Currency Effects in the Danish and Swedish Inflation

Can Tongur, Statistics Sweden

Ottawa Group Meeting in Ottawa, Canada 13-15 May 2024

Abstract

During the last few years the Swedish currency (SEK) has experienced a notable decline against both the Euro (EUR) and the United States Dollar (USD) while the Danish currency (DKK) has remained pegged to the Euro. Correspondingly, consumer inflation in terms of CPI in Sweden has reached far higher levels than has Danish CPI. In this brief exposé, certain observations are made regarding potential currency impacts on the Danish and Swedish consumer price indexes. Developments in presumably related economic time series, especially import price index, are compared with CPI movements with an attempt to infer the degree of respective basket's sensitivity to imported inflation, if possible. Some macro aspects are considered that may substantiate differences between the two countries inflation besides the apparent currency regime of pegging versus floating.

Key words: Danish CPI, Swedish CPI, import prices, pegged currency, Eurozone

---

Views and statements expressed herein are those of the author and do not necessarily reflect the standing point of Statistics Sweden. The author claims all shortcomings, especially regarding currency regimes.
The author is grateful for all the input received from Rohan Draper, Statistics Denmark. Olivia Ståhl, Statistics Sweden, contributed with valuable remarks and input to the paper.

Background

Denmark and Sweden are neighbouring Nordic countries that whilst both are members of the European Union and have significant trade with the EU and Eurozone countries have both abstained from joining the Eurozone currency themselves. To this end, they have retained their sovereign currencies of Danish krone and the Swedish krona respectively albeit with two contrasting sets of monetary policy.

Popular vote determined the stance through referendum, in Denmark in year 2000 and in Sweden in year 2003. The two countries' central banks apply somewhat different strategies to achieve their main and common goal – price stability. The Danish central bank Danmarks Nationalbank pursues necessary means to keep the exchange rate fixed to the Euro by regulating the Danish currency DKK through several steering mechanisms.[1] The Swedish central bank Sveriges Riksbank sets monetary policy mainly through the steering interest rate for the banking system in order to align the economy with the inflation target of 2 percent.[2] It can be noted that the European Central Bank also conducts their policy towards a 2 percent inflation target.

After a long period with steady-state economies, several shocks of different kind have manifested starting with the Covid-19 pandemic and followed by the war in Ukraine and ongoing climactic issues, especially drought in both Europe and in several parts of the world that supply Europe and hence Nordic countries with agricultural products, cf. EU (2024) and Copernicus (2024). Inflation has risen globally and appears to have affected Denmark and Sweden with seemingly different magnitude: the inflation in Denmark appears to have levelled out more smoothly whereas the inflation in Sweden has shown slower tendencies to stabilize at target, so far.[3] The two neighbouring Nordic countries Finland and Norway as well as Iceland have experienced inflation to various degrees, of which Finland is in the Eurozone while the latter two are not part of the European Union.

Inflation in Nordic countries (HICP)

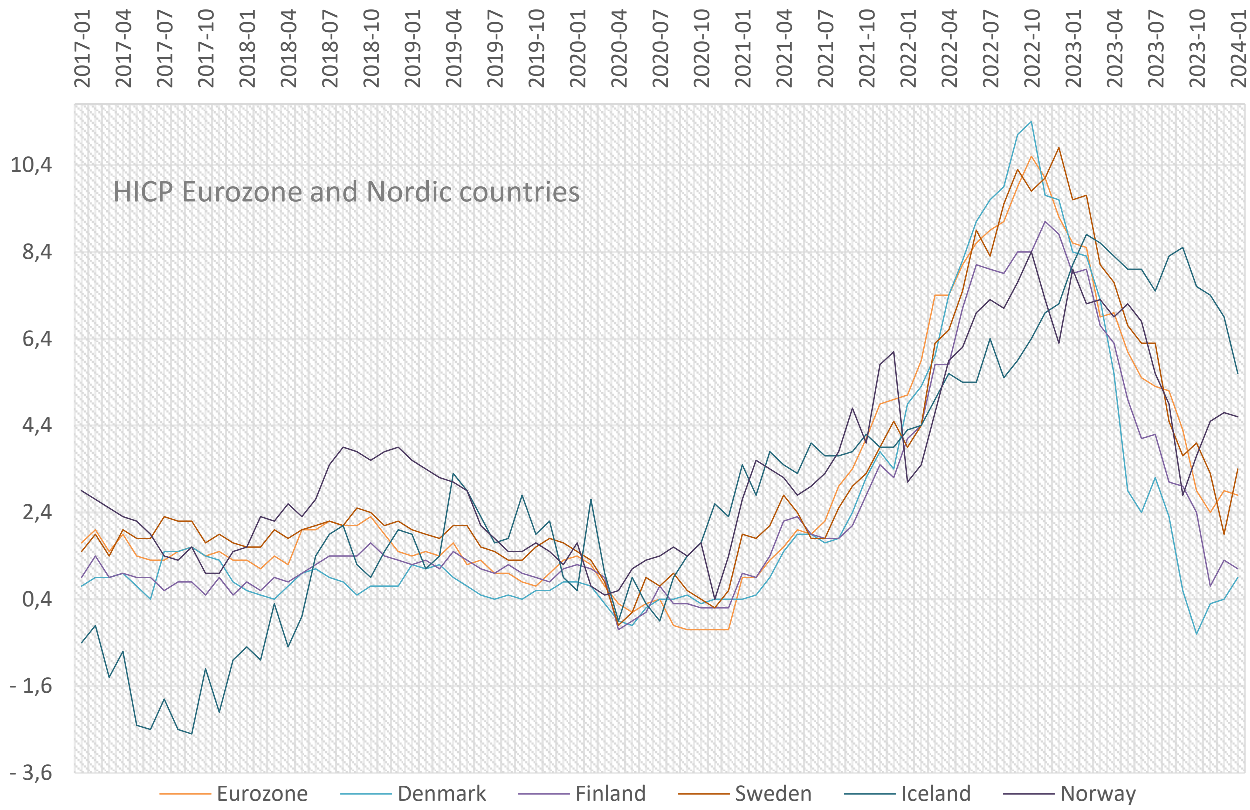
Comparative analyses between Nordic countries are common and can reveal structural differences regarding the subject of interest such as economic phenomena, taxes, crime or societal issues. Comparative analysis may also be affected by measurement methodology, like in the national CPI and other statistics. In a study by Norberg (2023) presented for the Swedish CPI Board in 2023, several subseries (COICOP main and subgroups) were compared for Nordic countries. Remarkable differences were noted in the macro analysis, not the least when comparing Denmark and Sweden. The points identified by Norberg (2023) are of essence in more detailed comparisons since this study serves to point out merely macro movements in inflation and import prices with the intention of inferring on potential currency issues. However, several underlying (also statistical/methodological) factors may exist that altogether may affect drawing reliable conclusions on the macro level.

In the following graph, inflation in terms of annual percentage change in the harmonized index for consumer prices (HICP) is shown for the Nordic countries and the Eurozone.

---

[1] C.f. the homepage of Danmarks Nationalbank*:*
https://www.nationalbanken.dk/en/what-we-do/stable-prices-monetary-policy-and-the-danish-economy
[2] C.f. the homepage of The Riksbank*:*
https://www.riksbank.se/en-gb/monetary-policy/
[3] The inference herein limits to completion of 2023 and January 2024 while the economic situation is ongoing.

Graph 1 Annual inflation through HICP (year-on-year change, percent). Eurozone and Nordic countries. January 2017to January 2024, inclusively.



Source: Eurostat (HICP)

There are notable level and fluctuational differences between Nordic countries relative to the Eurozone inflation, as seen in Graph 1. To determine the magnitude of difference, average deviations in absolute value per country *j* from the Eurozone inflation have been computed according to the formula

$$MAD = \frac{1}{12}\sum_{t=1\ to\ 12\ |j,year} abs|\pi_{j,t} - \pi_t^{HICP}|,$$

and the average absolute deviation means values (MAD) are reported in Table 1.

Table 1 Average deviations from Eurozone inflation per year (Mean Absolute Deviation, MAD), monthly data.

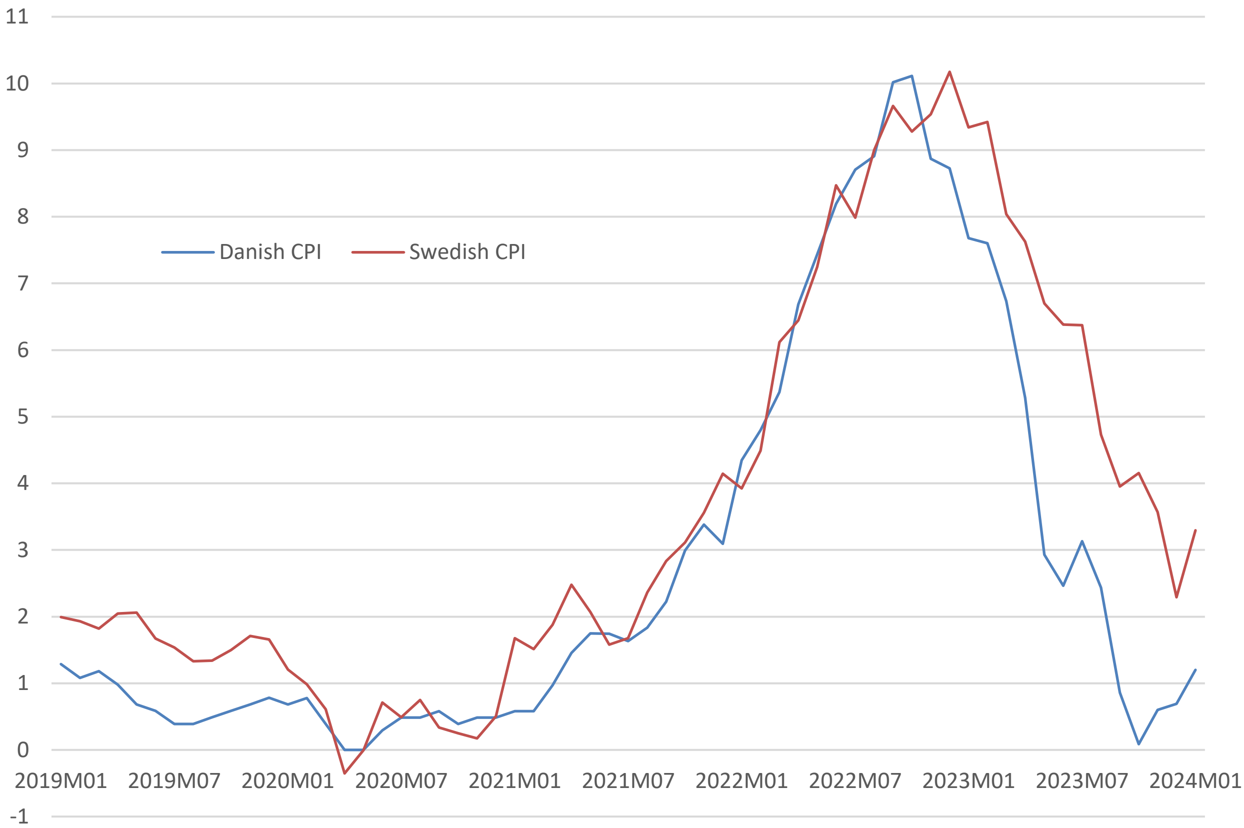
Year	Denmark	Finland	Sweden	Iceland	Norway
2017	0.51	0.69	0.4	3.18	0.50
2018	1.04	0.6	0.29	1.1	1.26
2019	0.45	0.18	0.53	0.96	1.12
2020	0.48	0.37	0.49	1.22	1.02
2021	0.65	0.71	0.67	1.43	1.29
2022	0.59	1.2	0.78	2.65	2.15
2023	2.09	1.08	0.9	2.62	0.97
Average	**0.83**	**0.69**	**0.58**	**1.88**	**1.19**

Source: Eurostat (HICP)

It appears from Table 1 that Sweden has the smallest absolute deviation on average over the last 7 years from the Eurozone average inflation. However, it is seen from Graph 1 and the underlying data that Denmark has, on average, an inflation that would position it in the lower band of the individual Eurozone countries' inflation (i.e. below the average), rendering a significant negative deviation prior to taking absolute values. This latter observation was also made by Norberg (2023) for several subgroups in which the Danish CPI (HICP) stood out with fairly low inflation in comparison with other Nordic countries while Swedish CPI (HICP) had more average tendencies.

The last five years inflation through national CPI excluding interest rates is seen in Graph 2 for Denmark and Sweden respectively (year-on-year change). Longer series of both import prices indices and CPI are graphed in Appendix A3. Over the 18 complete years in data (January 2005 to December 2023), the Danish CPI shows an increase of almost 42% and the Swedish CPI shows a corresponding 48% whereas a trajectory of annual 2% inflation would have rendered an increase of 43% correspondingly for the time period.

Graph 2 Annual inflation (year-on-year change) through CPI, interest rates excluded. Time window January 2019 to January 2024, inclusively.



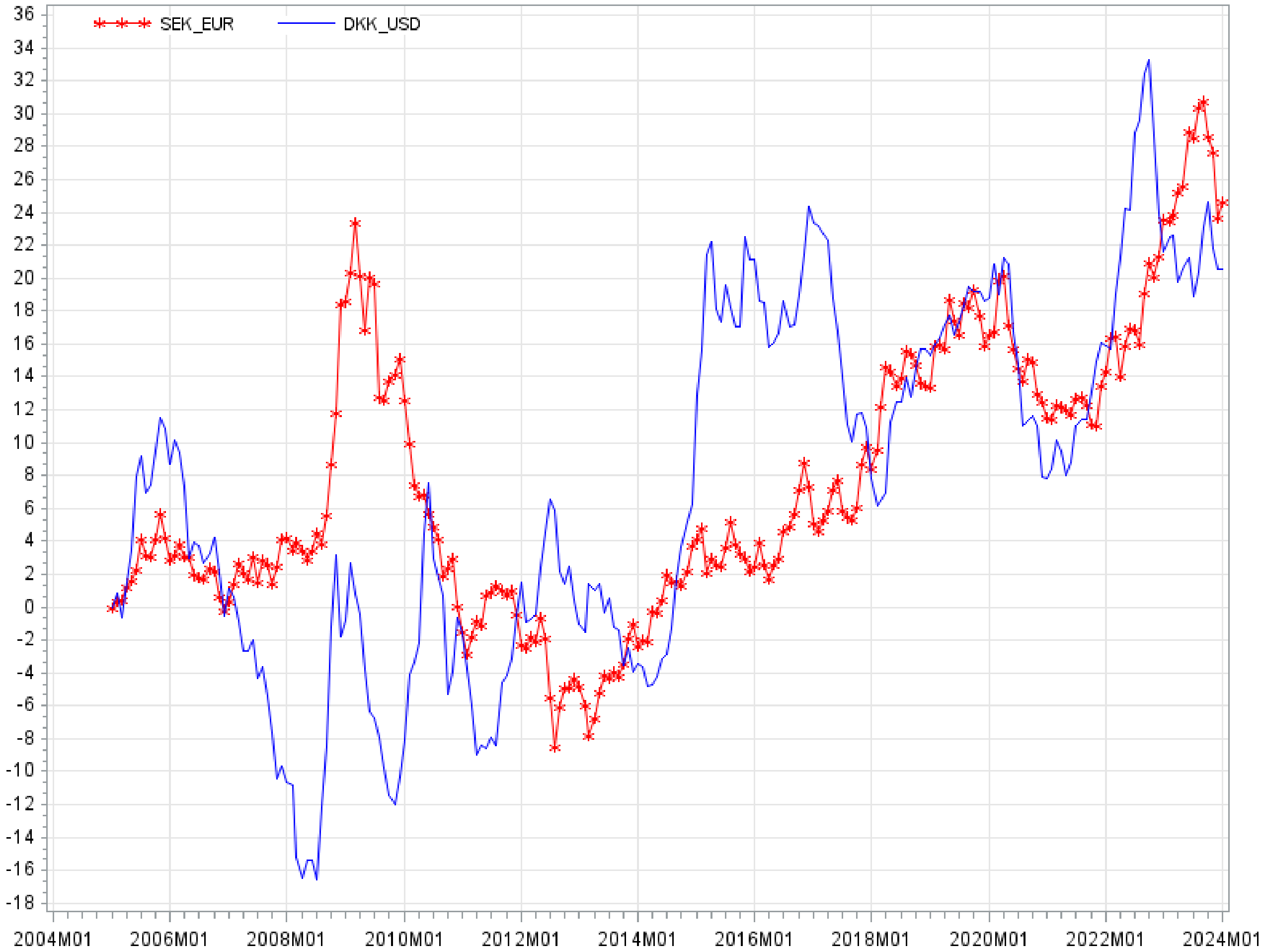
Source: Statistics Denmark and Statistics Sweden

It is seen from Graph 2 that the Danish and Swedish CPI inflation have somewhat similar tendencies in the focused window January 2019 to January 2024, though with a clear wedge appearing at end of 2022/beginning 2023:[4] Sweden seems to have experienced far higher inflation than did Denmark as the area between the two countries' CPI during 2023 appears to increase, though trends are similar. By late 2023, after a trending decline in inflation and while having in mind that the previous years' CPI levels (2022) were high, a new turning point upwards is observed for both countries in their respective inflation, in this case referencing new high CPI levels as of late 2023/early 2024 and onwards, if not transient.

[4] This is unlikely merely an effect from the COVID19 pandemic but rather a structural difference as noted by Norberg (2023).

In Graph 3, the DKK/USD and SEK/EUR exchange rate are shown. The DKK/EUR exchange rate is omitted since constant due to pegging.[5]

Graph 3 The SEK/EUR and DKK/USD exchange rate developments, in percent. January 2005 to January 2024.



Note: Scaled to zero (0) at starting point January 2005. Increase (>0) shows more SEK per EUR or DKK per USD, (in %).
Source: The Riksbank

It is seen from Graph 3 that the SEK experiences two remarkable dips in value against the Euro: the first following the financial crisis in late 2008 and 2009 and the second occurring as of 2022 after a long period of slow but steady depreciation of SEK against the Euro, starting from its strongest position in mid-2012. The DKK (and thus the Euro) has experienced a notable but more volatile path of decreased value against the USD. This is also the case for SEK against the USD for which the effect is the compound of the two graphed rates.

Regarding international trade, the two counties' share of trade with the EU is given in Table A4 of Appendix A4. It is seen that there are relatively small fluctuations between years in respective imports and exports series with overall stability of the distribution of trade with EU versus non-EU countries.

[5] Any fluctuations between DKK and EUR are assumed to be residuals in practice from timing asynchronies, possibly from currency alignment operations by the Danish central bank during the period of study. Hence, the parity is treated as completely fixed.

A model for comparing inflation between countries

Denmark and Sweden are highly dependent on imports of consumer goods while industries in the two countries differ on domestic production and exports, especially due to geography and natural resources but also from other causes. Hence, controlling for all possible/potential factors regarding the two countries' characteristics would be tedious in a model. Harberger (1963) suggested a simple predictive regression model for inflation in Chile, which was extended by Vogel (1974) to multiple country comparisons in Latin America. The model used money supply and production as predictors for consumer inflation, besides previous inflation. Hamilton (2012) elaborated on a similar model with the amendment of producer prices and input prices (commodities) and discussed the potential importance of specifically intra-EU prices when modelling intra-EU inflation – which ideally should be accounted for if possible although there is usually a lack of such precise data. The model accounted for the *direction* of such input price changes in order to control for potential ratchet effects, i.e. inertia/resistance to downward price changes, which is a phenomenon discussed by e.g. Rassekh and Wilbratte (1990).[6] Departing from the referenced work, a highly simplified pass-through model could be specified as

$$\pi_{j,t} = \alpha_j + \beta_1 \Delta M_{j,t-k} + \beta_2 \Delta imp_{j,t-k} + B_j + \varepsilon_{j,t}. \quad (1)$$

The annual inflation rate $\pi_{j,t}$ for country *j* at time *t* is computed from the year-on-year percentage change in index value as published by the statistical agency, interest rates excluded. The annual percentage change in money supply is $M_{j,t-k}$ is included from a time point (*t-k, k≥0*) either prior to current period *t* (*k>0*) or at current period *t* (*k=0*). The annual percentage change in import price index is $imp_{j,t-k}$ at current period *t* or prior to that (*k>0*) is included. A dummy variable B_j is added to account for some shift or breakpoint as for instance the start of Covid-19 restrictions as of late March 2020 or the beginning of the war in Ukraine in February 2022. This is an implicit assumption that transmission parameters β_1, β_2 are stable between potential level partitions of inflation (high/low). The model intercept is α_j and residuals are $\varepsilon_{j,t}$ which will examined for heteroskedasticity and serial correlation, having in mind specifically a potential connection with the breakpoint and/or some other level-dependent effect.

Estimation results

Inflation data was obtained from the homepage of respective statistics agency, Statistics Denmark and Statistics Sweden. Money supply (M1) for Denmark was obtained from the homepage of the Danish central bank, Danmarks Nationalbank while Statistics Sweden disseminates money supply (M1).

The model was fitted to the period January 2006 to January 2024, inclusively, with first data point January 2005 after which differencing (Δ) was applied. In order to determine appropriate lag *k* for the effects from money supply $M_{j,t-k}$ and $imp_{j,t-k}$ correlations were computed at lags *k=0* and *k=1* and are reported in Table 2.

[6] The topic of price decrease is a stand-alone subject for study due to duration effects in price changes – both short-term adjustments and long-term adjustments downwards (or upwards) may be identified at retailers and possibly in import prices (likely though with methodological restrictions if not transaction data). This is likely to contamine macro analysis models like the suggested pass-through model (1), especially during periods with high inflation that show many movements.

Table 2 Correlation of $\pi_{j,t}$ with annual change (Δ) in both money supply $M_{j,t-k}$ and import price index $imp_{j,t-k}$ at lags (*k=0)* and (*k=1)*, January 2006 to January 2024, inclusively.

Country	Variable	$\Delta \boldsymbol{M_{j,t}}$	$\Delta \boldsymbol{M_{j,t-1}}$	$\Delta \boldsymbol{imp_{j,t}}$	$\Delta \boldsymbol{imp_{j,t-1}}$
Denmark	$\pi_{Den,t}$	-0.1712	-0.1725	0.79	0.8379
Sweden	$\pi_{Swe,t}$	-0.4856	-0.4227	0.7036	0.7471

Note: Estimates from PROC CORR in SAS. All p-values were below 0.05 (<0.05). Correlation of monthly movements in (SEK/EUR) with $\pi_{j,t}$ was found to be around 0.55.

It can be noted from both countries' data that the annual change in money supply has negative correlation with inflation and it can be seen in Table 2 that correlations at either of lags are fairly similar in magnitude. For symmetry, *k*=0 was chosen for money supply in estimating the final model (1) since correlation for Swedish data was slightly larger at *k=0* than at *k=1.* However, the finding may also be a spurious outcome due to nature/substantiation of money supply, as discussed later on regarding model specification. For the annual change in import price indices, lag *k=1* was found more strongly correlated with inflation for both countries and also appears more intuitive to precede inflation in order of time, i.e. expected causality. Some variation properties of the data are given in Table 3.

Table 3 Variance, coefficient of variation (CV) in percent and total sum of square (TSS) of $\pi_{j,t}$, $\Delta M_{j,t}$ and $\Delta imp_{j,t-1}$. Time span February 2006 to January 2024, inclusively, for symmetry with model estimation period

Country	Variable	$\boldsymbol{Variance}$	$\boldsymbol{CV}$	$\boldsymbol{TSS}$
Denmark	$\pi_{Den,t}$	3.641	101.530	1545.93
Sweden	$\pi_{Swe,t}$	3.919	94.1796	1796.79
Denmark	$\Delta M_{Den,t}$	21.942	87.0353	10974.16
Sweden	$\Delta M_{Swe,t}$	37.384	75.2447	22299.64
Denmark	$\Delta imp_{Den,t-1}$	30.29	237.712	7670.07
Sweden	$\Delta imp_{Swe,t-1}$	65.821	249.941	16427.37

Note: Coefficient of variation in percent $(100 * SE(variable)/mean(variable))$. Estimates obtained from PROC SUMMARY in SAS.

Seen from Table 3, variance are smaller in Danish data compared with Swedish data and for both change in money supply and change in import price index the Swedish data shows more than twice total squared sum compared with the Danish data, indicating that modelling may be difficult, at least partially.

Table 4 Estimated parameters of model (1): Regression of $\pi_{j,t}$ on $(\Delta M_{j,t})$ and $(\Delta imp_{j,t-1})$. First data point prior to differencing (Δ) is January 2005. Breakpoint estimate B_j at January 2022. Number of observations =216.

Country	$\Delta \boldsymbol{M_{j,t-0}}$	$\Delta \boldsymbol{imp_{j,t-1}}$	$\boldsymbol{B_j}$ **(***2022M01* **)**	$\boldsymbol{\alpha_j}$	R2 (adj.) | DW| White's
Denmark	β_1 =-0.00931 (0.01368)	β_2 = 0.23506 (0.01293)	B_j = 1.86939 (0.22962)	1.16899 (0.104)	0.7765 |0.19| 26.06 (0.001)
Sweden	β_1 = -0.04061 (0.01116)	β_2 = 0.10760 (0.00821)	B_j = 3.30747 (0.25161)	1.69977 (0.117)	0.8421|0.426| 22.86 (0.0036)

Note: Estimates obtained from PROC REG in SAS. Time span January 2005 to January 2024, inclusively. First estimable observation as of February 2006 due to monthly and annual differencing to obtain annual change and lag parameters (*t-1*) for the model. Standard errors of parameters shown in parenthesis.

Parameter estimates of model (1) are reported in Table 4. For both countries' data, the import price index appears to be a predictor with perhaps significant but perhaps varying strength - relationships are far from direct and clear as can be inferred from the series presented in Appendix A3. The model explanatory power (adjusted R2) does not support a strong connection either. In accordance with correlations in Table 2, the estimated parameter of import price index is larger for Danish data than for Swedish data, indicating an impact about twice as large of import price index change in the Danish CPI than in the Swedish CPI, though at lower levels given the respective series development which is controlled for by the intercept. Analogously, the magnitude of the breakpoint parameter is notable, being almost twice as large for the Swedish data as was indicated in Graph 2 for the time window with the notable divergence between the two countries' time series. The intercept and the breakpoint appear to carry a substantial part of the relationship, especially at higher values of inflation and thus decreasing the relative impact from import prices given this extremely simplified model specification. Residuals appear to have some heteroskedasticity as indicated from White's value in both cases. The reason for this appears to be the bimodal (or multimodal) magnitude of inflation with either smaller values or larger values (as measured in terms of *percentages*) which thus transfers to the model estimation through residuals that enlarge as inflation grows. Residual plots are given in Appendix A2, indicating this feature clearly and implying a insufficiency of the employed simple model.

Not surprisingly, the explanatory power of change in money supply is insignificant for the Danish data while significant for the Swedish data but with small magnitude given the specification together with import prices in the model, with negative sign. This is line with expectations from correlations reported in Table 2, in which the magnitude of correlations in Danish data between money supply and inflation were less than half of those in the Swedish data, correspondingly for the two examined lags, and negative. The estimated parameter may however be the outcome of a spurious relationship given the larger movements in the Swedish data and perhaps indicate that higher inflation requires more explanatory input as whole or perhaps not correlate to well with other time series when volatility is high.

Remarks on the model specification

The presented model (1) is far from complete to explain inflation exhaustively but is here employed rather for explanatory analysis and does not accommodate the impulse-response function in a VAR model that can embed simultaneous dependencies in a system of variables, i.e. endogeneity and second order effects. However, such complexity also comes with further uncertainty and interpretability issues, as pointed out by Hamilton (2012). Regarding included variables, any change in money supply M is a priori expected to be well substantiated (and transient) due to high awareness in monetary governance, especially in the current context compared with the original context of high inflation and political turmoil in Latin America before 1980, from which the models of Harberger and Vogel originate. However, when comparing a pegged (or fixed) exchange rate regime to a non-pegged one the parameter may carry information,[7] as conceptualized by Argy (1990). Argy (1990) also accounted for a trading partner effect in the model analogous to the introductory remark on main trading partnership when the two countries voted on (against) the Euro. We choose not to specify a transmission parameter for trading partnership (EU/Non-EU or Eurozone) in the model as it would likely benefit from a detailed commodity- dependent estimation which in turn would require an elaboration beyond the limited scope of this analysis and also of perhaps limited potential.[8] However, aggregate import price indices likely reflect the provenance of goods imported. Also, a recent study by Arndt and Enders (2024) discusses the transmission of producer prices to inflation regimes

[7] Alternatively, unaccountable effects will spill over to residuals.

[8] In addition, changing trading partner to or away from the internal market (EU) appears as a structural choice not made too quickly when facing inflation of unclear horizon and is hence unlikely to be accounted for precisely in this simple model. Thus, choice of trading partner is taken as constant during such the relatively short time span with high inflation (2022 onwards) whereas a posteriori analysis could yield more input to this assumption. Overall EU share of trade is seen in Appendix A4, stable over time.

through an elaborate model and point out the instability of modelling at high-levels versus low-levels of inflation, which was observed as a shortcoming of model (1) and seen in residual plots.

Inflation in main groups

The consumer prices indices in both Denmark and Sweden comprise various data collection modes and the consumer markets are similar with respect to type of consumption and commerce on site or online. CPI main group weights for the two countries are presented in Table 5.

Table 5 COICOP Main Group Weights 2024 in national CPI

COICOP	Denmark	Sweden
01 Food and beverages	119.81	134
02 Tobacco, Alcohol	34.51	32
03 Clothing and footwear	40.05	42
04 Housing, water and fuels	296.55	253
05 Furnishings, household equip.	53.80	62
06 Health	30.51	32
07 Transport	125.77	132
08 Communication	20.13	32
09 Recreation and culture	111.16	127
10 Education	9.08	4
11 Restaurants and hotels	71.53	79
12 Miscellaneous goods and services	87.11	71

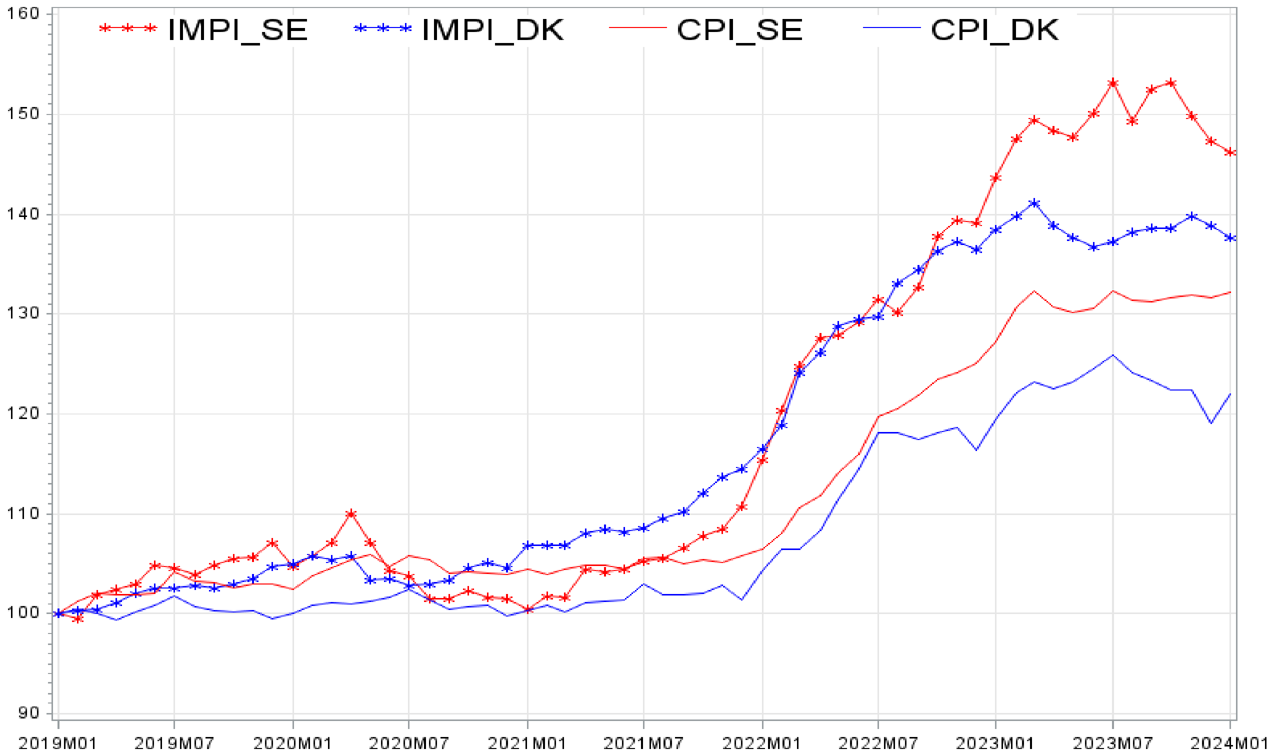
Source: Statistics Denmark and Statistics Sweden

Seen in Table 5, overall main group weights are fairly similar for the two countries. perhaps with largest (relative) differences in **10 Education, 12 Miscellaneous goods and services** and in **04 Housing, water and fuels**. Both Danish and Swedish private consumption are highly import-dependent, e.g. in clothing, furniture, home electronics but also in food: although both countries do have significant domestic production of food and agricultural products geography does put limitations on the production frontier and calls for importations. The two countries have rather unsimilar energy supply systems which plays a crucial role in inflation development. Details on the energy supply exceeds the immediate scope of our analysis as energy prices have second order impact on practically everything in the economy and thus the CPI. The CPI development in main groups (COICOP 01 to 12) for the period January 2019 to January 2024 inclusively, based to December 2018 (=100), are graphed in Appendix A1. It is seen that Danish CPI exceeds Swedish CPI in COICOP 02, 08, 09 and 11. Regardless of similarities and differences in subgroupings, the assumption for model (1) has been that per country, the distribution of relative expenditure is stable during the time frame of 18 years and hence that the share of importations has been constant.

In Graph 4, CPI development in **Food and non-alcoholic beverages** (COICOP 01) is compared with corresponding import price index for **food products** (CPA 10), based to January 2019 and stretching to January 2024, inclusively.[9]

[9] This is a limited analysis due to limited data access and/or correspondance issues between COICOP and CPA regarding consumer products.

Graph 4 COICOP 01 versus import price index for CPA 10 (food products). January 2019 as base (=100). January 2019 to January 2024, inclusively.



Source: Statistics Denmark and Statistics Sweden

Graph 4 depicts a clear and increasing wedge between respective country's import price index for food products (CPA 10) and consumer price index for food and non-alcoholic beverages (COICOP 01). Import prices have tended to increase rapidly already since late 2021 and perhaps flattened out (somewhat) in mid/late 2023. Corresponding CPI for COICOP 01 have later movements but for both countries the magnitude of increase in the CPI is smaller than in the import prices at the later end of data, say end of 2022/beginning 2023 and onwards than was the case earlier. Swedish data show a steeper increase in both series than does the Danish data which appears to be more damped but with a longer period of increasing wedge between the two series.[10]

A reduced model for inflation in COICOP01

Given the observable features in Graph 4, the model is re-estimated almost in accordance with equation (1) except the input from money supply which does not match this sublevel of data and also did not show substantial influence as could be understood from Table 2 and 3. Estimation results are reported in Table 6.

[10] This indicates a questionable signal value of import price index as predictor for CPI, unclear if more accentuated when broken down to subgroupings instead of this aggregate/macro level. It also hints at the choice of lag/transmission window, which may require elaboration or be non-stable depending on underlying products. It could well be a step-function in the transmission i.e. occasional moves (or, simply, random shocks). The latter issue would require elaboration on how the import price indices react to changes in the respective statistical sample and the correspondence to consumer prices.

Table 6 Estimated parameters of model (1) excluding money supply: regression of $\pi_{j,t}$ of COICOP01 on annual change in import price index ($\Delta imp_{j,t-1}$) for CPA10. First data point prior to differencing (Δ) is January 2005. Breakpoint estimate B_j at January 2022. Number of observations = 216.

Country	$\boldsymbol{\Delta imp_{j,t-1}}$	$\boldsymbol{B_j}$ **(*2022M01*)**	$\boldsymbol{\alpha_j}$	**R2 (adj.) | DW| White's**
Denmark	β_1 = 0.27379 (0.02843)	B_j = 5.27046 (0.58273)	0.99355 (0.19673)	0.6011 |0.163| 33.68 (0.001)
Sweden	β_1 = 0.33364 (0.03237)	B_j = 4.20723 (0.67061)	1.00184 (0.17954)	0.7303|0.22| 24.76 (0.001)

Note: Estimates obtained from PROC REG in SAS. Time span January 2005-January 2024, first estimable observation as of February 2006 from monthly and annual differencing to obtain annual change and lag parameters (*t-1*). Standard errors of parameters are shown in parenthesis.

Residual plots are shown in Appendix A2 and can be seen to convey substantial heteroskedasticity with level of inflation, similar to the residuals of the overall model (1) also in Appendix A2.

Discussion

It appears as Denmark's monetary policy including alignment with the Euro zone exchange rate through pegging have paid off regarding consumer inflation in terms of CPI (and HICP) and appears favourable in total. Judging from the observations made from these data, Sweden does not position far away from the Eurozone average in HICP, thus the difference between Danish inflation and the Swedish inflation is not necessarily only from choice of alignment policy for the currency but could likely also be from structural differences, calling for more thorough analysis of the transmission of import prices and producer prices to the CPI, if possible.

However, should the Swedish currency depreciate even further, there may be a risk that the inflation gap between the two countries extends even more, especially as both countries rely on imported goods and may cause structural differences since price levels are already affected.

Not addressed here, turning points are of concern for modelling, specifically those in the currency exchange rate. These should matter either through sensitivity (high-pass) or dampened, inertia (low-pass) in terms of price changes on the *consumer side* perhaps more than on the *import* or *producer* sides that face such changes more immediately (high-pass). As noted in the modelling section, this topic has been addressed in the related literature but is also a statistical problem of assessing whether prices may actually *decrease* in the CPI and remain on a lower level or if they merely fluctuate transiently, as was mentioned in the footnote to the model discussion.

A backdoor for inflation?

Another more silent risk of having a perhaps too cheap a currency is when the national export becomes increasingly preferred by trading partner countries (from decrease in international relative prices). Such domestic producers may prioritise foreign markets rather than supplying the internal market if too small or non-beneficial. That is a second order effect that creates structural inflation from the producer side, i.e. supply-driven. Given the difficulty of modelling relationships through the simple model and/or at differing inflation levels, it does appear questionable if the import share of a national CPI is a determinant and if it can be isolated at all through any macro approach, i.e. there is perhaps not a first-order direct connection as presumed. This also impairs the potential for using either of the time series as a macro indicator for verification purposes of the other in terms of macro editing as a working process at statistical agencies.

The movements and trend of the Swedish currency (SEK) may be a plausible explanation to why import prices become volatile and consequently that the Swedish CPI goes higher than Denmark. But it does not alone give a complete picture since consumers also tend to substitute away with increasing relative prices, which may explain why Sweden positions around HICP average despite the increasingly weakened currency over time. The compound inflation over 18 years has been around 42% for Danish CPI and around 48% for Swedish CPI, slightly above target rate of 43% at annual inflation target of 2 percent. The approximately 30% decline in Swedish currency (to the Euro alone) appears to have transferred rather ambiguously into the Swedish CPI or has been absorbed well through substitution and adaptations of retailers (e.g. margin-cuts). However, as was a presumption for the paper, some producers face world-market prices and thus also non-imported but exportable goods and especially commodities (food) are likely to be affected and their price movements may likely transfer to the CPI. Such an inflation is likely to be more “silent” by nature if not clearly identifiable through a producer price index and affects the consumed goods also through the annual baskets (when employing a fixed basket as is the case in e.g. Sweden). On the contrary, product groups may show little relative change in between them over time. Hence, even though “imported inflation” can be substituted away by consumers over time, export-driven inflation may appear and consumers will likely keep constant their relative shares of consumption between consumption categories (unless shocks appear, like Covid-19).

Concluding remarks

The analysis herein does not indicate that the currency regime itself needs to be the driving factor of inflation – Denmark has experienced an inflation below HICP average albeit a pegged currency whereas Sweden has a fairly average HICP outcome despite a floating currency, indicating somewhat inconclusiveness regarding headline inflation. In terms of modelling and with respect to import prices, one may suspect that a stable currency mirrors channels through to trading positions to be free from currency effects ex ante and thus affects expectations positively through price stability also in transmission mechanisms. This will most likely (though speculatively) render less volatility in import price index and consequently more stable consumer inflation, although one may notice a tendency of difficulty in modelling when magnitude of inflation and volatility increases, also indicating a potential for spiral effects in CPI.

As pointed out, a weak currency in a strong exporting country like Sweden may cause a kick-back to inflation if domestic market demand becomes non-profitable in comparison with international demand, which would counter the substitution made by consumers immediately. Such effects may be seen with time and require further analysis of the producer’s side transfer to consumer prices, not merely through import price index, hence opening a backdoor for inflation to enter due to the currency, not limited to the share of imported goods and services in the CPI.

Accounting for changes in relative prices and preferences calls for sensitive index methods that account for immediate preference alterations and their related quantity changes in order to capture substitution in assortments, which thus would favour multilateral methods whenever possible instead of fixed baskets with merely annual adaptations.

References

Arndt, S. and Enders, Z. (2024). *The Transmission of Supply Shocks in Different Inflation Regimes*. Banque de France, working paper 938. Available online per 2024-04-12 from Banque de France: https://www.banque-france.fr/system/files/2024-01/WP938.pdf

Argy, Victor (1990). *The Choice of Exchange Rate Regime for a Smaller Economy: A Survey of Some Key Issues,* in Choosing an Exchange Rate Regime, ed. by Victor Argy and Paul De Grauwe. Washington: International Monetary Fund 1990. Available online per 2024-02-26 from IMF: https://www.elibrary.imf.org/display/book/9781557751331/ch002.xml

European Union (2024). *"Drought in the Mediterranean – January 2024".* Commission's Joint Research Center on (JRC) report. Retrieved online by 2024-04-09 from https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/prolonged-drought-and-record-temperatures-have-critical-impact-mediterranean-2024-02-20_en

Copernicus (2024). Copernicus Drought Observatories of the European Commission Joint Research Center. https://drought.emergency.copernicus.eu/tumbo/php/index.php?id=1400#

Hamilton, J.D. (2012). *Import Prices and Inflation*. International Journal of Central Banking, March 2012. Retrieved online by 2024-04-11 from https://www.ijcb.org/journal/ijcb12q1a13.pdf

Harberger, A.C. (1963). *The Dynamics of Inflation in Chile.* Measurement in Economics: Studies in Mathematical Economics and Econometrics in Memory of Yehuda Grunfeld, Stanford 1963, 219-50.

Norberg, A. (2023). *Macro Analysis of the Swedish HICP*. Paper presented for the Swedish CPI Board, May 2023. Available online per 2024-03-23 from Statistics Sweden: https://www.scb.se/contentassets/1b48f2064ebd46a78eda4d68d51c0403/16/macro_analysis_of_the_swedish_hicp_ver_2.pdf

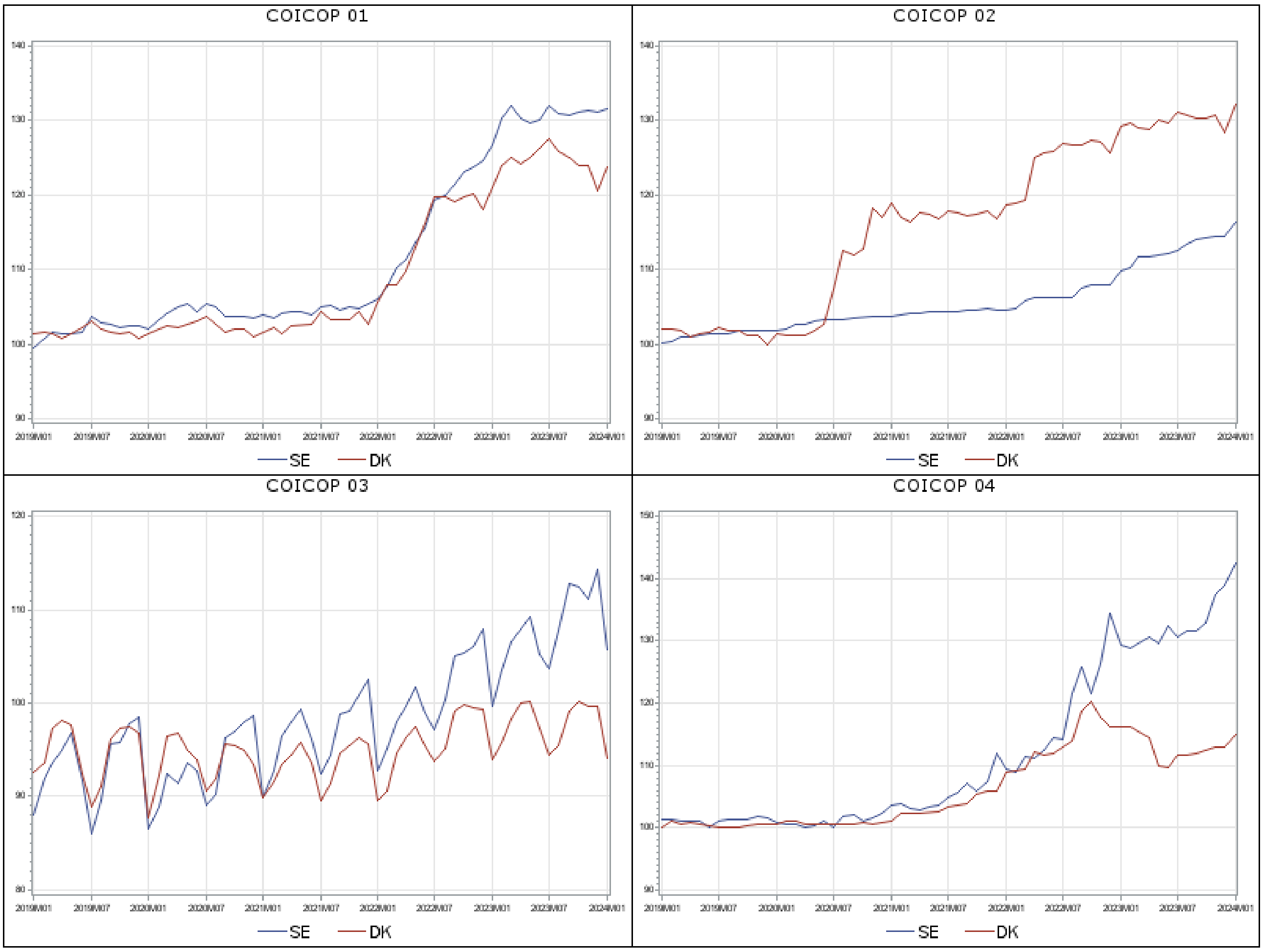
Rassekj, F. & Wilbratte, B. (1990). *The Effect of Import Price Changes on Domestic Inflation: An Empirical Test of the Ratchet Effect.* Journal of Money, Credit and Banking, Vol. 22, No. 2 (May 1990). 1990 Ohio State University Press.

Vogel, R.C. (1974). *The Dynamics of Inflation in Latin America, 1950-159*. The American Economic Review, Mar. 1974, Vol. 64, No. 1, pp. 102-114.

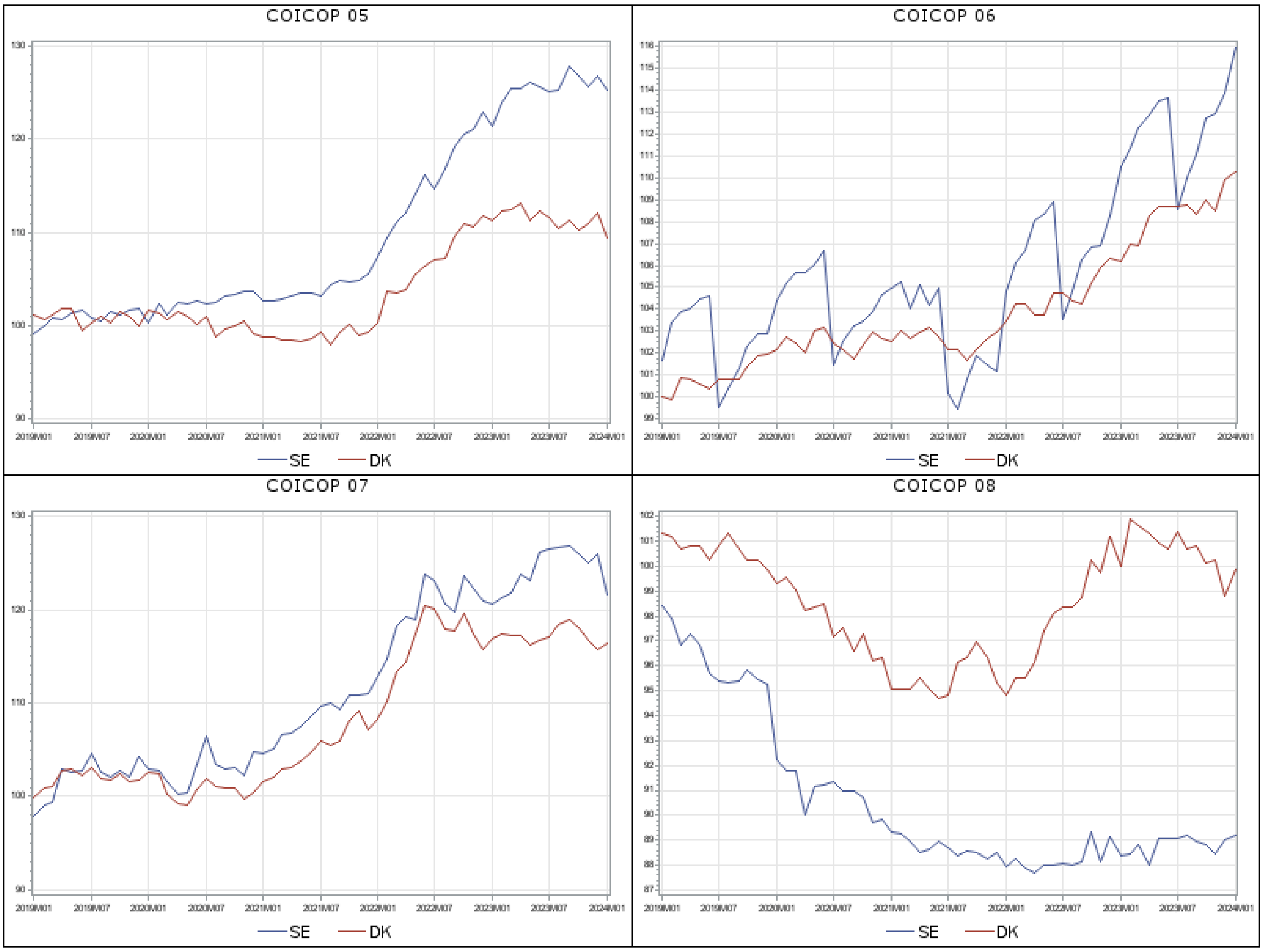
Appendix A1 CPI in Main Groups (COICOP 01-12)

CPI Development in Main Groups, January 2019- January 2024 (inclusively). Base December 2018.

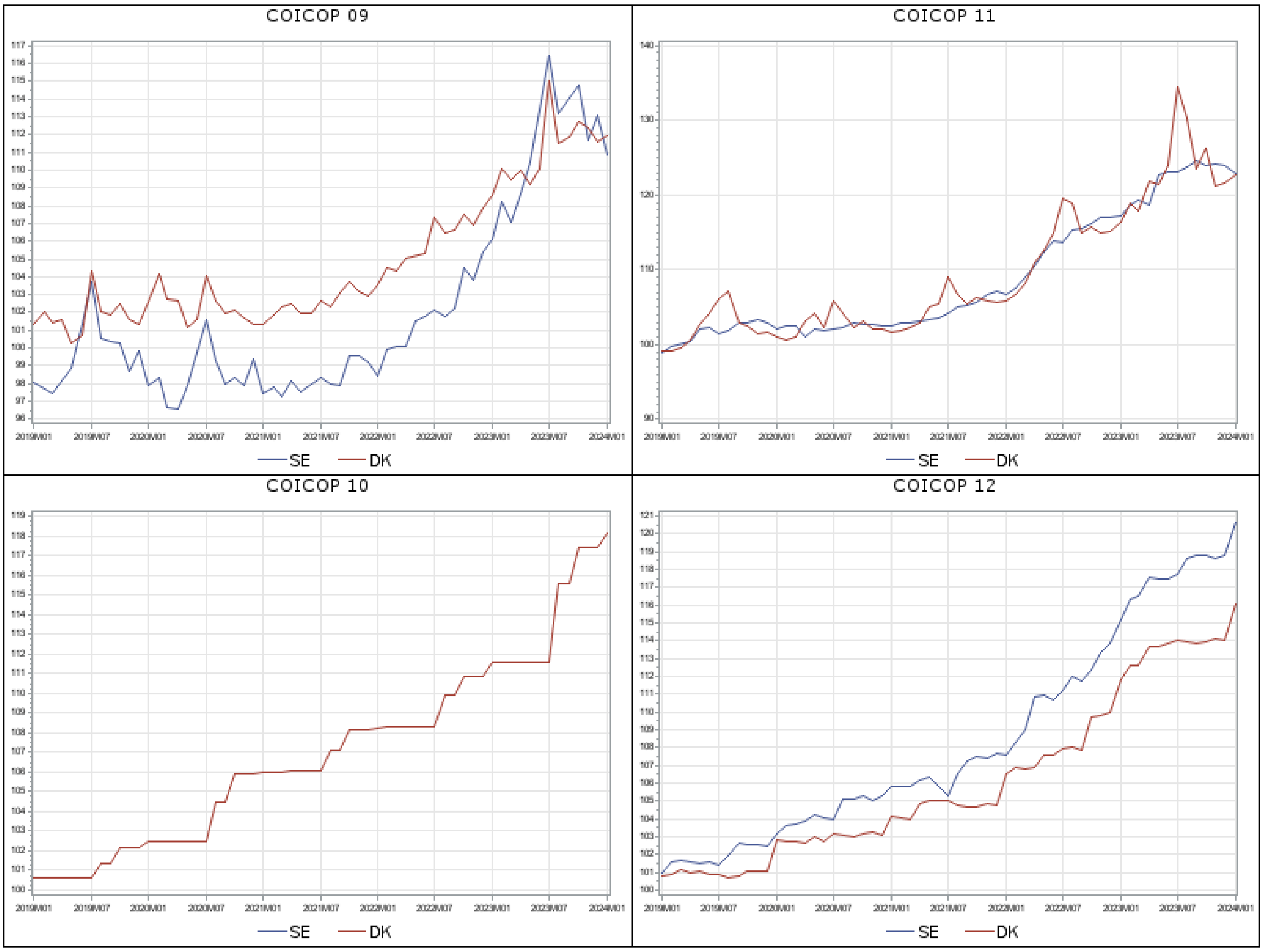
Graph A1 COICOP 01, 02, 03, 04



Graph A1 COICOP 05, 06, 07, 08



Graph A1 COICOP 09, 10, 11, 12



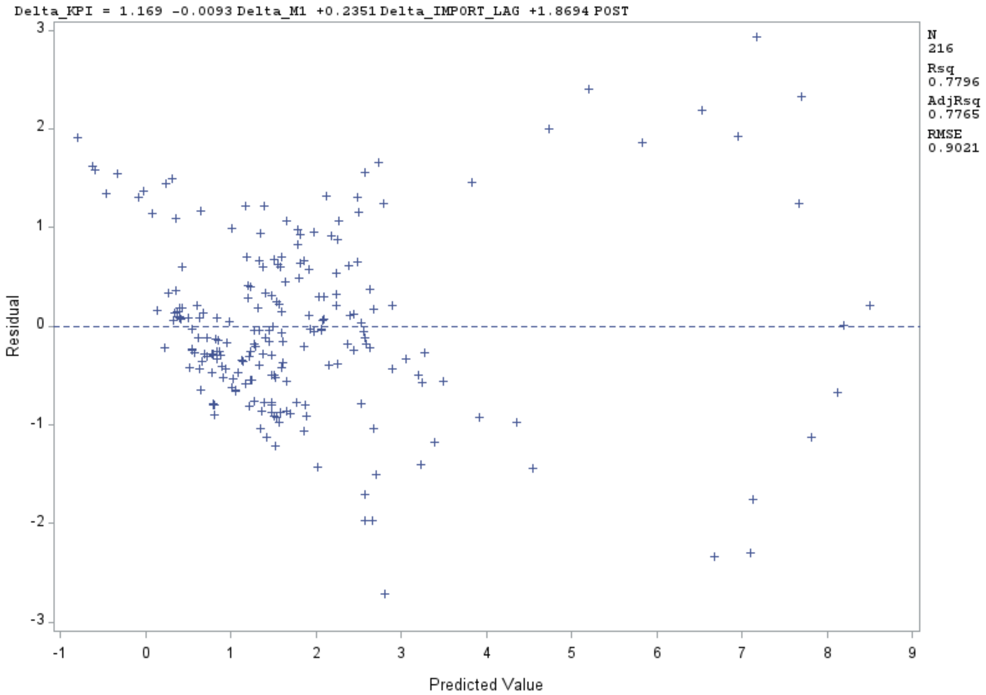
Note: COICOP 10 in the Swedish CPI is not disseminated.

Appendix A2 Residual plots for estimated model

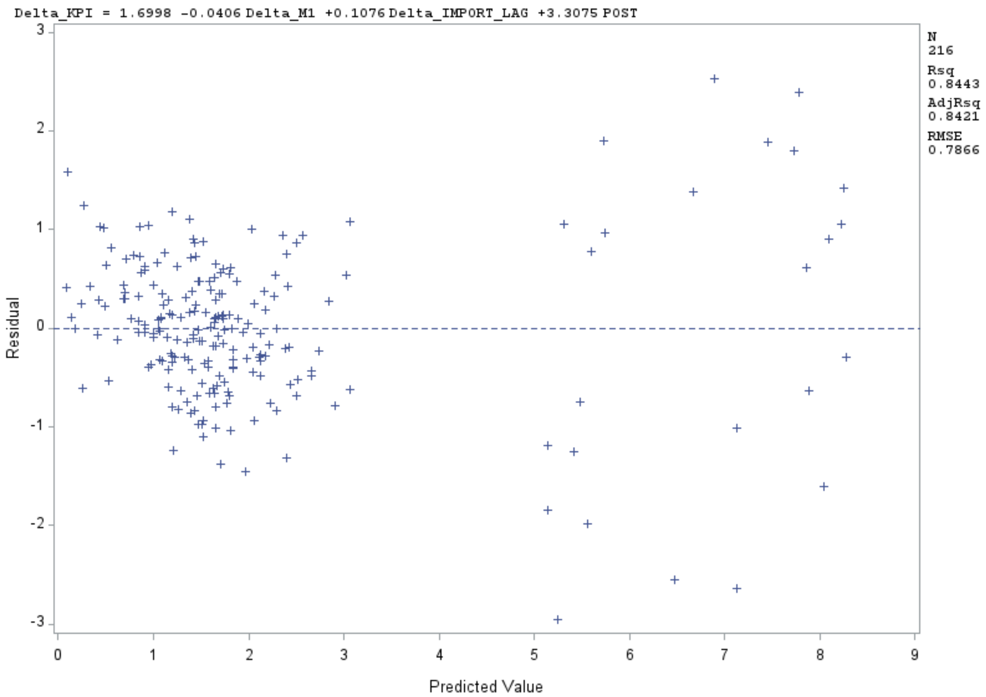
Residuals for the complete model (1)

The estimated model according to equation (1) parametrized and corresponding residuals plotted at predictions of the dependent variable (inflation "Delta_KPI").

Graph A2:1 Denmark



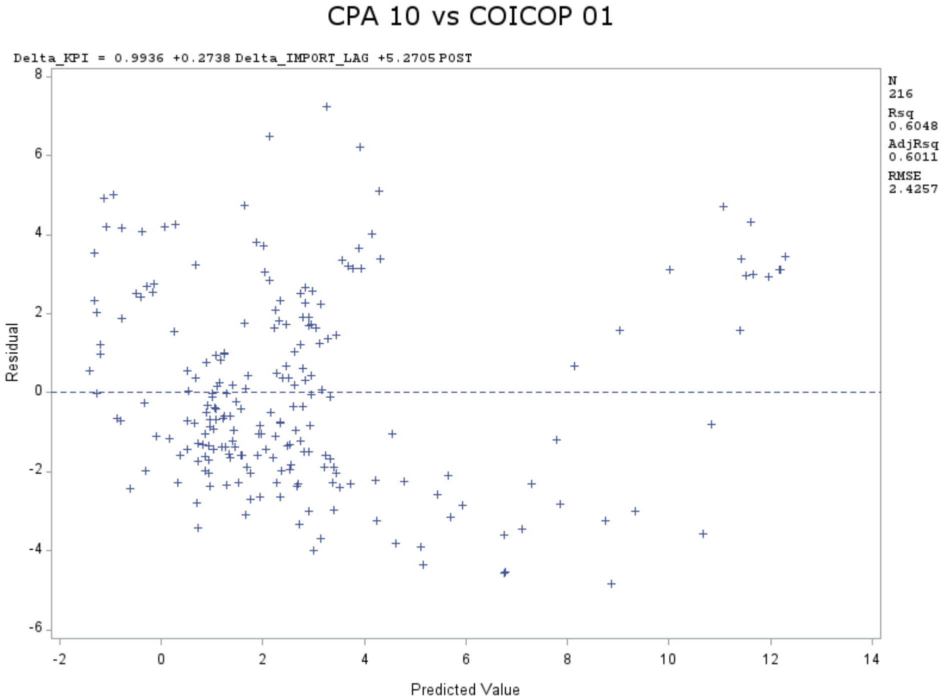
Graph A2:2 Sweden



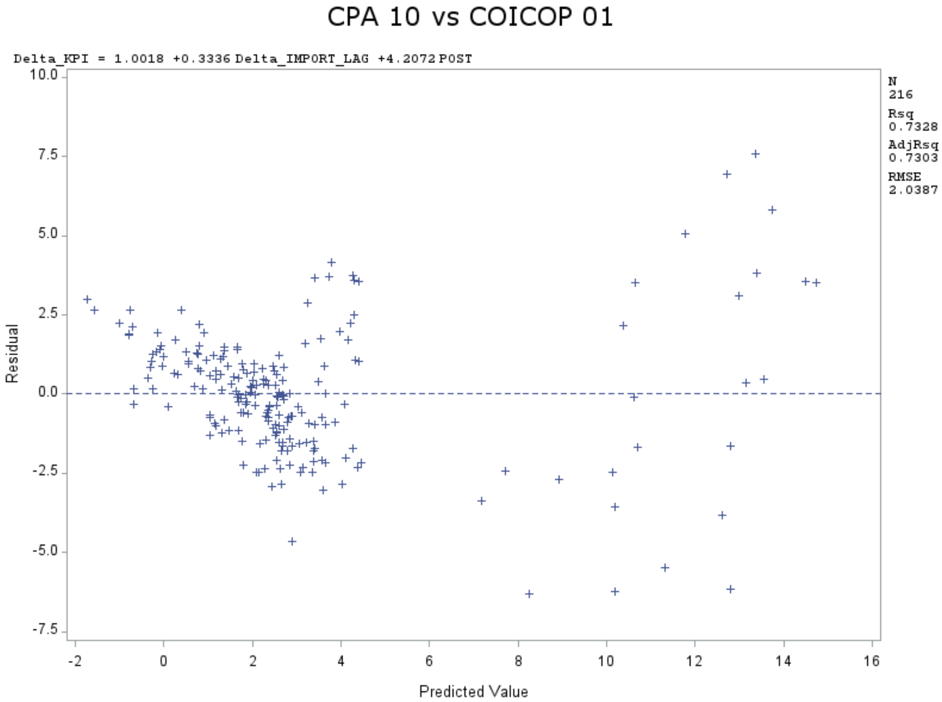
Residuals for the subseries model (COICOP 01, CPA01)

Model (1) excluding money supply, estimated and parametrization given below and corresponding residuals plotted at predictions of the dependent variable (inflation "Delta_KPI") for the setting reported in Graph 4 and Table 6.

Graph A2:3 Denmark

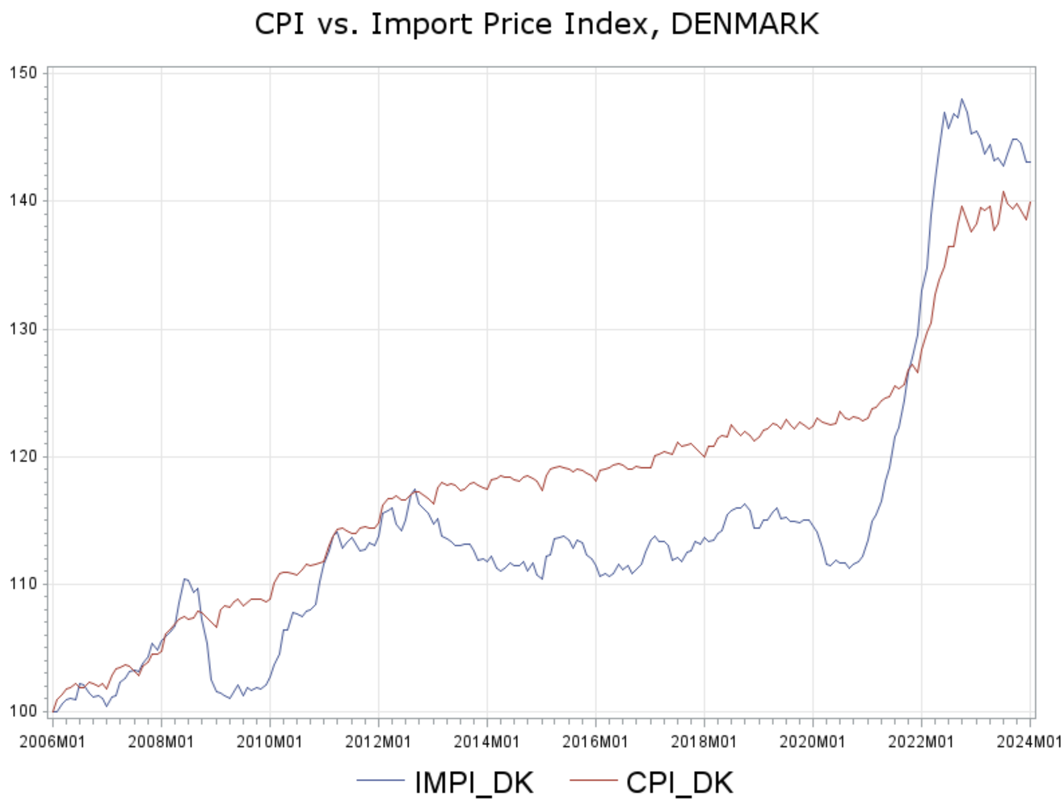


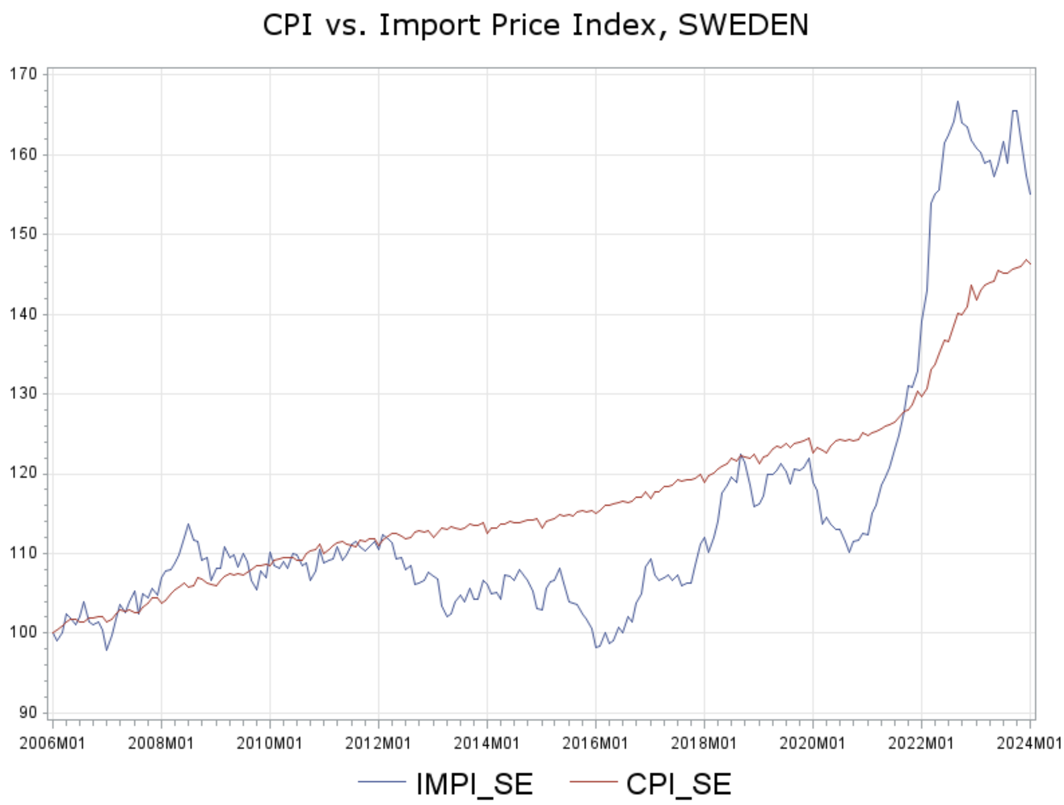
Graph A2:4 Sweden



Appendix A3: CPI and Import Price Index for Denmark and Sweden

Data from January 2006 to January 2024, inclusively. Index series based to starting point January 2006 (=100). Interest rates excluded.





Appendix A4: Share of foreign trade in goods (FTG) with the EU

Table A4 Share of trade in goods with EU to total foreign trade in goods.
EU-27 according to current definition.

YEAR	IMPORTS (DK)	EXPORTS (DK)	IMPORTS (SE)	EXPORTS (SE)
2005	0.67	0.61	0.65	0.51
2006	0.67	0.61	0.64	0.53
2007	0.68	0.61	0.64	0.54
2008	0.67	0.60	0.64	0.53
2009	0.64	0.57	0.63	0.51
2010	0.64	0.56	0.62	0.50
2011	0.65	0.55	0.63	0.49
2012	0.65	0.53	0.61	0.49
2013	0.65	0.54	0.63	0.51
2014	0.65	0.55	0.63	0.51
2015	0.65	0.54	0.65	0.51
2016	0.67	0.55	0.66	0.53
2017	0.66	0.53	0.66	0.53
2018	0.67	0.54	0.65	0.54
2019	0.67	0.52	0.66	0.52
2020	0.69	0.51	0.68	0.52
2021	0.68	0.52	0.66	0.54
2022	0.66	0.55	0.63	0.54
2023	0.64	0.57	0.67	0.55

Source: Statistics Denmark and Statistics Sweden