results for the VAR model conditional on outcomes (see red line in Figure 16). However, when we condition on actual, imperfect forecasts of global inflation, the gains appear more limited (see blue line in Figure 16).

[78] Mikolajun and Lodge (2016) also find that measures of global inflation contributed to better forecasting ability in the 1970s and 1980s but have been less useful since the mid-1990s when inflation has been stable. They interpret this as global inflation acting as a proxy for domestic long-term inflation expectations by capturing trend movements in inflation.

**Figure 16. Relative forecast error for AR model compared to VAR model. Forecasts at one-year horizon, 1975M1-2021M12**



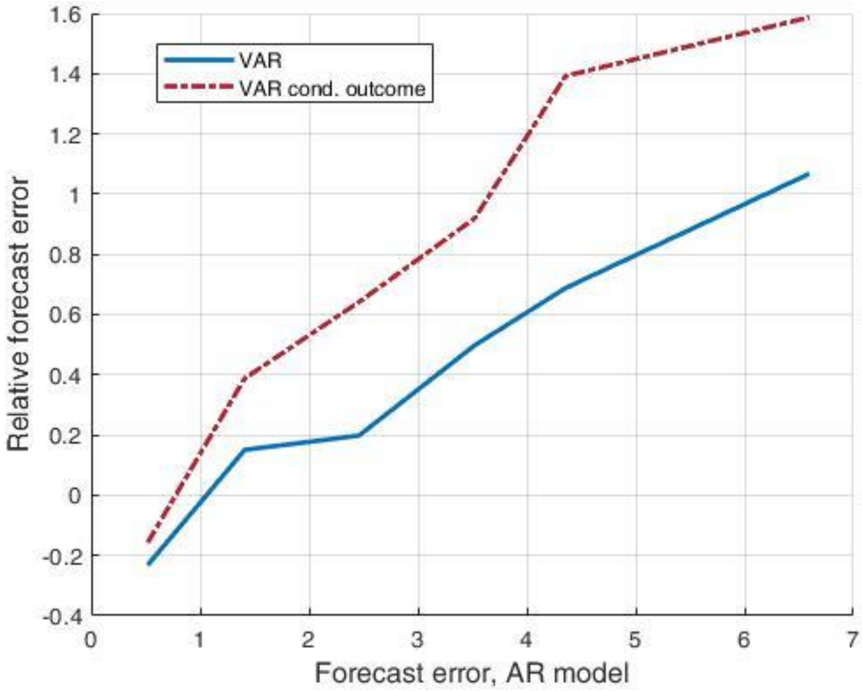

Note. The chart shows the difference in absolute forecast error for forecasts at the one-year horizon for the AR and VAR models (blue line) and the VAR model conditional on outcomes (red line). The line has been smoothed by taking a 10-year moving average. Positive values mean that the VAR model provides more accurate forecasts than the AR model, and vice versa. The dashed line shows the average difference in absolute forecast errors between the two models over the period 1975M1-2021M12.

Source: Own calculations.

Finally, we examine the circumstances under which the value of using global inflation to forecast national inflation is greatest. In Figure 16 we see that the relative forecast error, like inflation, has decreased over time and it is therefore reasonable to believe that there is a relationship between these two variables. In the appendix, we show that there is such a relationship but that it is relatively weak. We also show that there is some relationship between the inflation differential, i.e. the difference between inflation in Sweden and globally, and the relative forecast error (see Figure 28). These relationships indicate that global inflation is particularly helpful for forecasting Swedish inflation when inflation is high or when the (absolute) inflation differential towards the rest of the world is large.

In Figure 17, we show the relationship between the absolute forecast error of the AR model, which can be seen as a measure of how difficult it is to make a good forecast, and the relative forecast error. We note that there is a clear relationship between these variables. This can be interpreted to mean that the importance of using global inflation to forecast inflation is greatest when forecasting is most difficult, i.e. when forecast errors are greatest.

**Figure 17. Relationship between the forecast error with the AR model and the relative forecast error**




Note. The chart shows the relationship between the forecast error of the AR model (a measure of the difficulty of forecasting inflation) and the difference in the (absolute) forecast error of the AR and VAR models. The forecast errors have been divided into 7 groups by size and for each group we show the average forecast error and the associated average relative forecast error.

Source: Own calculations.

To summarise, our forecast evaluation can be seen as more principled in the sense that our aim has not been to find the best forecast model. For example, we have not examined whether other international variables, such as different measures of resource utilisation or oil prices, are more or less important for forecasts of Swedish inflation. We find that global inflation can help to improve the ability to forecast Swedish inflation and that the importance of international inflation is greatest when inflation is high, when the difference between inflation in Sweden and abroad is large and/or when it is difficult to forecast inflation. However, the value of using global inflation to forecast Swedish inflation has been limited during the inflation-targeting period.

Of course, the Riksbank and other forecasters use models that include external variables to forecast domestic variables, including inflation.[79] Our results imply that international inflation is an important predictor of Swedish inflation, which is in line with

[79] Medium-term forecasts are, for example, generated using a general equilibrium model and BVAR models that include various measures of international inflation.

other studies for Sweden.[80] A contribution of our analysis is that we show how the importance of global inflation as a predictor has varied over time and with different situations.

# 6 Concluding discussion

Sweden is a small open economy that is largely influenced by economic developments in the rest of the world. In this staff memo we have focused on how the relationships between different measures of inflation in Sweden and globally have changed since the 1960s. We have shown that the relationships between CPI inflation in Sweden and abroad have been strong and relatively stable throughout the period from 1960 to the present. The relationships between CPIF inflation in Sweden and CPI inflation globally have also been strong if we disregard the special period 2009-2012 when both the policy rate and the krona exchange rate were volatile. For the inflation-targeting period, the strong relationships can be attributed to strong relationships for energy and food inflation, while the relationships for core inflation (goods and services) have been weak. These empirical observations for Sweden are similar to those for an average OECD country. The overall picture is that global commodity price shocks and similarities in the response of monetary policy in developed countries can explain much of the covariation over the inflation-targeting period, and in particular the period from the global financial crisis of 2007-2009 onwards.

In 2021 and 2022, inflation rose rapidly in many countries and neither central banks nor other analysts anticipated the rapid rise. This has led to criticism of central banks, including the Riksbank.[81] A key question is what lessons can be learnt and how forecasting methods can be improved. An important aspect here concerns the international dependence of Swedish inflation. Both the Riksbank itself and external analysts have emphasised that the analysis of inflation developments abroad and how they affect inflation in Sweden needs to be deepened.[82] Our staff memo can be seen as part of such an analysis and we conclude by summarising our analysis in two practical lessons related to inflation forecasting.

### The starting point for forecasts should be that inflation in Sweden and abroad develops in a similar way

A reasonable starting point when making forecasts for inflation in Sweden is that the strong relationships with inflation abroad in the data are also reflected in the forecasts.[83] These relationships can inspire simple models that can highlight whether the

[80] See, for example, Lindholm et al. (2018), who show that a measure of CPI inflation abroad improves forecasts of Swedish inflation when used in BVAR models. They also show that forecasting ability increases more if CPI inflation is included than if a measure of core inflation is used, which is in line with our results.

[81] See Håkansson and Laséen (2024) for a discussion and references to this criticism.

[82] See Hassler et al. (2023) and Johansson et al. (2022).

[83] A similar conclusion is presented by Ca' Zorzi et al. (2017) who show that good exchange rate forecasts are characterised by the incorporation of the strong relationships between inflation in different countries in the forecasting model.

relationships in the forecasts (or forecast revisions) deviate from the normal relationships. For example, differences between inflation in Sweden and abroad tend to decrease relatively quickly over time, which can be expressed as international inflation being an attractor for Swedish inflation.[84]

Lindé and Reslow (2017) study the relationship between *revisions* of the Riksbank's and other forecasters' forecasts for inflation in Sweden and abroad. They conclude that the relationship between the revisions is roughly in line with the relationships in the data in the short term but weaker than those in the data for the 2-3 year forecasts. We are not aware of any similar analysis for the level forecasts. However, as inflation forecasts often revert to the inflation target within the forecast period, the main question is how inflation differentials look in the shorter term, within two years. The Riksbank has, for example, been criticised for the inflation forecasts made in February 2022, and on that occasion the differences between the inflation forecasts for Sweden and the rest of the world (mainly the USA but also the euro area) were relatively large.[85]

### Good forecast judgements are based on knowledge of how relationships in the data have changed over time.

Our analysis of CPIF inflation in Sweden and CPI inflation abroad illustrates the value of studying time variation in the relationships. Models with constant parameters capture average relationships in the data - for example, the Riksbank's general equilibrium model MAJA and various VAR models estimated on data for the inflation target period have a relatively weak correlation between the two variables, which is in line with the average relationships in the data. Lindé and Reslow's (2017) result that the forecast revisions for inflation in Sweden and abroad in the short term are in line with the data relationships (see above) is based, for example, on a correlation between CPIF inflation in Sweden and KIX-weighted international inflation of 0.5. Our analysis shows that this correlation is weakened by the particular developments in 2009-2012 and one could therefore argue that the relationship has typically been even stronger, with a correlation around 0.8 instead of 0.5. With this correlation, the conclusion would instead be that the relationships between the forecast revisions have been too weak in relation to the data relationships.

It is not clear how time variation in the relationships should affect the estimation of forecast models, i.e. what weight should be given to different data observations in such estimates. However, our discussion illustrates that a good knowledge of the relationships in the data and how these relationships are reflected in the forecast models is necessary to be able to adjust model forecasts in an appropriate way in terms of judgement.

[84] A simple way to illustrate this idea of international inflation as an attractor for Swedish inflation is to count the number of times Swedish inflation crosses global inflation. For CPI inflation, this has happened on average about once a year since 1960, although the inflation differential has sometimes been more persistent.

[85] See Hassler et al. (2023).

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# APPENDIX

## Data

We have consumer price index (CPI) and CPI excluding food and energy (core inflation) data from the OECD (Macrobond), and food and energy price index data from the World Bank for 22 OECD countries.[86] [87]The sample period is 1955M1−2012M12 for the CPI, 1970M1-2022M12 for core inflation and the energy price index, and 1970M1−2022M11 for food. For some countries and series, data are partially or completely missing and Table 1 describes in detail what data are available. When we calculate various statistics, such as the median inflation rate for countries, the calculations are based on the observations available in each time period. Figure 19 to Figure 22 show the four inflation series for the 22 countries. We also use data for the HICP, and different sub-components of the HICP, for the period 1996−2022 (from Macrobond). Table 2 shows what data are available.

[86] In 2022, the OECD had 38 member countries. Our sample of 22 countries is the same sample used by Ciccarelli and Mojon (2010).

[87] The World Bank's global database of inflation series for over 200 countries from 1970 to the present day is available on the organisation's website, https://www.worldbank.org/en/research/brief/inflation-database.

## Table 1. Price data for 22 OECD countries: CPI, food, energy and CPI excluding food and energy

| | | CPI | | Food | | Energy | | CPI excl. food and en | |
|---|---|---|---|---|---|---|---|---|---|
| | | Begin | End | Begin | End | Begin | End | Begin | End |
| Australia | | 1955M1 | 2022M12 | Missing | | Missing | | 1971M4 | 2022M12 |
| Austria | | 1958M1 | 2022M12 | 1970M1 | 2022M11 | 1970M1 | 2022M12 | 1970M1 | 2022M12 |
| Belgium | | 1955M1 | 2022M12 | 1991M1 | 2022M11 | 1975M6 | 2022M12 | 1976M6 | 2022M12 |
| Canada | | 1955M1 | 2022M12 | 1970M1 | 2022M11 | 1970M1 | 2022M12 | 1970M1 | 2022M12 |
| Denmark | | 1967M1 | 2022M12 | 1970M1 | 2022M11 | 1970M1 | 2022M12 | 1970M1 | 2022M12 |
| Finland | | 1955M1 | 2022M12 | 1970M1 | 2022M11 | 1970M1 | 2022M12 | 1970M1 | 2022M12 |
| France | | 1955M1 | 2022M12 | 1970M1 | 2022M11 | 1970M1 | 2022M12 | 1970M1 | 2022M12 |
| Germany | | 1955M1 | 2022M12 | 1970M1 | 2022M11 | 1970M1 | 2022M12 | 1970M1 | 2022M12 |
| Greece | | 1955M1 | 2022M12 | 1970M1 | 2022M11 | 1989M1 | 2022M12 | 1970M1 | 2022M12 |
| Ireland | | 1955M1 | 2022M12 | 1975M11 | 2022M11 | 1975M11 | 2022M12 | 1975M11 | 2022M12 |
| Italy | | 1955M1 | 2022M12 | 1970M1 | 2022M11 | 1970M1 | 2022M12 | 1970M1 | 2022M12 |
| Japan | | 1955M1 | 2022M12 | 1970M1 | 2022M11 | 1970M1 | 2022M12 | 1970M1 | 2022M12 |
| Luxembourg | | 1955M1 | 2022M12 | 1970M1 | 2022M11 | 1970M1 | 2022M12 | 1970M1 | 2022M12 |
| Netherlands | | 1960M4 | 2022M12 | 1970M1 | 2022M11 | 1970M1 | 2022M12 | 1970M1 | 2022M12 |
| New Zealand | | 1955M1 | 2022M12 | Missing | | Missing | | 1970M1 | 2022M12 |
| Norway | | 1955M1 | 2022M12 | 1979M1 | 2022M11 | 1979M1 | 2022M12 | 1979M1 | 2022M12 |
| Portugal | | 1955M1 | 2022M12 | 1970M1 | 2022M11 | 1970M1 | 2022M12 | 1970M1 | 2022M12 |
| Spain | | 1955M1 | 2022M12 | 1970M1 | 2022M11 | 1976M1 | 2022M12 | 1976M1 | 2022M12 |
| Sweden | | 1955M1 | 2022M12 | 1970M1 | 2022M11 | 1970M1 | 2022M12 | 1970M1 | 2022M12 |
| Switzerland | | 1955M1 | 2022M12 | 1970M1 | 2022M11 | 1970M1 | 2022M12 | 1970M1 | 2022M12 |
| United Kingdom | | 1955M1 | 2022M12 | 1970M1 | 2022M11 | 1970M1 | 2022M12 | 1970M1 | 2022M12 |
| United States | | 1955M1 | 2022M12 | 1970M1 | 2022M11 | 1970M1 | 2022M12 | 1970M1 | 2022M12 |

Note. The table shows data availability for the CPI, CPI food, CPI energy and CPI excluding food and energy used in our analysis.

Source: World Bank.

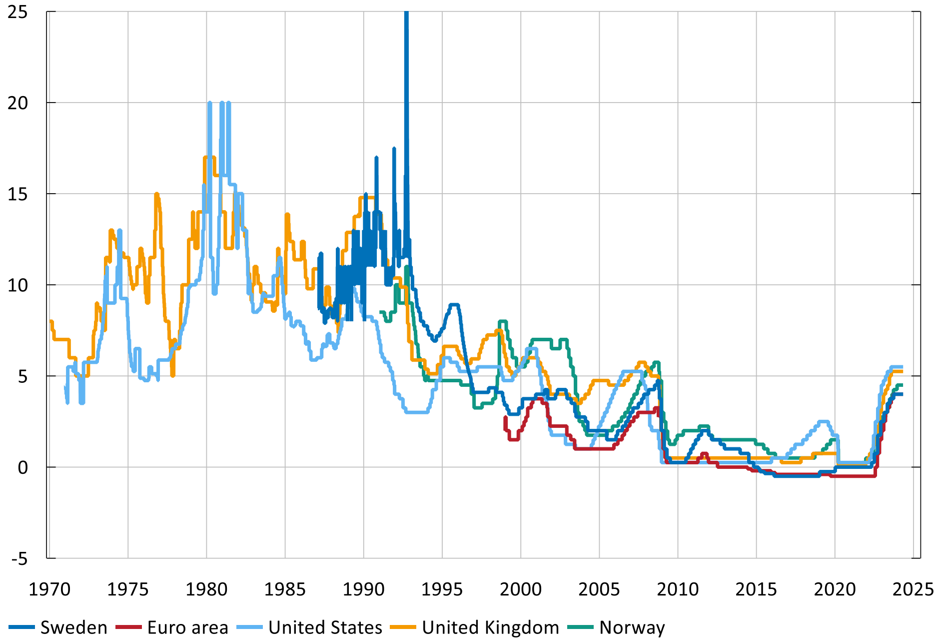
## Table 2. Price data for 22 OECD countries: HICP and components of HICP

| | | HICP | | Goods | | Services | | Energy | | Food | | HICP excl. food and e | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Begin | End | Begin | End | Begin | End | Begin | End | Begin | End | Begin | End |
| Australia | | Missing | | Missing | | Missing | | Missing | | Missing | | Missing | |
| Austria | | 1996M1 | 2022M12 | 1999M12 | 2022M12 | 1999M12 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1999M12 | 2022M12 |
| Belgium | | 1996M1 | 2022M12 | 1998M12 | 2022M12 | 1998M12 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1998M12 | 2022M12 |
| Canada | | Missing | | Missing | | Missing | | Missing | | Missing | | Missing | |
| Denmark | | 1996M1 | 2022M12 | 1999M12 | 2022M12 | 1999M12 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 | Missing | |
| Finland | | 1996M1 | 2022M12 | 1999M12 | 2022M12 | 1999M12 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1999M12 | 2022M12 |
| France | | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 |
| Germany | | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 |
| Greece | | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 |
| Ireland | | 1996M1 | 2022M12 | 1999M12 | 2022M12 | 1999M12 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1999M12 | 2022M12 |
| Italy | | 1996M1 | 2022M12 | 1999M12 | 2022M12 | 1999M12 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1999M12 | 2022M12 |
| Japan | | Missing | | Missing | | Missing | | Missing | | Missing | | Missing | |
| Luxembourg | | 1996M1 | 2022M12 | 1999M12 | 2022M12 | 1999M12 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1999M12 | 2022M12 |
| Netherlands | | 1996M1 | 2022M12 | 1999M12 | 2022M12 | 1999M12 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1999M12 | 2022M12 |
| New Zealand | | Missing | | Missing | | Missing | | Missing | | Missing | | Missing | |
| Norway | | 1996M1 | 2022M12 | 1999M12 | 2022M12 | 1999M12 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1999M12 | 2022M12 |
| Portugal | | 1996M1 | 2022M12 | 1999M12 | 2022M12 | 1999M12 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1999M12 | 2022M12 |
| Spain | | 1996M1 | 2022M12 | 2000M12 | 2022M12 | 2000M12 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 2000M12 | 2022M12 |
| Sweden | | 1996M1 | 2022M12 | 1999M12 | 2022M12 | 1999M12 | 2022M12 | 1996M1 | 2022M12 | 1996M1 | 2022M12 | 1999M12 | 2022M12 |
| Switzerland | | 2004M12 | 2022M12 | 2004M12 | 2022M12 | 2004M12 | 2022M12 | 2004M12 | 2022M12 | 2004M12 | 2022M12 | 2004M12 | 2022M12 |
| United Kingdom | | 1996M1 | 2022M12 | 1996M1 | 2020M11 | 1996M1 | 2020M11 | 1996M1 | 2020M11 | 1996M1 | 2020M11 | 1996M1 | 2022M12 |
| United States | | 2001M12 | 2022M12 | Missing | | Missing | | Missing | | Missing | | Missing | |

Note. The table shows the data availability of HICP and components of HICP used in our analysis.
Source: Eurostat.

**Figure 18. Policy rates in various countries and regions**

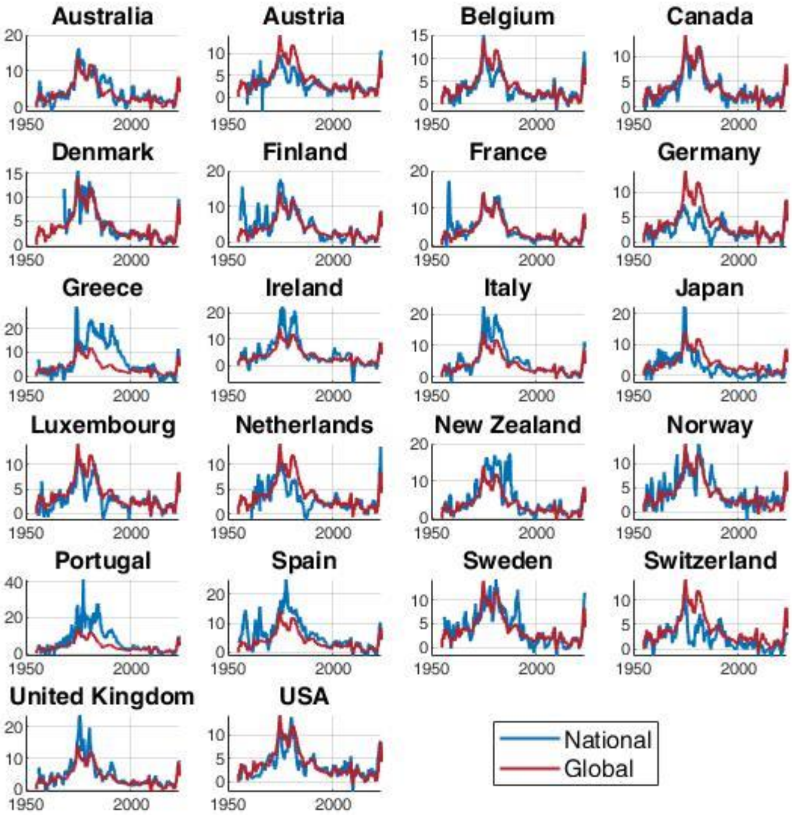
Per cent




Note. The y-axis is cropped and the rise in Swedish interest rates to 500 per cent in September 1992 is thus not visible in the graph.

Source: Respective central bank.

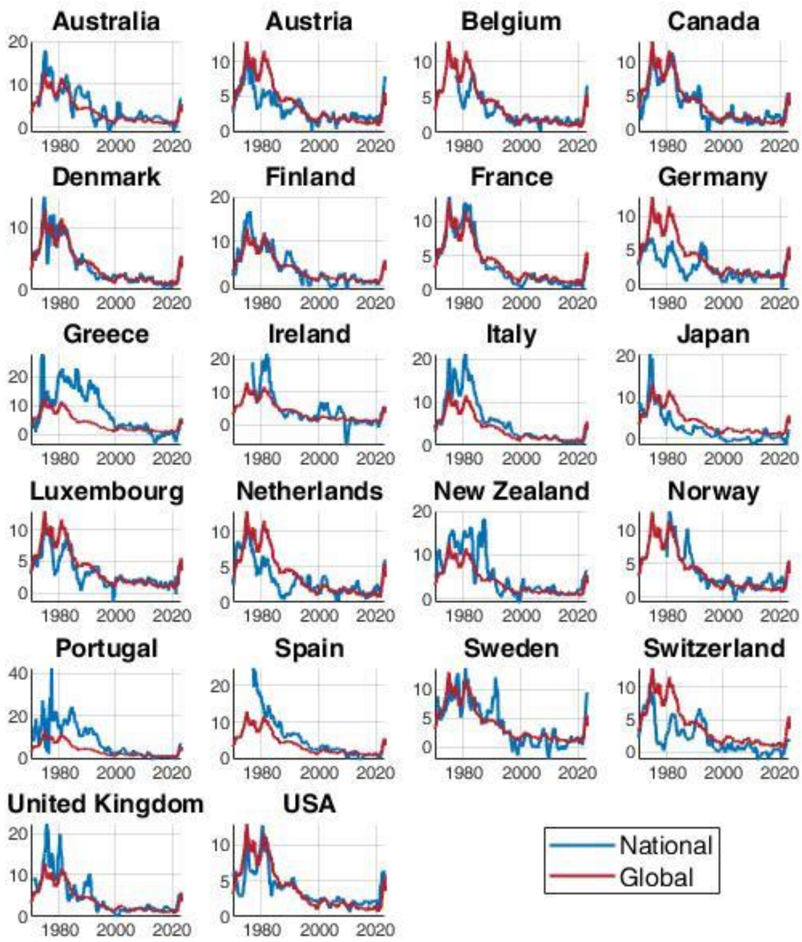
**Figure 19. Consumer price index (CPI) in 22 OECD countries, 1955−2022**
Annual percentage change




Note. Global inflation is given by the median inflation rate of the 22 OECD countries.

Source: OECD.

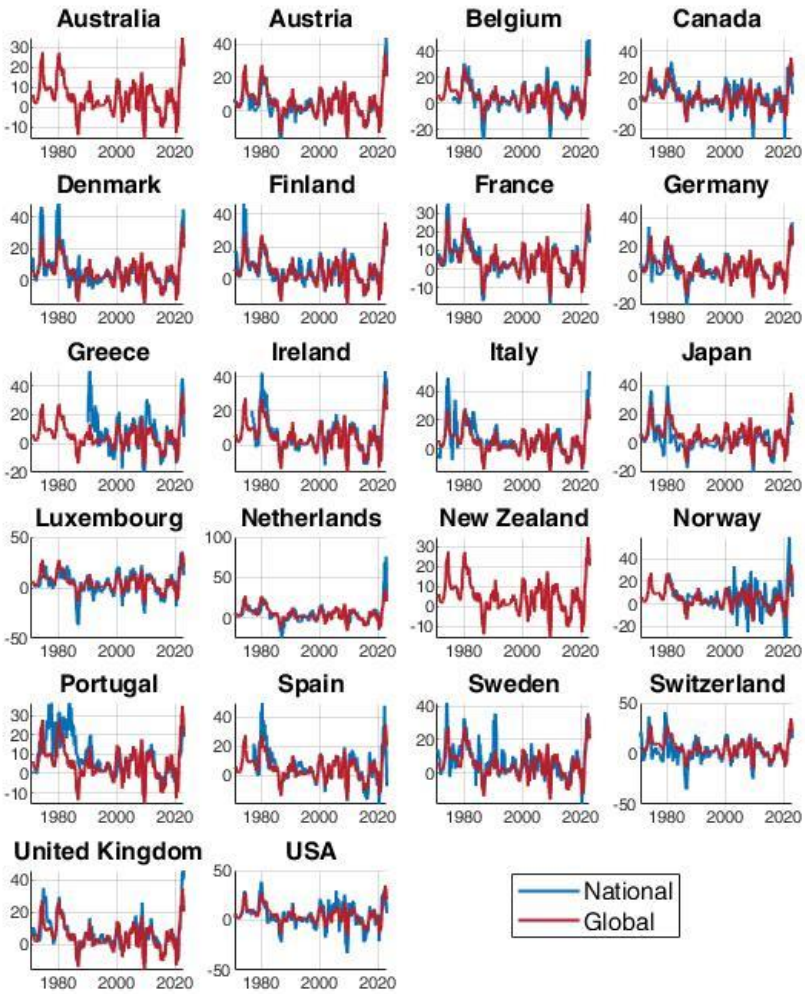
**Figure 20. CPI excluding food and energy in 22 OECD countries, 1970–2022**
Annual percentage change




Note. Global inflation is given by the median inflation rate of the 22 OECD countries.
Source: OECD.

**Figure 21. Energy prices in 22 OECD countries, 1970–2022**

Annual percentage change

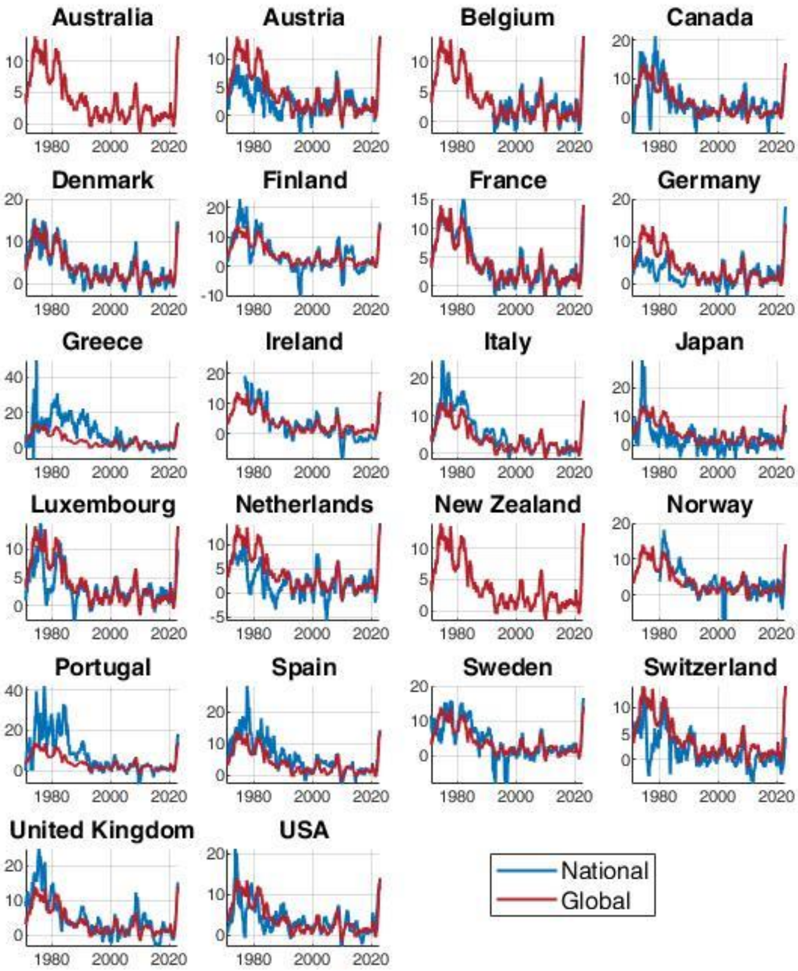



Note. Global inflation is given by the median inflation rate of the 22 OECD countries. Data are missing for Australia and New Zealand.

Source: World Bank.

**Figure 22. Food prices in 22 OECD countries, 1970−2022**

Annual percentage change




Note. Global inflation is given by the median inflation rate of the 22 OECD countries. Data are missing for Australia and New Zealand.

Source: World Bank.

# Relationships between national and global inflation

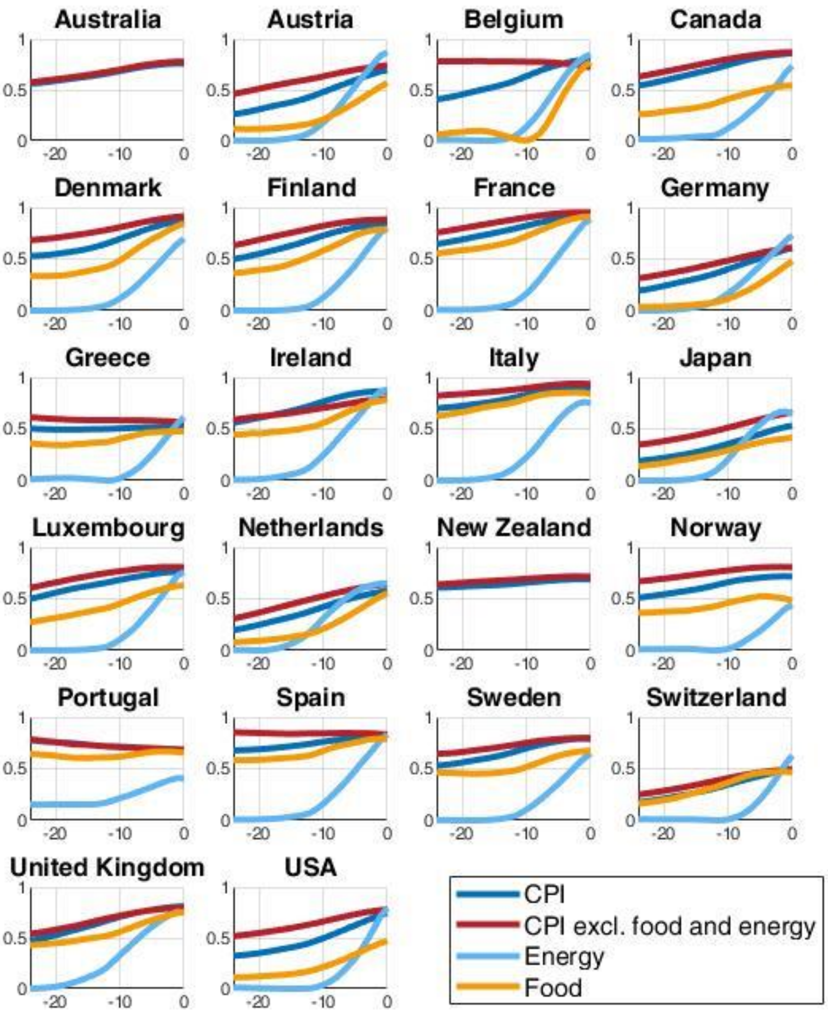
**Table 3. Share of variation in national CPI inflation explained by global CPI inflation with four different measures of global inflation. Long samples.**

| | OECD | G7 | Euro area | OECD, median |
|---|---|---|---|---|
| Australia | 0,72 | 0,70 | 0,37 | 0,76 |
| Austria | 0,54 | 0,74 | 0,85 | 0,68 |
| Belgium | 0,59 | 0,74 | 0,80 | 0,78 |
| Canada | 0,76 | 0,86 | 0,53 | 0,86 |
| Denmark | 0,78 | 0,85 | 0,72 | 0,87 |
| Finland | 0,73 | 0,84 | 0,69 | 0,82 |
| France | 0,79 | 0,88 | 0,90 | 0,92 |
| Germany | 0,45 | 0,66 | 0,82 | 0,59 |
| Greece | 0,74 | 0,50 | 0,44 | 0,51 |
| Ireland | 0,68 | 0,81 | 0,51 | 0,87 |
| Italy | 0,85 | 0,85 | 0,82 | 0,89 |
| Japan | 0,47 | 0,70 | 0,08 | 0,51 |
| Luxembourg | 0,54 | 0,69 | 0,80 | 0,75 |
| Netherlands | 0,39 | 0,63 | 0,73 | 0,57 |
| New Zealand | 0,66 | 0,59 | 0,46 | 0,71 |
| Norway | 0,70 | 0,63 | 0,22 | 0,72 |
| Portugal | 0,70 | 0,58 | 0,59 | 0,69 |
| Spain | 0,74 | 0,76 | 0,82 | 0,79 |
| Sweden | 0,75 | 0,73 | 0,65 | 0,79 |
| Switzerland | 0,47 | 0,56 | 0,50 | 0,48 |
| United Kingdom | 0,65 | 0,85 | 0,69 | 0,82 |
| United States | 0,74 | 0,92 | 0,71 | 0,76 |
| | | | | |
| Median | 0,70 | 0,74 | 0,69 | 0,76 |

Note. The table shows the R2 value in a regression of national CPI inflation on global CPI inflation for different measures of the latter (see the respective column). The regression is estimated on the longest possible sample period for each country during the period 1960M1-2022M12. OECD inflation is available from 1970M1, G7 inflation from 1970M1, euro area inflation from 1990M1 and median inflation for OECD countries since 1955M1.

Source: The OECD and own calculations.

**Figure 23. Share of the variation in four different measures of inflation explained by a matching measure of global inflation. Regressions with lag=0,...,24. Long samples.**




Note. The figure shows the R2 value in a regression of national inflation on global inflation for four different measures of inflation and for different lags of global inflation, lag = 0,...,24 (shown on the x-axis). The regression is estimated on the longest possible sample period for each country during the period 1960M1-2022M12 for CPI inflation and the period 1970M1-2022M12 for other measures.

Sources: World Bank and own calculations.

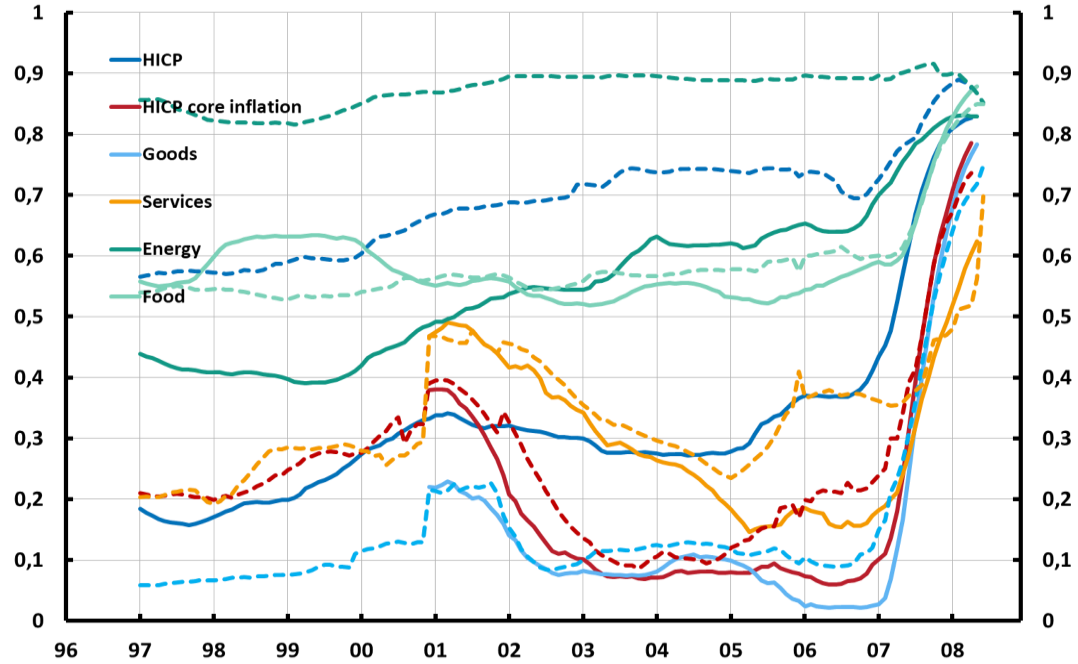
**Table 4. Share of variation (R2) in national CPI excluding energy and food explained by global core inflation using four different measures of global inflation**

| | OECD | G7 | Euro area | OECD, median |
|---|---|---|---|---|
| Australia | 0,67 | 0,69 | 0,25 | 0,78 |
| Austria | 0,50 | 0,70 | 0,48 | 0,74 |
| Belgium | 0,63 | 0,55 | 0,56 | 0,72 |
| Canada | 0,76 | 0,87 | 0,42 | 0,83 |
| Denmark | 0,76 | 0,85 | 0,59 | 0,91 |
| Finland | 0,71 | 0,83 | 0,32 | 0,82 |
| France | 0,79 | 0,91 | 0,70 | 0,95 |
| Germany | 0,44 | 0,62 | 0,56 | 0,59 |
| Greece | 0,74 | 0,52 | 0,21 | 0,57 |
| Ireland | 0,60 | 0,77 | 0,26 | 0,80 |
| Italy | 0,84 | 0,89 | 0,50 | 0,91 |
| Japan | 0,44 | 0,66 | 0,00 | 0,53 |
| Luxembourg | 0,54 | 0,72 | 0,44 | 0,80 |
| Netherlands | 0,37 | 0,62 | 0,42 | 0,56 |
| New Zealand | 0,69 | 0,66 | 0,32 | 0,72 |
| Norway | 0,78 | 0,70 | 0,03 | 0,81 |
| Portugal | 0,68 | 0,58 | 0,53 | 0,68 |
| Spain | 0,71 | 0,76 | 0,43 | 0,83 |
| Sweden | 0,74 | 0,76 | 0,45 | 0,80 |
| Switzerland | 0,40 | 0,45 | 0,33 | 0,45 |
| United Kingdom | 0,64 | 0,86 | 0,39 | 0,80 |
| United States | 0,77 | 0,91 | 0,47 | 0,71 |
| | | | | |
| Median | 0,69 | 0,71 | 0,43 | 0,79 |

Note. The table shows the R2 value in a regression of national inflation on global inflation for different measures of the latter (see respective columns). The regression is estimated on the longest possible sample period for each country during the period 1960M1-2022M12. OECD inflation is available from 1970M1, G7 inflation from 1970M1, euro area inflation from 1996M1 and median inflation for OECD countries since 1955M1. The different results for the euro area are mainly due to the short sample period.

Source: OECD.

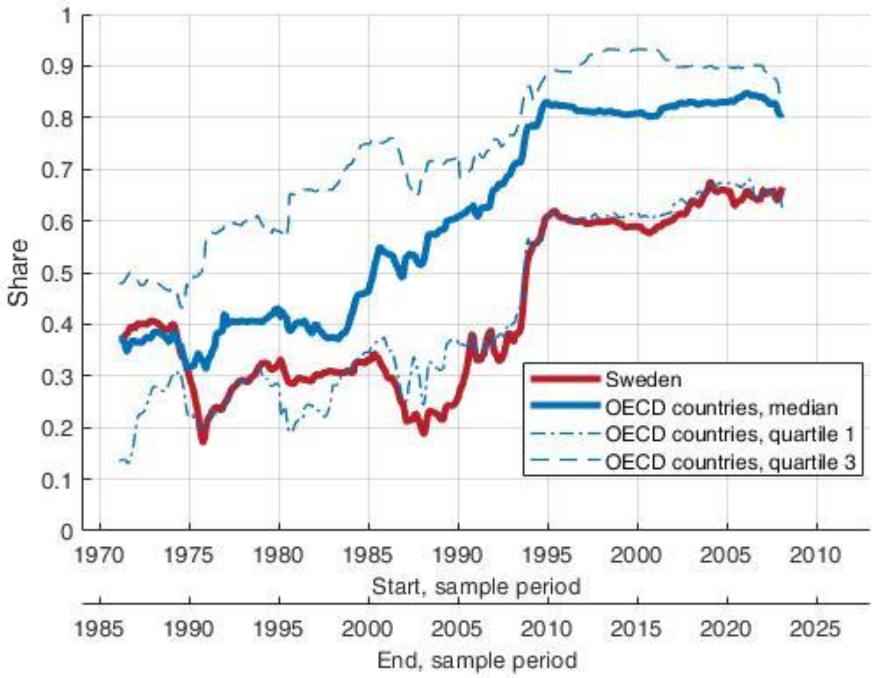
**Figure 24. The share of the variation in inflation explained by a global component. HICP and components of HICP, 1997−2022. Sweden (solid lines) and the median of OECD countries (dashed lines).**




Note. The figure shows rolling estimates of the share of the variation in Swedish inflation explained by global inflation (solid lines). Inflation is calculated for HICP and different components of HICP. The dashed lines show the median share for the OECD countries in our sample and can be interpreted as the relationship for an average country. Goods are non-energy industrial goods. The relationships are calculated for 15-year samples over the period 1997M1 to early 2023. The year on the x-axis indicates the first month of the sample.

Sources: Eurostat and own calculations.

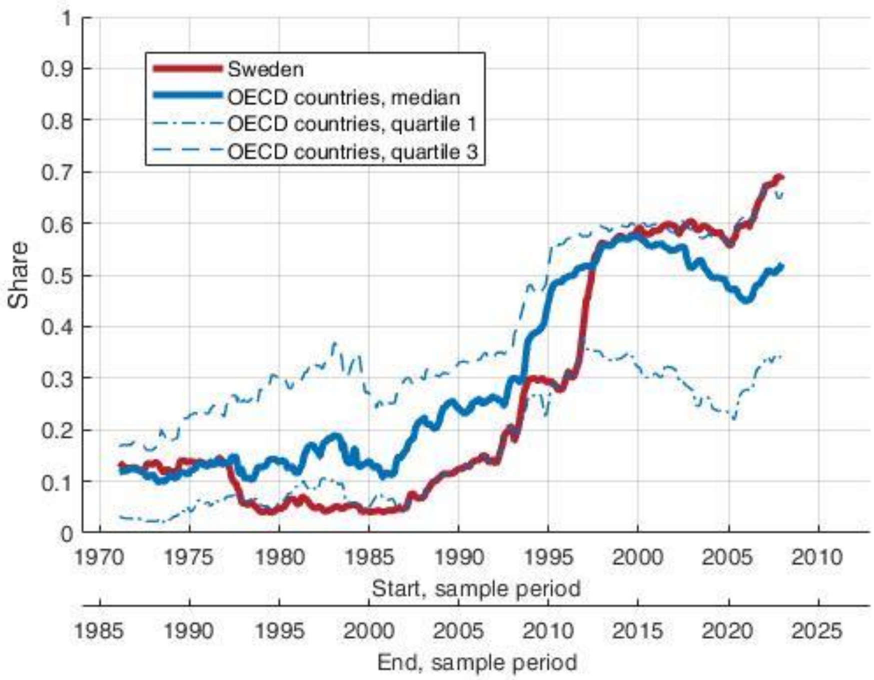
**Figure 25. Share of variation in the cyclical component of energy inflation explained by a global component, 1970–2022**




Note. The share of the variation in the cyclical component of energy inflation explained by the cyclical component of global energy inflation is given by the R2 value in a regression of the former on the latter and is the square of the correlation between the two variables. The share is calculated for rolling samples of 15 years duration (180 monthly observations) and the dates on the x-axis indicate the start and end dates of the sample. The share is calculated between inflation in all countries and global inflation and the median share (blue) and the share for Sweden (red) are shown. The quartiles illustrate the distribution of the share for different countries. 25 per cent of countries have a correlation lower than quartile 1 and 25 per cent of countries have a correlation higher than quartile 3. The cyclical component is calculated using the HP filter with smoothing parameter 1600.

Sources: World Bank and own calculations.

**Figure 26. Share of the variation in the cyclical component of food inflation explained by a global component, 1971-2022**




Note. The share of the variation in the cyclical component of food inflation explained by the cyclical component of global food inflation is given by the R2 value in a regression of the former on the latter and is the square of the correlation between the two variables. The share is calculated for rolling samples of 15 years duration (180 monthly observations) and the dates on the x-axis indicate the start and end dates of the sample. The share is calculated between inflation in all countries and global inflation and the median ratio (blue) and the share for Sweden (red) are shown. The quartiles illustrate the distribution of the share for different countries. 25 per cent of countries have a correlation lower than quartile 1 and 25 per cent of countries have a correlation higher than quartile 3. The cyclical component is calculated using the HP filter with smoothing parameter 1600.

Sources: World Bank and own calculations.

## Forecasts

Here we describe our forecast evaluation in more detail and compare our results with Ciccarelli and Mojon (2010). We use monthly data on CPI inflation in annual percentage change. We estimate the models on a rolling sample for a period of 15 years (180 monthly observations). The first sample period is 1960M1−1974M12 and the first three-year forecast period is 1975M1−1977M12. The final sample is 2007M1−2021M12 and the final forecast period is 2022M1−2022M12. The models estimated are AR models ("national model") and bivariate VAR models ("global model") for national and global CPI inflation. The latter model is assumed to be block-exogenous, i.e. the coefficients in front of national inflation in the global inflation equation are assumed to be zero. We have also estimated the model without this restriction, and it turns out that the assumption has little impact on the results (the results for the model without the restriction are not reported here). For the bivariate VAR model, we make forecasts in two different ways: regular (endogenous) forecasts and forecasts conditional on outcomes for global inflation. We also compare with simple random walk forecasts where the forecast inflation rate is assumed to be equal to the baseline inflation rate.

For each model, the model is estimated with lag lengths from 1 month to 12 months. We then select the lag length that produces forecasts with the lowest root mean square error (RMSFE) for a given forecast horizon over the entire evaluation period. The lag length is thus chosen specifically for the country, model and forecast horizon, but of course does not vary with the forecast time. The typical optimal lag length for different countries and horizons is 2 or 3. For Sweden, the optimal lag length for the AR model is 2 at both 12 and 24 month horizons, and for the VAR model is 1 and 3 at these two horizons.

In Table 5, relative RMSFE, i.e. the ratio of the RMSFE of each model to the AR model, is shown for different countries and the forecast horizons of 1 and 2 years. We compare our results with those presented by Ciccarelli and Mojon (2010), abbreviated CM. There are a number of differences between the two studies which are listed below:

- CM have inflation at quarterly frequency while we have monthly data.
- We use autoregressive models and forecast recursively. Instead, CM use so-called direct regression models ("h-step ahead specification").
- CM estimate the models on samples of expanding size starting in 1960 and the forecast evaluation is done for the period 1995-2008.

CM's overall finding is that the global model outperforms the AR model (and other simple benchmark models) for most countries and forecast horizons. Our results imply that the average differences in forecast ability between the global (AR) and national (VAR) models are smaller. However, there is a similarity with CM regarding for which countries global inflation improves the forecasts. Like CM, we find that global inflation is helpful for the following countries: Australia, Denmark, Portugal, Spain, Sweden, Norway, Italy, Canada and the United Kingdom. For the following countries, like CM, we find that the forecasts do not improve: USA, Japan, Greece and Finland.

In Figure 27, we show the forecast errors for CPI inflation at a one-year horizon using the AR and VAR models for Sweden. We can see that the forecast errors are strongly correlated, which means that the different models make good, or less good, forecasts at roughly the same times.[88] We also see that the forecast errors for the VAR model are smaller (in absolute terms) than for the AR model in some cases where the forecast errors for both models are large. This relationship is also illustrated in Figure 16 in the main text.

We define the *relative forecast error* as the difference between the absolute forecast error of the AR model and the absolute forecast error of the VAR model. When the difference is positive, global inflation contributes to better forecasts of national inflation. In Figure 17 in the main text, we show that the relative forecast error is more positive when forecasting inflation is difficult, i.e. when the absolute forecast errors of

[88] The pairwise correlations between the forecast errors of the AR model and the two types of forecasts with the VAR model are 0.9.

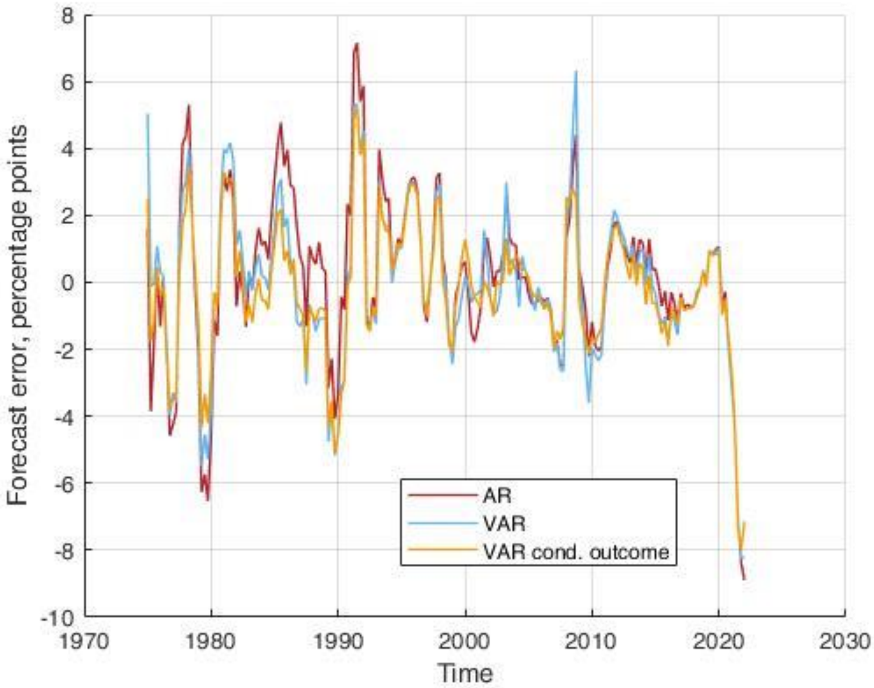
the models are large. In Figure 28, we show the relationship between the relative forecast error and the level of inflation and the difference in inflation in Sweden and globally. The weaker relationships when inflation or the inflation differential is high are probably because we have few such observations. Overall, the relationships can be interpreted as meaning that global inflation is more important to use when forecasting Swedish inflation when it is difficult to make forecasts, when inflation is high, and/or when the difference in inflation rates in Sweden and abroad is large.

**Table 5. Relative RMSE for CPI inflation forecasts**

| | 12 months | | | 24 months | | |
|---|---|---|---|---|---|---|
| | RW | VAR | VAR (outc.) | RW | VAR | VAR(outc. |
| Australia | 0,97 | 0,97 | 0,92 | 0,94 | 0,88 | 0,83 |
| Austria | 1,11 | 1,10 | 1,04 | 1,21 | 1,19 | 1,04 |
| Belgium | 1,08 | 1,07 | 0,91 | 1,06 | 1,15 | 0,75 |
| Canada | 1,03 | 0,96 | 0,82 | 1,00 | 0,98 | 0,70 |
| Denmark | 0,86 | 0,91 | 0,85 | 0,72 | 0,88 | 0,72 |
| Finland | 1,07 | 1,03 | 0,97 | 1,16 | 1,18 | 0,96 |
| France | 0,94 | 0,97 | 0,88 | 0,91 | 0,92 | 0,79 |
| Germany | 1,02 | 1,02 | 1,02 | 1,08 | 1,11 | 1,12 |
| Greece | 0,97 | 1,04 | 1,02 | 0,95 | 1,08 | 1,04 |
| Ireland | 0,97 | 0,93 | 0,90 | 0,93 | 0,93 | 0,84 |
| Italy | 0,87 | 0,85 | 0,82 | 0,81 | 0,98 | 0,58 |
| Japan | 1,06 | 1,07 | 0,98 | 1,04 | 1,10 | 1,02 |
| Luxembourg | 1,02 | 0,96 | 0,86 | 1,06 | 1,02 | 0,78 |
| Netherlands | 1,01 | 1,00 | 0,99 | 0,97 | 1,03 | 0,96 |
| New Zealand | 1,01 | 1,00 | 0,96 | 0,99 | 0,95 | 0,90 |
| Norway | 1,13 | 0,98 | 0,93 | 1,17 | 0,98 | 0,83 |
| Portugal | 0,94 | 0,90 | 0,91 | 0,92 | 0,78 | 0,88 |
| Spain | 0,91 | 0,96 | 0,92 | 0,86 | 0,90 | 0,90 |
| Sweden | 1,04 | 0,92 | 0,79 | 1,07 | 0,95 | 0,72 |
| Switzerland | 1,07 | 1,10 | 1,08 | 1,15 | 1,24 | 1,24 |
| United Kingdom | 0,81 | 0,83 | 0,82 | 0,71 | 0,71 | 0,70 |
| United States | 1,09 | 1,19 | 1,17 | 1,07 | 1,38 | 1,39 |
| **Median** | **1,02** | **0,97** | **0,92** | **0,99** | **0,98** | **0,86** |

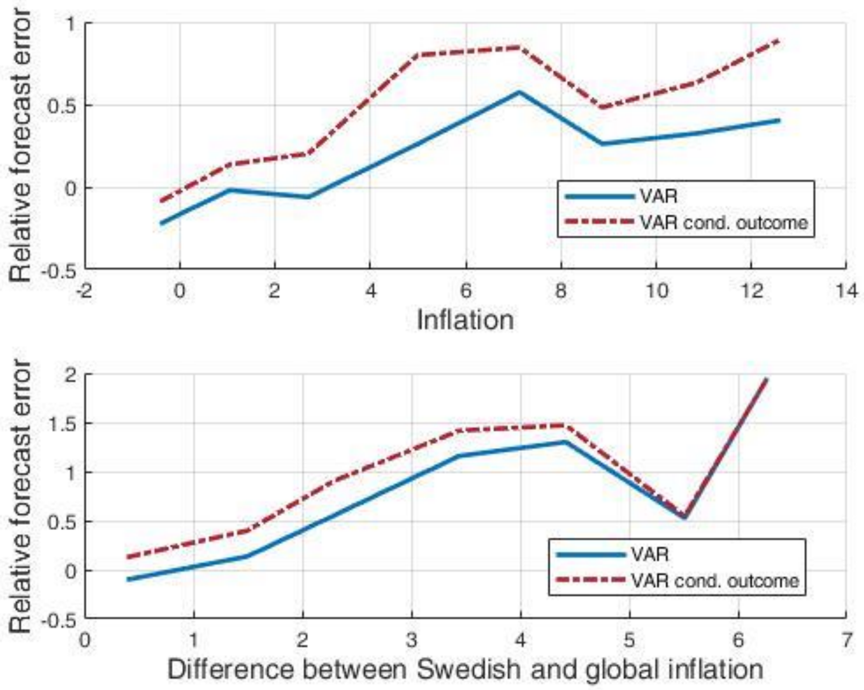
Note. The table shows the RMSFE for 12- and 24-month ahead forecasts made with 3 different models. The RMSFE is expressed relative to the RMSFE of the AR model, the national model. The forecasts are made with models estimated on samples with 15 years of data during the period 1960M1-2021M12, and the last outcome month is 2022M12. The lag length of the models has been chosen optimally for each country, model and forecast horizon.
Sources: The OECD and own calculations.

**Figure 27. Forecast errors for CPI inflation at the 1-year horizon with three forecast models.**




Note. The forecast error is the difference between the one-year forecast and the inflation outcome, and is expressed in percentage points.

**Figure 28. The relationship between the relative forecast error and inflation**




Note. The relative forecast error is the difference between the absolute forecast error of the AR model and the VAR model and is given in percentage points. A positive value means that the VAR model is more accurate, and vice versa. VAR conditional on outcome indicates that the forecasts for Swedish inflation are conditional on outcomes for global inflation. Inflation is the annual percentage change in the CPI. The difference between inflation in Sweden and globally is the absolute difference in percentage points. To make the chart easier to read, we have divided the observations into groups and show the average relative forecast error for each group, e.g. observations for which inflation is between -1 and 0 per cent, 0 and 1 per cent, etc.

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