Staff Memo

The Effects of Oil Price Shocks on the Swedish Economy

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Staff Memo

A Staff Memo provides members of the Riksbank's staff with the opportunity to publish advanced analyses of relevant issues. It is a publication for civil servants that is free of policy conclusions and individual standpoints on current policy issues. Publication is approved by the appropriate Head of Department. The opinions expressed in staff memos are those of the authors and are not to be seen as the Riksbank's standpoint.

Summary

In this Staff Memo, I estimate the effect of oil price changes on the Swedish economy. Using the oil supply news shocks of Känzig (2021) as instruments to estimate the causal effect of oil price changes, I show that an increase in the oil price has stagflationary effects. A higher oil price leads to an increase in consumer prices, a fall in economic activity, a short-run appreciation and a longer-run depreciation of the Swedish krona against the U.S. dollar, an increase in short-run inflation expectations, muted increases in long-run inflation expectations and nominal wages, and an increase in the Riksbank's policy rate. In terms of prices, both the consumer price index with and without energy prices increase, which indicates that oil price changes have both direct and indirect effects.

Further analysis of disaggregated consumer price and consumption data shows that (i) the aggregate price response is driven primarily by higher prices of goods, such as food and furniture, rather than services, and (ii) the disaggregated consumption responses are broadly consistent with the price responses, in the sense that categories experiencing larger price increases also tend to experience larger declines in consumption.

Quantitatively, my estimates are similar to those of Känzig (2021) for the U.S., despite Sweden being less dependent on oil. This suggests that open-economy channels, such as international spillovers and the exchange rate, may amplify the effects of oil price shocks. However, my estimates for the Swedish economy are quantitatively sensitive to restricting the sample to December 2019 and excluding the COVID-19 and high-inflation periods.

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1 Introduction

The recent spike in oil prices following the conflict in the Middle East has led to renewed interest in the effect of oil price changes on the macroeconomy. A major concern among policymakers is that the increase in oil prices will have large negative consequences in the form of higher inflation and lower economic activity. Prominent historical examples of such episodes include the OPEC I and II crises of the 1970s, when dramatic reductions in the oil supply led to large increases in oil prices, high inflation, and low economic activity. More recently, Russia's invasion of Ukraine in 2022 was followed by large increases in oil prices and inflation, as well as a fall in economic activity.

The effects of oil price changes can be divided into direct, indirect, and second-round effects. The direct effects come from prices of petroleum products. Typical examples are diesel and gasoline prices. When oil prices increase, diesel and gasoline prices follow. Since they are part of the Consumer Price Index (CPI), inflation increases. When households and firms (e.g., trucking companies) have to spend more on fuel, real incomes and profits fall, which in turn leads to lower aggregate demand and economic activity. Indirect effects arise when firms that use petroleum products as inputs pass higher production costs on to consumers in the form of higher prices. This further increases inflation and reduces aggregate demand. In addition, aggregate supply effects from the higher production costs may reduce the quantity of final output firms choose to supply. Second-round effects on inflation and economic activity may also arise if nominal wage growth increases or if long-run inflation expectations increase above the central bank's target. Overall, the increase in inflation and the fall in economic activity create a trade-off for the central bank: raise the policy rate to reduce inflation or lower the policy rate to attenuate the decline in economic activity.

In this paper, I estimate the effect of oil price changes on the Swedish economy. My empirical strategy consists of using the oil supply news shocks of Känzig (2021) as instruments to isolate exogenous variation in oil prices and estimate the impulse response functions (IRFs) to oil price changes using instrumental variable Jordá (2005) local projections. The oil supply news shocks are identified from an oil market VAR model using surprises in the future supply of oil, measured in narrow windows around Organization of the Petroleum Exporting Countries (OPEC) production target announcements, as external instruments.[2] Intuitively, these shocks are purged of confounding factors, such as expectations about future oil demand and overall global economic conditions, which allows the estimation of the causal effect of oil price changes driven by changes in expectations about future oil supply.

My results show that oil price shocks have stagflationary effects on the Swedish

[2] OPEC consists of 12 countries (Algeria, Congo, Equatorial Guinea, Gabon, Iran, Iraq, Kuwait, Libya, Nigeria, Saudi Arabia, United Arab Emirates (until May 2026), and Venezuela) and accounts for about 40 per cent of world oil production and controls about 80 per cent of the world's oil reserves. OPEC meets at regular intervals (usually twice per year, but with the option to call for extraordinary meetings if necessary) to decide on production quotas for the organization and its members in attempts to influence oil prices. The decisions are communicated through press briefings and conferences. See Känzig (2021) for details about the institutional setting of OPEC.

economy. An increase in the real price of Brent crude oil driven by an oil supply news shock leads to an increase in consumer prices, a fall in economic activity, a short-run appreciation and a longer-run depreciation of the Swedish krona against the U.S. dollar, an increase in one-year inflation expectations, muted increases in two- and five-year inflation expectations and nominal wages, and an increase in the Riksbank's policy rate. In terms of prices, both the CPI including and excluding energy prices increase, which indicates that an increase in the oil price has both direct and indirect effects.

To further inspect the transmission mechanism, I estimate the response of the underlying categories of the CPI with fixed interest rate (CPIF) and Statistics Sweden (SCB)'s monthly consumption indicator.[3] The disaggregated price responses of the 13 subcategories (defined at the 2-digit Classification of Individual Consumption According to Purpose (COICOP) level) show that the increase in the aggregate CPIF is driven both by direct effects of increased fuel prices that are a part of the index as well as other subcategories, such as food and beverages and household goods. The latter is consistent with indirect effects stemming from higher production and transportation costs. This interpretation is supported by the responses at the even more granular 3-digit COICOP level, which show that the price increases generally come from goods rather than services. The responses of the 9 subcategories of the consumption indicator are generally consistent with the price responses, i.e., the subcategories that experience the largest price increases also experience the largest falls in consumption, and standard assumptions about the demand elasticities of the different subcategories.

I assess the robustness of the estimates by varying the sample period. In the baseline, I use data spanning January 2000 to December 2024. I find that these results are sensitive to whether the COVID-19 and high-inflation periods are included or not. Estimates based on the sample 2000:1–2019:12 show that while oil price changes still have stagflationary effects, the responses of most variables are more muted and less persistent. However, estimating the effects using a longer sample from 1987:1 to 2019:12, for which data on consumer prices and the unemployment rate are available, yields results that are more similar to the baseline sample in terms of magnitude and persistence, indicating that the 2000:1-2019:12 results might suffer from a small-sample problem.

This paper adds to the empirical literature on the effects of oil price changes on the macroeconomy (Hamilton, 1983; Kilian, 2009; Kilian and Murphy, 2012; Baumeister and Hamilton, 2019; Känzig, 2021). These papers generally find that oil price increases lead to higher prices and lower economic activity at the global level and in the U.S.

There are several reasons why the transmission might differ in Sweden. Most importantly, the share of oil in Sweden's total energy mix is relatively low (20 per cent compared to 36 per cent in the U.S. as of 2024 according to data from the

[3] SCB's consumption indicator is a monthly estimate of households' quarterly consumption within the national accounts. It is based on input from a variety of sources, including turnover statistics, energy statistics, statistics on newly built dwellings, the consumer price index, the retail assortment survey, and the structural business statistics.

International Energy Agency).[4] All else equal, this should reduce the effects of oil price changes on the Swedish economy. On the other hand, Sweden is a small open economy with a strong influence from regional and global economic conditions. Indirect effects on prices and lower aggregate demand abroad are therefore likely to influence Swedish prices and output. In addition, Sweden has no domestic oil production that may cushion the fall in output.

My estimates show that Sweden is affected by oil price changes in an economically significant way, despite its relatively low oil dependency. The peak effects of a 10 per cent increase in the oil price are 0.4 per cent for consumer prices and 0.2 percentage points for the unemployment rate in my baseline estimates, same as the estimates reported by Känzig (2021) for the U.S. This suggests that open-economy channels, such as exchange-rate movements and international spillovers, as well as Sweden's lack of domestic oil production, may amplify the effects of oil price shocks.

These findings differ from previous estimates on Swedish inflation by Bjellerup and Löf (2008). They find a peak effect of 0.28 per cent using a VAR model. Similarly, Vasi (2026) find larger effects of the Känzig (2021) oil supply news shocks on the Danish economy compared to the VAR estimates of Kronborg (2021), for example. Vasi (2026) finds peak effects of 0.3 per cent and 0.25 percentage points for consumer prices and the unemployment rate, respectively, to a 10 per cent increase in the oil price.

The rest of this paper is structured as follows. Section 2 describes the identification of the oil supply news shocks as well as the outcome variables used in the empirical analysis. Sections 3 describes the empirical strategy. Section 4 presents the baseline results on aggregate and disaggregated data. Additional results are presented in Section 5. Section 6 concludes.

2 Data

This section describes the data used in the empirical analysis. I first describe the identification of the oil supply news shocks and then the outcome variables.

2.1 Oil supply news shocks

The supply and demand of oil, and consequently oil prices, move endogenously with the business cycle. For example, firms demand more oil in expansions to produce more output. Depending on the response of supply, oil prices may increase, fall, or remain constant. Unless these endogenous movements in supply and demand are controlled for, direct estimates of oil price changes on the macroeconomy will likely be biased.

In this paper, I use the oil supply news shocks of Känzig (2021) to measure the *causal* effect of oil price changes driven by these shocks. These shocks are identified in two

[4] These numbers are taken from the International Energy Agency's website: https://www.iea.org/.

steps. First, exogenous and unanticipated changes in the future oil supply are measured using high-frequency surprises in oil futures prices around OPEC production target announcements. Specifically, the surprises are computed as the first principal component of the daily change in the price of West Texas Intermediate (WTI) crude futures with maturities from 1 to 12 months on announcement days. The identifying assumptions are that i) the price of the futures contracts reflects all available information used by financial markets to forecast oil prices, including expectations about OPEC's production target announcements, and ii) no other information that is correlated with the announcements and movements in futures prices is systematically released simultaneously.[5] The first assumption holds under the efficient market hypothesis and the second assumption is likely to hold in practice given the narrow window in which the surprises are computed. In addition, reverse causality from global economic conditions to OPEC's production decision can plausibly be ruled out, because the decision is taken before the announcement and is unlikely to respond to developments occurring within the narrow window. See Känzig (2021) for further discussion about the identifying assumptions and the robustness of the surprises to alternative specifications.

Second, these surprises are used as external instruments in an otherwise standard oil market VAR model to identify structural oil supply news shocks.[6] The model includes the real oil price, world oil production and inventories, world and U.S. industrial production, and the U.S. CPI. As shown by Känzig (2021), these shocks cause an increase in the oil price on impact, a gradual decline in oil production, an increase in oil inventories, a decline in both U.S. and world industrial production, as well as a decline in the U.S. CPI. These results are based on a sample spanning 1974:1–2017:12 for the monthly outcome variables and 1983:4–2017:12 for the instrument. In this paper, I use an extended version of the shock series that incorporates data until 2024:12, which is based on 158 surprises around OPEC announcements.[7] Figure 1 plots the monthly sum of the daily surprise series and the monthly news shock series.[8] Both series display a good deal of variation over time, with both positive and negative surprises and shocks. Moreover, there are no noticeable differences across different parts of the samples in terms of size or frequency of the surprises or shocks.

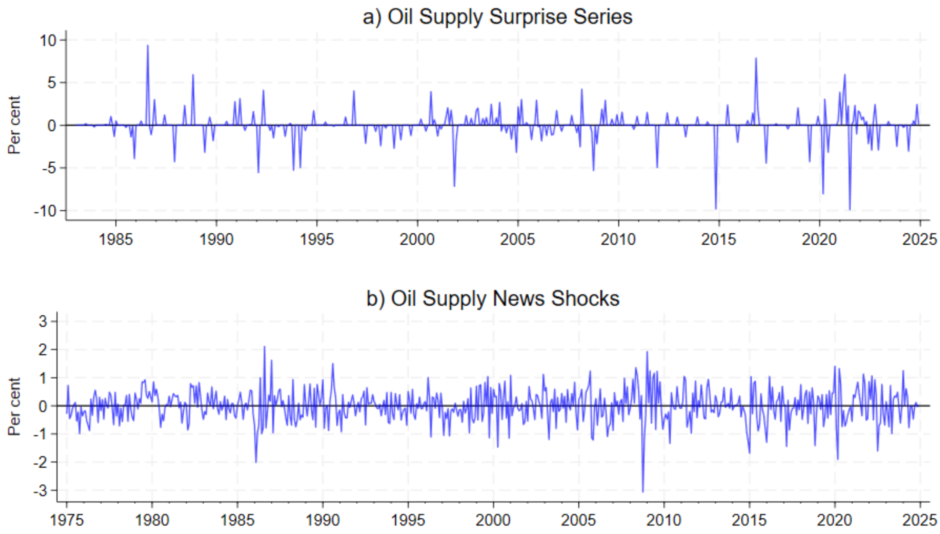
[5] The same assumptions are commonly used to identify surprises in monetary policy (see, e.g., Kuttner (2001), Gürkaynak et al. (2005), and Bauer and Swanson (2023)).

[6] The approach of using external instruments, i.e., variable that is correlated with the shock of interest but not the other shocks, in a VAR was developed by Stock and Watson (2012) and Mertens and Ravn (2013). In general, VARs needs to be invertible, i.e., span all relevant information to be able to recover the structural shocks (Nakamura and Steinsson 2018; Stock and Watson, 2018). However, VARs with external instruments can be identified under weaker assumptions, requiring only that the shock of interest be invertible and that the instrument satisfy a limited lead–lag exogeneity condition (Miranda-Agrippino and Ricco, 2019). See Känzig (2021) for evidence supporting the assumption that the oil supply news shock is invertible.

[7] The oil supply news shocks of Känzig (2021) as well as the underlying surprises are regularly updated and available via the author's website, https://www.diegokaenzig.com/research.

[8] Känzig (2021) converts the daily surprises into a monthly series as follows: When only one surprise occurs within a month, the monthly surprise is equal to the daily. When multiple daily surprises occur within a month, the monthly surprise is equal to the sum of those. When no surprise occurs, the monthly surprise is set to zero.

Figure 1. The oil supply surprise series and oil supply news shocks



Notes: Panel (a) shows the oil supply surprise series, constructed as the first principal component of daily changes in the prices of 1- to 12-month WTI crude oil futures contracts around OPEC announcements. The surprises are scaled to match the average volatility of the underlying price changes. Sample period: 1983:4 to 2024:12. Panel (b) shows the structural oil supply news shock series identified from the oil market proxy VAR of Känzig (2021). Sample period: 1975:1 to 2024:12. See text for details.

Source: https://www.diegokaenzig.com/research.

2.2 Swedish macroeconomic variables

The outcome variables used in the empirical analysis are the real oil price, defined as the Brent crude spot price deflated by the U.S. CPI, and for the Swedish economy, CPIF, CPIF without energy prices (CPIF-XE), one-, two-, and five-year inflation expectations of money market participants from the Origo Group survey (formerly made by Kantar Prospera), the SCB GDP and consumption indicators, the unemployment rate for people aged 16–64, the exchange rate between the Swedish krona and U.S. dollar (USDSEK), nominal wages, and the Riksbank's policy rate.[9] The data are at a monthly frequency, and the baseline sample spans 2000:1 to 2024:12. The sample starts in 2000:1, as this is the first period for which GDP and consumption indicators are available. In Section 5, I assess the robustness of the results by restricting the sample to end in 2019:12 to exclude the COVID-19 and high-inflation periods.

To further inspect the transmission channels, I use disaggregated data on prices and consumption. Specifically, I use data on the 13 underlying categories of the CPIF and

[9] The Brent crude spot price is from the World Bank, the U.S. CPI is from FRED, the inflation expectations are from Origo Group (formerly made by Kantar Prospera), the exchange rate and the policy rate are from the Riksbank, nominal wages are from the Swedish National Mediation Office, and the remaining variables are from SCB.

their respective components (defined at the 2- and 3-digit COICOP levels, respectively) as well as data on the 9 underlying categories of the consumption indicator.[10]

3 Empirical specification

I use the identified oil supply news shocks as instruments to isolate exogenous variation in the real price of Brent crude oil and estimate the IRFs to those price changes using the following instrumental variable Jordá (2005) local projections (LP-IV):

$$\Delta_h y_{t+h} = \alpha_h + \beta_h P_t^{oil} + \Gamma_h' \boldsymbol{X}_{t-1} + \varepsilon_{t+h}, \quad (1)$$

where $h = 0, \ldots, 24$ indexes the impulse response horizon, $\Delta_h y_{t+h} = y_{t+h} - y_{t-1}$ is the cumulative change in outcome variable y, α is a constant, β traces out the impulse response function, P_t^{oil} is the log real oil price instrumented with the identified oil supply news shocks, and $\boldsymbol{X}_{t-1}$ is a vector of lagged control variables. All outcome variables are in logs except for the unemployment rate, the policy rate, and the inflation expectations, which are in levels.

Using the oil supply news shocks as instruments for the real price of oil rather than regressing the outcome variables directly on the shocks has two main advantages. First, the oil supply news shocks are generated regressors whose measurement error needs to be accounted for when computing the standard errors. Generated instruments, on the other hand, do not require standard error correction under very general conditions (see Wooldridge (2010) Section 6.1 for details). Second, the instrumental variable approach naturally normalizes the IRFs. In this setting, the estimated coefficients can be interpreted as the effect of a 1 per cent change in the real price of oil (driven by an oil supply news shock) on the outcome variable of interest. Nonetheless, Figure 7 in Appendix A shows that the estimated impulse responses are very similar if I instead use the oil supply shocks directly in Equation (1) rather than as an instrument for the real oil price.

The vector of control variables, $\boldsymbol{X}_{t-1}$, includes 12 lags of the outcome variable, the shock, the real oil price, the U.S. CPI, and global economic activity measured as the world industrial production index from Baumeister and Hamilton (2019).[11] In principle, control variables are not needed for identification if the impulse variable is truly an exogenous "shock", which I have argued is the case for the oil supply news shocks. However, including controls can help improve the precision of the estimates in a finite sample. The choice of control variables follows the recommendation in Montiel Olea et al. (2025) to include the outcome and impulse variables, as well as additional variables that strongly predict either (or both) of them. Based on this recommendation, I also include 12 lags of the Federal Reserve Bank of New York's Global Supply Chain Pressure Index (GSCPI) in the specifications where CPIF, CPIF-XE, or a CPIF subcategory is the outcome variable.[12] This choice is motivated by the strong lead-lag

[10] Both the disaggregated price and consumption data are publicly available at SCB's website.

[11] The world industrial production index measures the industrial production of the OECD countries and six other major economies. The index is regularly updated and can be downloaded at https://sites.google.com/site/cjsbaumeister/datasets.

[12] The GSCPI is available at https://www.newyorkfed.org/research/gscpi.html.

relationship between the GSCPI and both CPIF and CPIF-XE during the 2021-2023 high-inflation period.[13]

Finally, I use heteroskedasticity-robust standard errors to compute the confidence intervals (Montiel Olea and Plagborg-Møller, 2021).[14]

4 Results

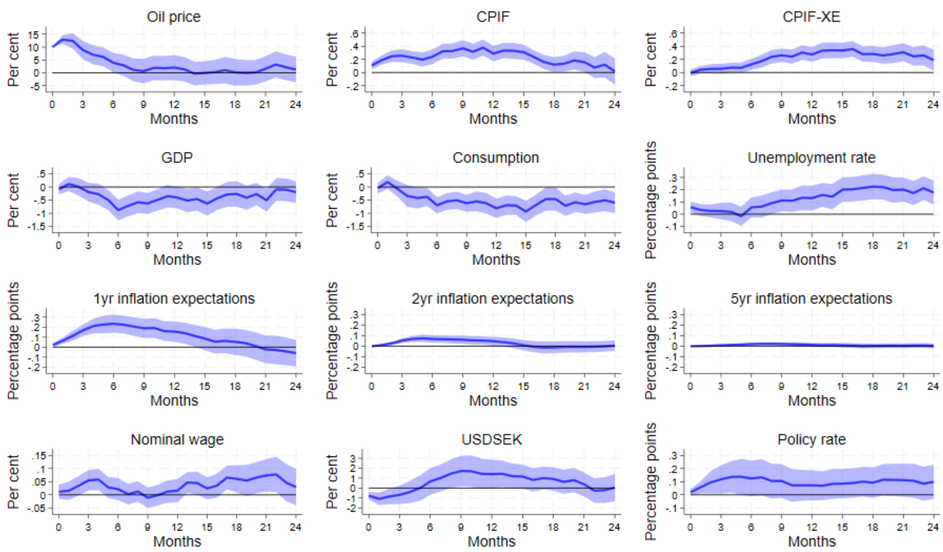
This section presents the IRFs to a 10 per cent increase in the real oil price driven by an oil supply news shock. Section 4.1 shows the IRFs of the aggregate variables and Section 4.2 shows the IRFs of the disaggregated price and consumption data. In each figure, the blue solid lines report the point estimates, and the blue shaded regions report 90 per cent heteroskedasticity-robust confidence bands. The first-stage F-statistics from the LP-IVs are shown in Appendix C. The F-statistics exceed 100 for all variables for all impulse response horizons, which is well above the critical value of 23.19 from the Montiel Olea and Pfluger (2013) heteroscedasticity and autocorrelation consistent (HAC)-robust test for instrument relevance. This indicates that the oil supply news shocks are relevant instruments for changes in the real oil price.

[13] Unreported results show that the remaining outcome variables are largely unaffected by including 12 lags of the GSCPI as additional controls. However, the peak responses of CPIF and CPIF-XE are 39 and 53 per cent larger, respectively, when excluding lagged values of the GSCPI as controls.

[14] While the residual, ε_{t+h}, is typically serially correlated, what matters for the distribution of the estimators is the product of the residual and the residualized shock (i.e., the independent variable conditional on the control variables) (Montiel Olea and Plagborg-Møller, 2021). This product is serially uncorrelated (though likely heteroskedastic) under the assumption that the oil supply news shocks are unpredictable (i.e., conditionally mean independent) from their past and future values, which is likely to hold given the identifying assumptions discussed above. Based on the recommendation in Montiel Olea and Plagborg-Møller (2021) and Montiel Olea et al. (2025), I therefore use heteroskedasticity-robust rather than heteroskedasticity and autocorrelation consistent standard errors.

4.1 Aggregate data

Figure 2. Impulse response functions of aggregate variables to changes in the oil price



Notes: Impulse response functions of aggregate variables to a 10 per cent increase in the real oil price driven by an oil supply news shock estimated using the instrumental variable local projections specification in Equation (1). Blue solid lines report point estimates and blue shaded regions report 90% heteroskedasticity-robust confidence bands. Sample period: 2000:1 to 2024:12.

Source: Prospera, Statistics Sweden, Sveriges Riksbank, Swedish National Mediation Office, and the World Bank.

The top left panel of Figure 2 shows the first-stage response of the real oil price to an oil supply news shock normalized to a 10 per cent response on impact. The response peaks at 12.93 per cent after 1 month and is significant for the first 6 months. The remaining panels show the impulse response functions to a 10 per cent increase in the oil price driven by the oil supply news shocks. CPIF increases persistently and significantly for all horizons with a peak response of 0.38 per cent after 11 months. CPIF-XE also increases, but with a delay compared to the CPIF response. The response becomes significant after 6 months and peaks at 0.36 per cent after 16 months. The CPIF-XE response indicates that the increase in the oil price has indirect effects in addition to direct effects on the fuel prices in the CPIF, which is consistent with firms passing on higher production and transportation costs. As noted above, because Sweden is a small open economy, the indirect effects can arise both from domestic firms increasing prices and from higher import prices driven by price increases abroad.

Consistent with the standard theoretical prediction of oil shocks as supply shocks, economic activity decreases.[15] Specifically, GDP and consumption fall and the unemployment rate increases. The trough of GDP occurs after 6 months with a fall of 0.88

[15] See Barsky and Kilian (2002) and the references therein for a theoretical discussion of how oil shocks affect the macroeconomy.

per cent. The consumption response is somewhat larger and more persistent, with a trough of 0.93 per cent after 15 months. The peak unemployment response occurs after 18 months with an increase of 0.23 percentage points.

One-year inflation expectations increase significantly for the first 13 months with a peak response of 0.23 percentage points after 6 months. Two- and five-year inflation expectations also increase, although more muted with peaks of 0.07 and 0.02 percentage points, respectively. Nominal wages increase, although not persistently and with a muted effect (0.08 per cent at the peak). Taken together, the responses of two- and five-year inflation expectations and nominal wages suggest that second-round effects on inflation and economic activity through de-anchoring of long-run inflation expectations or higher wage growth are limited.

The krona appreciates against the U.S. dollar by 1.09 per cent after 1 month and then depreciates from 6 months forward with a peak of 1.72 per cent after 9 months. The short-run appreciation and longer-run depreciation of the krona are consistent with the findings of Lizardo and Mollick (2010) and Känzig (2021). Lizardo and Mollick (2010) discuss two mechanisms that may explain this response. On the one hand, given that crude oil is predominantly traded in U.S. dollars, an increase in the oil price means that the dollar revenues of oil exporting countries increase. As these countries exchange dollars for their respective domestic currencies, the global supply of dollars increases, leading to an overall downward pressure on the dollar. On the other hand, oil importing countries (like Sweden) need to purchase more dollars for the same amount of crude oil, which puts upward pressure on the dollar. One interpretation is that the former mechanism dominates in the short run while the latter dominates in the longer run.

Finally, the policy rate increases for all horizons and significantly for the 1- to 5-month horizons with a peak effect of 0.14 percentage points after 5 months. The positive response is consistent with the Riksbank following a monetary policy rule placing a positive weight on inflation and a positive but smaller weight on economic activity.

Taken together, the increases in the price level and the fall in economic activity indicate that the oil supply news shocks transmit like a supply shock, consistent with the standard theoretical prediction. The increases in both the CPIF and the CPIF-XE point to both direct and indirect price effects. The muted responses of long-run inflation expectations and nominal wages point to limited second-round effects. My estimates are also qualitatively and quantitatively similar to the VAR estimates of Känzig (2021) for U.S. data. He also finds that oil supply news shocks have stagflationary effects, direct and indirect effects on consumer prices, and a positive yet mostly insignificant increase in the central bank's policy rate.

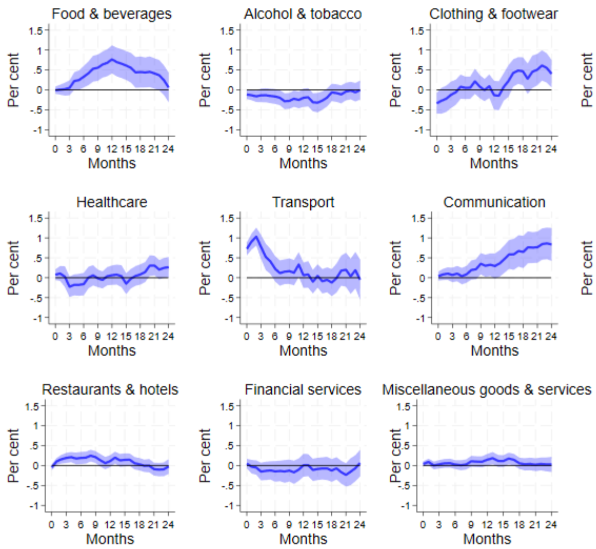
4.2 Disaggregated data

Having established that an increase in the oil price leads to an increase in prices and a fall in economic activity, I turn to inspecting the mechanisms behind these effects further. Specifically, I estimate the effects of oil price changes on disaggregated data on prices and consumption using the LP-IV specification in Equation (1).

Prices

I start by estimating the effects on the subcategories of the CPIF. In the main text, I show the IRFs of the 13 subcategories defined at the 2-digit COICOP level. To conserve space, I show the IRFs of prices at the more granular 3-digit COICOP level in Appendix B but refer to them throughout the main text. As a complementary analysis, I quantify the relative contribution of each subcategory to the overall price response by dividing each weight-adjusted 2-digit IRF by the sum of the weight-adjusted IRFs across all subcategories.

Figure 3. Impulse response functions of consumer prices to changes in the oil price



Notes: Impulse response functions of the subcategories of the CPIF to a 10 per cent increase in the real oil price driven by an oil supply news shock estimated using the instrumental variable local projections specification in Equation (1). Blue solid lines report point estimates and blue shaded regions report 90% heteroskedasticity-robust confidence bands. Sample period: 2000:1 to 2024:12.

Source: Statistics Sweden.

Figure 3 shows the IRFs of the 13 subcategories of the CPIF, measured at the 2-digit COICOP level, to a 10 per cent increase in the real oil price driven by an oil supply news shock. The direct effects occur through Housing and utilities and Transportation, which include fuel for heating and diesel and gasoline, respectively. Both categories increase significantly. The former increases with more of a delay and reaches a peak effect of 0.38 per cent after 7 months and the latter with a peak of 1.03 per cent after 2 months and a response that generally follows the first-stage response of the oil price displayed in Figure 2.

Inspecting these mechanisms further, the responses at the 3-digit COICOP level in Figure 11 in Appendix B show that the response of housing and utilities is driven by direct effects through Electricity, gas, and other fuels, which contains “liquid fuels”, and to a lesser extent indirect effects through Maintenance, repairs, and safety regarding the residence. The remaining subcategories, which include rents, water, and miscellaneous housing services, do not respond significantly. Figure 14 in Appendix B shows that the response of transport is driven by direct effects through an immediate increase in Operating costs for personal transportation, which contains diesel and gasoline, as well as significant but delayed indirect effects of subcategories Purchase of vehicles and Transportation services of goods.

Among the subcategories that do not include direct effects, Food and beverages and Household goods (furniture etc.) respond the most with peak effects of 0.91 and 1.13 per cent, respectively. These responses can be understood from the fact that petroleum products such as fuel, fertilizer, petrochemicals, plastic, paint, synthetic rubber, and textiles are key inputs in the production of these products. The price effects may be further amplified by increased transportation costs and the longer-run depreciation of the krona. The responses at the 3-digit COICOP level (Figure 8 and Figure 12 in Appendix B) show that while there are some quantitative differences between their respective subcategories, they all increase significantly.

Communication, Recreation and culture, and to a lesser extent Clothing and footwear increase significantly but with a delay of around 10-18 months. These responses are consistent with indirect effects that eventually trickle out to consumers stemming from increased production and transportation costs. The responses at the 3-digit level show that for all of these subcategories, the responses are generally driven by increases in prices of goods rather than services, which is consistent with the production of the former being more reliant on petroleum products as a direct input in production.

Restaurants and hotels increases significantly and persistently, although with a muted response compared to, e.g., Food and beverages and Household goods. Figure 18 in Appendix B shows that the increase is driven by Bar and restaurant services and that Accommodation services does not respond significantly. The increase in bar and restaurant services is consistent with the increase in food and non-alcoholic beverages, described above. The muted response is consistent with restaurants only passing on only part of their cost increases to consumers due to limited market power.

Finally, the IRFs of Alcohol and tobacco, Healthcare, Education services, Insurance and financial services, and Miscellaneous goods and services are generally flat and insignificant except for one or two horizons.

Overall, these results indicate that the increase in the CPIF is driven both by direct effects of increased fuel prices that are a part of the index as well as indirect effects consistent with higher production and transportation costs. As noted above, the indirect effects may also come from abroad since a large share of the products in the CPIF basket are imported. These effects may be amplified by the longer-run depreciation of the krona against the U.S. dollar. The IRFs of the subcategories at the 3-digit COICOP level provide additional support for this interpretation since the price increases generally come from goods rather than services. This result also provides additional support that second-round effects from long-run inflation expectations and nominal wages on consumer prices are limited since these would affect both goods and services.

Table 1. Contribution of the subcategories to the aggregate CPIF response

Subcategory	h = 0	h = 6	h = 12	h = 18	h = 24
Food & beverages	-0.01	0.29	0.49	0.53	0.11
Alcohol & tobacco	-0.05	-0.04	-0.04	-0.02	0
Clothing & footwear	-0.20	0.02	-0.03	0.22	0.29
Housing & utilities	0.07	0.29	0.09	-0.62	-0.93
Household goods	0.03	0.14	0.17	0.27	0.29
Healthcare	0.03	-0.03	0.01	0.02	0.11
Transport	1.08	0.20	0.04	-0.14	-0.09
Communication	0.03	0.03	0.08	0.33	0.64
Recreation & culture	0.03	0.04	0.12	0.40	0.66
Education	0	0	0	0	0
Restaurants & hotels	-0.03	0.08	0.03	0.02	-0.02
Financial services	0.01	-0.02	0	-0.02	0.02
Miscellaneous goods & services	0.02	0.01	0.03	0.02	0.02

Notes: The table shows the ratios between the product of the IRFs of the subcategories of the CPIF displayed in Figure 3 and their respective average weight in the index over the sample period and the sum of the weighted IRFs across all subcategories. Sample period: 2000:1 to 2024:12.
Source: Own calculations.

A natural follow-up question is how much the response of each subcategory matters for the aggregate response. To quantify this, I multiply each 2-digit IRF with its average weight in the CPIF over the sample period and divide the product by the sum of the weight-adjusted IRFs across all subcategories.[16] Table 1 shows these fractions for each subcategory at impulse response horizons (h) 0, 6, 12, 18, and 24 months after the shock. Note that since some subcategories respond negatively, the ratios may exceed one.

On impact (h=0), Transport has a ratio of 1.08 relative to the sum of the weighted IRFs. Since the remaining subcategories have ratios between -0.05 and 0.07, except for Clothing and footwear which has a ratio of -0.20, this suggests that Transport (which contains direct effects) accounts for most of the increase in the aggregate CPIF response on impact. For longer horizons, the contribution of Transport falls from 0.2 after 6 months, to 0.04 after 12 months, and even negative for 18 and 24 months. A similar pattern can be seen for Housing and utilities, the other subcategory that contains direct effects. Its ratio peaks at 0.29 after 6 months and becomes negative for the 18- and 24-month horizons.

The ratios of Food and beverages and Household goods illustrate why it is also useful

[16] The weights are available at SCB's website.

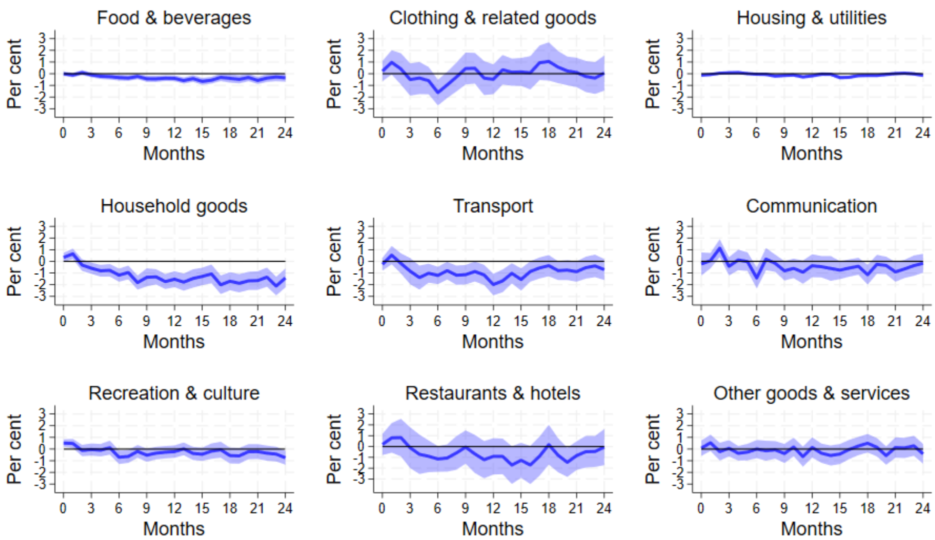
to look at the weighted IRFs. Even though both subcategories respond similarly in terms of magnitude and persistence, Food and beverages account for a larger share of the aggregate CPIF response with a peak ratio of 0.53 after 18 months compared to 0.29 after 24 months for Household goods. This difference can be explained by the larger average weight of Food and beverages in the CPIF.

For the 18- and 24-month horizons, Clothing and footwear, Communication, and Recreation and culture account for meaningful shares of the aggregate response with peak ratios of 0.29, 0.64, and 0.66, respectively. The remaining subcategories all account for negligible shares of the aggregate response.

Consumption

Having estimated the disaggregate price responses, I turn to estimating the disaggregate consumption responses, i.e., the responses of the 9 subcategories of the consumption indicator. These subcategories closely correspond to the subcategories of the CPIF. Due to lack of data on the weights of the different subcategories, I do not attempt to quantify the relative contribution of each subcategory to the overall consumption response.

Figure 4. Impulse response functions of consumption to changes in the oil price



Notes: Impulse response functions of the subcategories of the consumption indicator to a 10 per cent increase in the real oil price driven by an oil supply news shock estimated using the instrumental variable local projections specification in Equation (1). Blue solid lines report point estimates and blue shaded regions report 90% heteroskedasticity-robust confidence bands. Sample period: 2000:1 to 2024:12.

Source: Statistics Sweden.

Figure 4 shows the IRFs of the 9 underlying categories of the consumption indicator to a 10 per cent increase in the real oil price driven by an oil supply news shock. Categories Household goods and Transport both respond strongly and significantly reaching troughs of 1.93 and 2.07 per cent, respectively. Restaurants and hotels also respond strongly with a trough of 1.75 per cent, although the response is less significant. Food and beverages respond significantly and persistently, but more muted with a trough of 0.67 per cent.

These responses are consistent with the price responses described above. The corresponding price responses of Household goods and Transport both increase strongly, which can explain the fall in consumption. Similarly, the prices of Food and beverages and Restaurant and hotels increase, which can explain the fall in the consumption of these categories. The fall in consumption of Restaurant and hotels is relatively larger compared to the fall in Food and beverages (although less precisely estimated), whereas for the corresponding price responses, the price of Restaurant and hotels increases less. One interpretation is that Food and beverages constitutes a more necessary category than Restaurants and hotels, and that households therefore substitute away from the latter and toward the former by eating more at home.

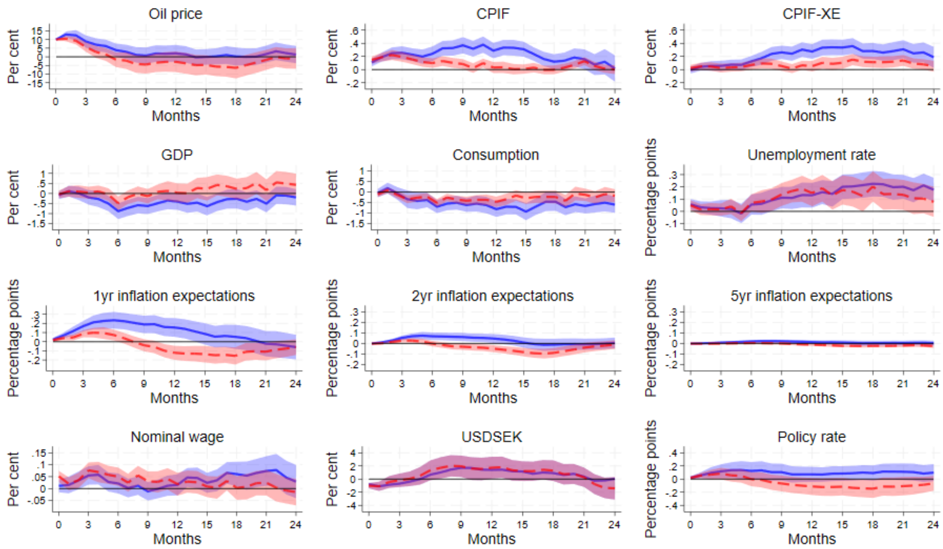
Apart from one or two horizons, the responses of the remaining consumption subcategories are flat and insignificant. For Clothing and related goods, Communication, and Recreation and culture, the price responses are somewhat more muted and occur with a delay, which could be part of the reason for the muted consumption responses. For Housing and utilities, the consumption response is essentially zero while the price increases. Given that the price response is driven primarily by direct effects on liquid heating fuels, and that very few Swedish households use such fuels for heating, it is not surprising that the consumption response is muted. A complementary interpretation is that the demand elasticities for these five subcategories are lower, i.e., that price changes have less of an effect on demand.

Taken together, the disaggregated consumption responses are broadly in line with the disaggregated price responses and standard assumptions about price elasticities across the different consumption categories.

5 Robustness: Alternative sample periods

In this section, I assess the robustness of the baseline results on aggregate data by restricting the sample period to 2019:12 and thereby excluding extreme movements in economic variables that occurred during the COVID-19 and high-inflation periods.

Figure 5. Impulse response functions of aggregate variables to changes in the oil price: Excluding the COVID-19 and high-inflation periods



Notes: Impulse response functions of aggregate variables to a 10 per cent increase in the real oil price driven by an oil supply news shock estimated using the instrumental variable local projections specification in Equation (1). Blue solid (red dashed) lines report point estimates and blue (red) shaded regions report 90% heteroskedasticity-robust confidence bands for the sample period 2000:1 to 2024:12 (2000:1 to 2019:12).

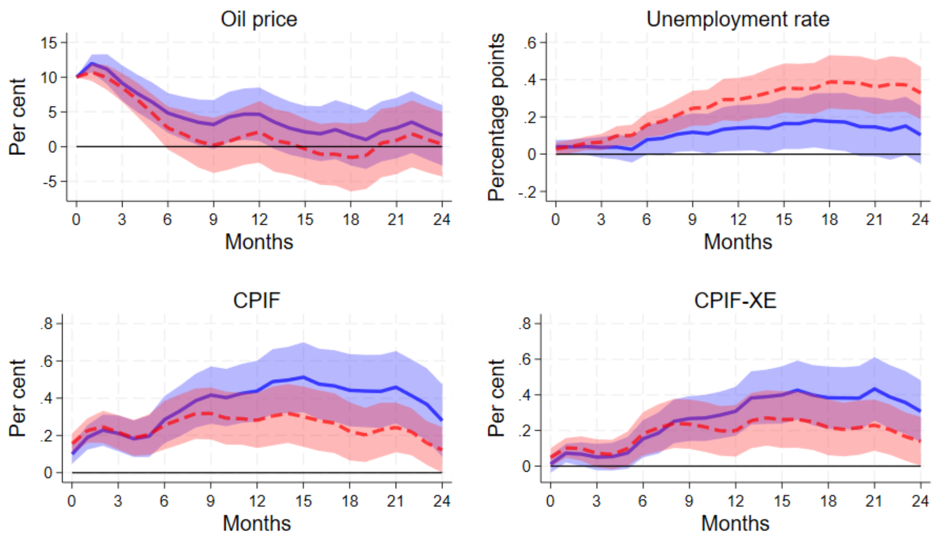
Source: Prospera, Statistics Sweden, Sveriges Riksbank, Swedish National Mediation Office, and the World Bank.

Figure 5 shows the IRFs for the sample period 2000:1 to 2019:12 (red dashed lines) compared to the baseline (blue solid lines). There are several noticeable differences compared to the baseline results. The first-stage response of the oil price is less persistent and only significant for 3 months. It even becomes negative after 6 months, although not significantly. The responses of CPIF and CPIF-XE are also less persistent, and the peak effects are roughly half as large as those in the baseline specification. CPIF peaks at 0.22 per cent after 2 months and reverts relatively quickly, while CPIF-XE becomes significant only after 16 months, when it reaches a peak of 0.15 per cent. On the real side, the GDP response is also less persistent and mostly insignificant. The consumption response is qualitatively consistent with the baseline, although quantitatively smaller with a trough of 0.51 per cent compared to 0.93. The unemployment rate response is both qualitatively and quantitatively consistent with the baseline. The same applies to the USDSEK response. The IRFs of inflation expectations and the policy rate, which were positive at all horizons in the baseline, are positive only during the first 6 months before turning negative. However, the increases and subsequent declines are statistically significant only for inflation expectations. Nominal wages respond similarly, although more muted for the later impulse response horizons.

While the estimates based on the different sample periods all imply that oil price increases have stagflationary effects with both direct and indirect effects on prices, the magnitudes differ substantially depending on whether the COVID-19 and high-inflation periods are included or not. One interpretation is that the large movements in the outcome variables, particularly prices, that occurred during the high-inflation period are needed for identification of oil price changes. An alternative interpretation is that the large increase in oil prices and the subsequent increase in prices constitute an outlier that creates a spurious relationship rather than capturing the true effect.

The potential outlier problem can be reduced by including more observations and thereby reducing the importance of the 2019:12 – 2024:12 part of the sample. To test for this, I extend the sample back to 1987:1, for which data on CPIF, CPIF-XE, and the unemployment rate are available.

Figure 6. Impulse response functions of aggregate variables to changes in the oil price: Extending the sample back to 1987



Notes: Impulse response functions of aggregate variables to a 10 per cent increase in the real oil price driven by an oil supply news shock estimated using the instrumental variable local projections specification in Equation (1), excluding lagged values of GSCPI in the vector of control variables. Blue solid (red dashed) lines report point estimates and blue (red) shaded regions report 90% heteroskedasticity-robust confidence bands for the sample 1987:1 to 2024:12 (1987:1 to 2019:12).

Source: Statistics Sweden and the World Bank.

Figure 6 shows that ending the sample in 2019:12 instead of 2024:12 does not yield such a dramatic difference when starting the sample in 1987:1 (red dashed lines). The first-stage oil price response is somewhat less persistent and only significant for the first 5 months compared to 9 months for the 1987:1 to 2024:12 sample (blue solid lines). The IRFs of CPIF and CPIF-XE for the shorter sample are qualitatively very similar to the longer sample but quantitatively muted with peak effects of 0.32 and 0.27 per cent, respectively, compared to 0.51 and 0.43 per cent. One should be cautious when interpreting the quantitative effects for the full sample, however, given that the specification does not include lags of GSCPI as controls.[17] The peak effects of the

[17] Unreported analysis shows that the quantitative effects on CPIF and CPIF-XE are very similar across the 1987:1–2024:12 and 2000:1–2024:12 samples when the GSCPI is excluded from the vector of lagged controls in the 2000:1–2024:12 specification. This suggests that the estimated effects for the sample starting in 1987:1 would likely also be smaller if data on the GSCPI were available for the earlier period. By contrast, the responses for the 2000:1–2019:12 sample are not sensitive to whether lags of the GSCPI are included.

shorter sample are more similar to those of the baseline 2000:1 to 2024:12 sample, which are 0.38 per cent for CPIF and 0.36 per cent for CPIF-XE. The IRF of unemployment is also qualitatively similar between the samples but it is quantitatively stronger for the 1987:1 to 2019:12 sample with a peak effect of 0.39 percentage points compared to 0.18 for the 1987:1 to 2024:12 sample.

The qualitative similarities between the IRFs for the sample periods 1987:1 to 2024:12 and 1987:1 to 2019:12 and the quantitative similarities of the price responses for the 1987:1 to 2019:12 and the 2000:1 to 2024:12 samples offer some reassurance that the effects have been stable over a longer period. One interpretation is that the estimates based on the 2000:1–2019:12 sample are affected by a small-sample problem, making the estimates based on the longer 2000:1–2024:12 sample more reliable.

6 Conclusion

This paper studies the effects of oil shocks on the Swedish economy. Using structural oil supply news shocks identified by the method of Känzig (2021) as instruments for the oil price in instrumental variable Jordá (2005) local projections, I show that an increase in the real price of Brent crude oil driven by the news shocks has stagflationary effects. An increase in the oil price leads to an increase in consumer prices, a fall in economic activity, a short-run appreciation and a longer-run depreciation of the Swedish krona against the U.S. dollar, an increase in one-year inflation expectations, muted increases in two- and five-year inflation expectations and nominal wages, and an increase in the Riksbank's policy rate. The responses of consumer prices with and without energy prices as well as further analysis of disaggregated data on consumer prices and consumption indicate that oil price changes have significant indirect effects in addition to direct effects on fuel price and fuel expenditure. The responses of longer-run inflation expectations and nominal wages indicate limited second-round effects on inflation and economic activity through de-anchoring of inflation expectations or higher wage growth.

The baseline results are estimated for the sample period January 2000 to December 2024. Additional results show that the estimates are sensitive to ending the sample in 2019 and thereby excluding the COVID-19 and high-inflation periods. In particular, the peak response of consumer prices is roughly half for the shorter sample. Extending the sample back to 1987, for which data on consumer prices and the unemployment rate are available, shows that the estimates are less sensitive to whether the sample is ended in 2019 or not, which offers some reassurance that the estimated coefficients have been more stable over a longer period.

Overall, this paper shows that even though Sweden has a relatively low oil dependency, it is still affected by oil price changes in an economically significant way.

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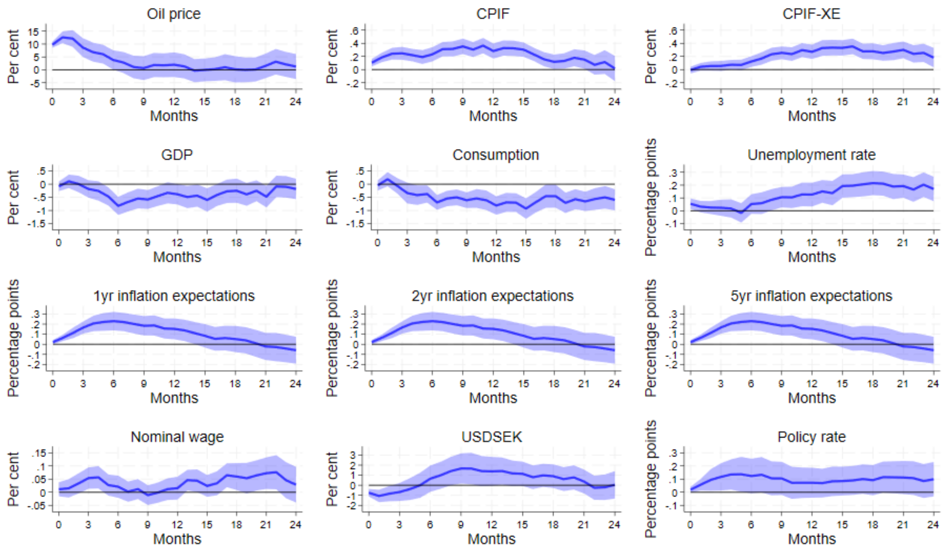
APPENDIX A – Additional Results

Figure 7. Impulse response functions using oil supply news shocks directly

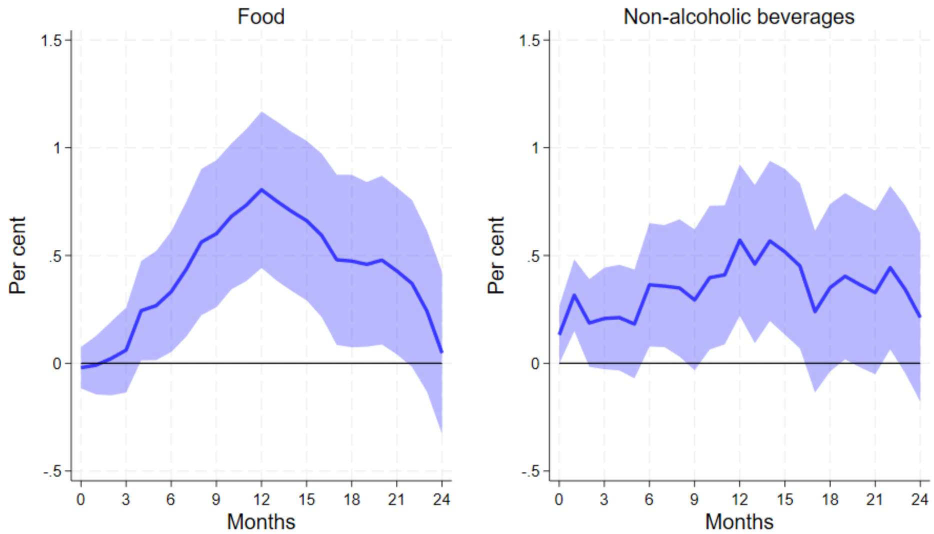


Notes: Impulse response functions to an oil supply news shock estimated using the local projections specification $y_{t+h} = \alpha_h + \beta_h oil\ news_t + \Gamma_h' \boldsymbol{x}_{t-1} + \varepsilon_{t+h}$. IRFs are rescaled to generate a 10 % increase in the oil price on impact. Blue solid lines report point estimates and blue shaded regions report 90% heteroskedasticity-robust confidence bands. Sample period: 2000:1 to 2024:12.

Source: Prospera, Statistics Sweden, Sveriges Riksbank, Swedish National Mediation Office, and the World Bank.

APPENDIX B – CPIF at 3-digit COICOP

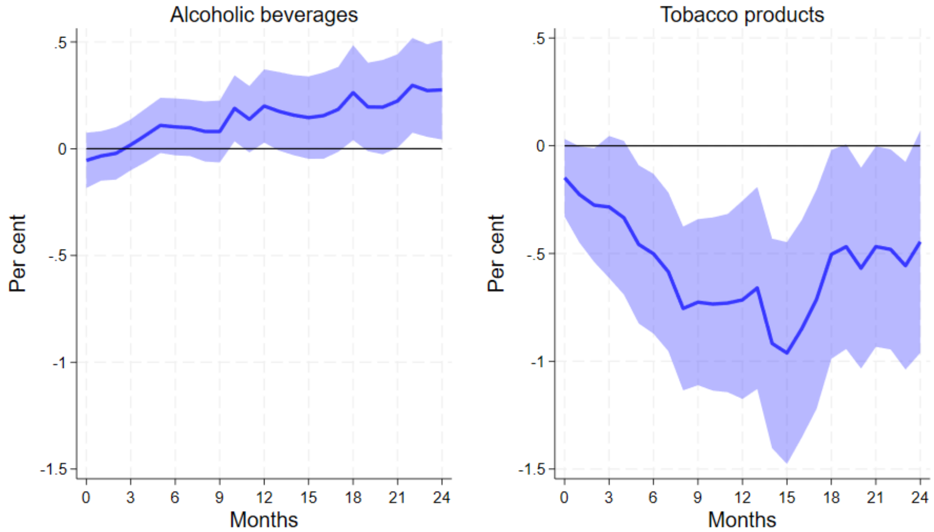
Figure 8. Impulse response functions of food and beverages to changes in the oil price



Notes: Impulse response functions to a 10 per cent increase in the real oil price driven by an oil supply news shock estimated using the instrumental variable local projections specification in Equation (1). The outcome variables are COICOP 011 “Food” and 012 “Non-alcoholic beverages”. Blue solid lines report point estimates and blue shaded regions report 90% heteroskedasticity-robust confidence bands. Sample period: 2000:1 to 2024:12.

Source: Statistics Sweden.

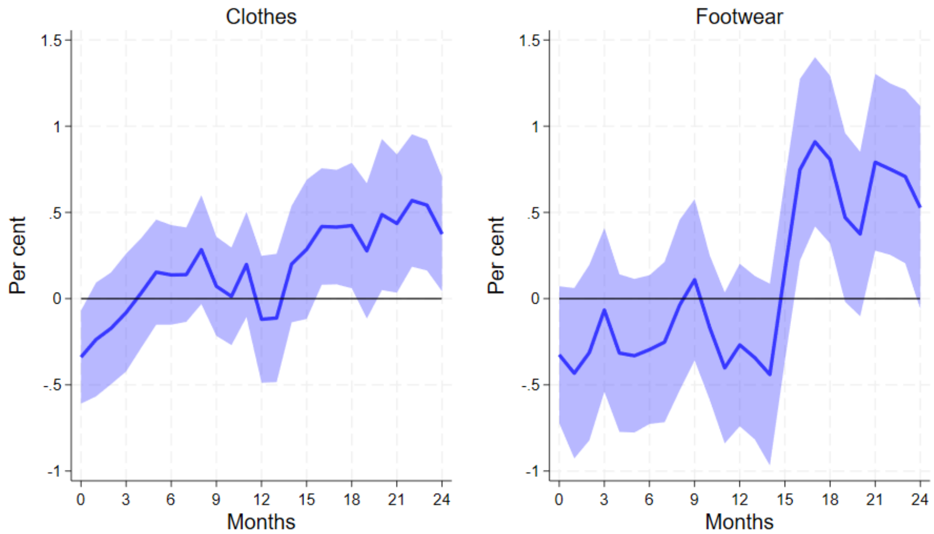
Figure 9. Impulse response functions of alcohol and tobacco to changes in the oil price



Notes: Impulse response functions to a 10 per cent increase in the real oil price driven by an oil supply news shock estimated using the instrumental variable local projections specification in Equation (1). The outcome variables are COICOP 021 "Alcoholic beverages" and 023 "Tobacco products". Blue solid lines report point estimates and blue shaded regions report 90% heteroskedasticity-robust confidence bands. Sample period: 2000:1 to 2024:12.

Source: Statistics Sweden.

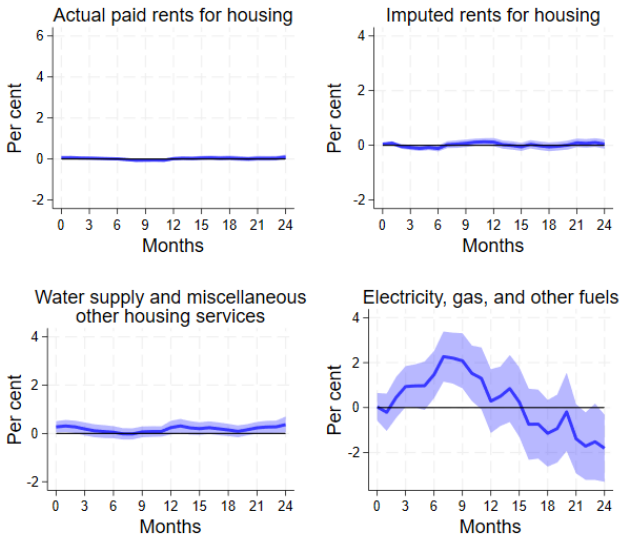
Figure 10. Impulse response functions of clothing and footwear to changes in the oil price



Notes: Impulse response functions to a 10 per cent increase in the real oil price driven by an oil supply news shock estimated using the instrumental variable local projections specification in Equation (1). The outcome variables are COICOP 031 "Clothes" and 032 "Shoes". Blue solid lines report point estimates and blue shaded regions report 90% heteroskedasticity-robust confidence bands. Sample period: 2000:1 to 2024:12.

Source: Statistics Sweden.

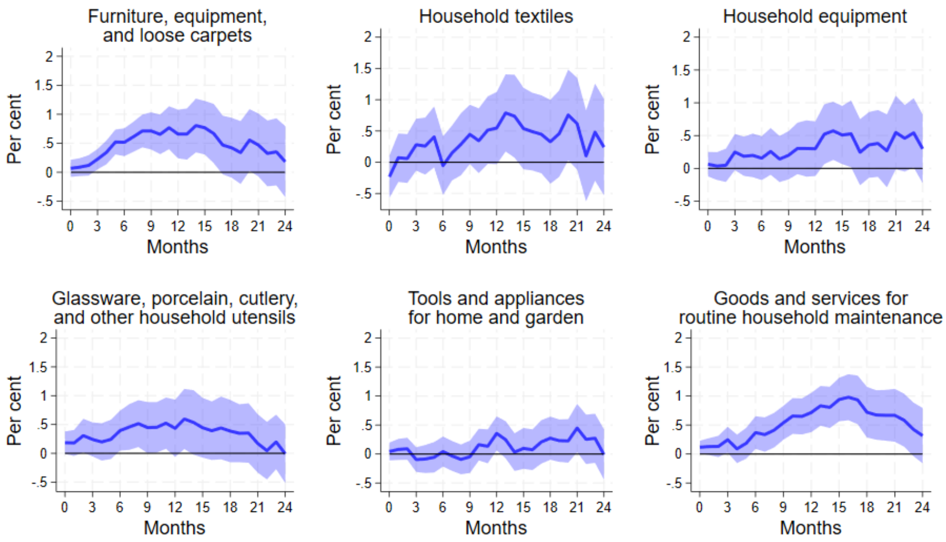
Figure 11. Impulse response functions of housing and utilities to changes in the oil price



Notes: Impulse response functions to a 10 per cent increase in the real oil price driven by an oil supply news shock estimated using the instrumental variable local projections specification in Equation (1). The outcome variables are COICOP 041 “Actual paid rents for housing”, 042 “Imputed rents for housing”, 043 “Maintenance, repairs, and safety regarding the residence”, 044 “04.4 Water supply and miscellaneous other housing services”, and 045 “Electricity, gas, and other fuels”. Blue solid lines report point estimates and blue shaded regions report 90% heteroskedasticity-robust confidence bands. Sample period: 2000:1 to 2024:12.

Source: Statistics Sweden.

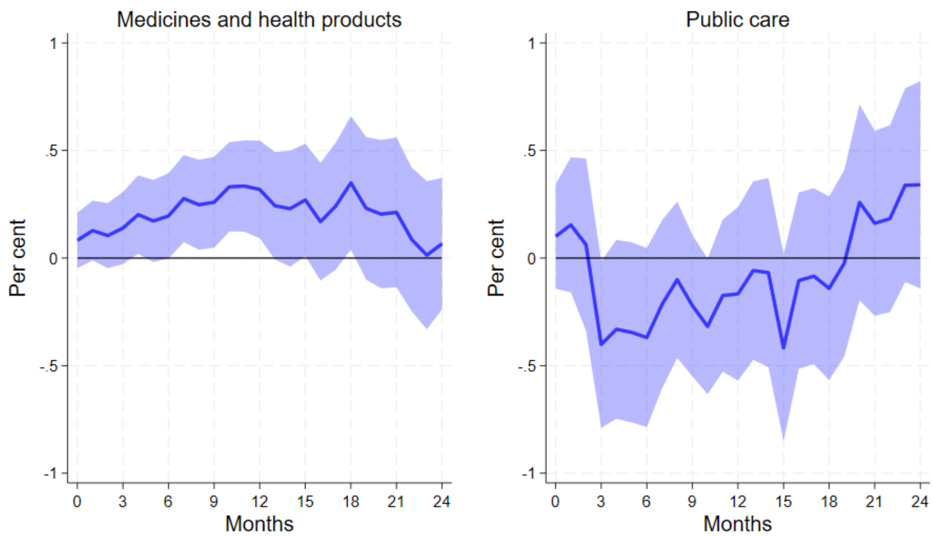
Figure 12. Impulse response functions of household goods to changes in the oil price



Notes: Impulse response functions to a 10 per cent increase in the real oil price driven by an oil supply news shock estimated using the instrumental variable local projections specification in Equation (1). The outcome variables are COICOP 051 “Furniture, equipment, and loose carpets”, 052 “Household textiles”, 053 “Household equipment”, 054 “Glassware, porcelain, cutlery, and other household utensils”, 055 “Tools and appliances for home and garden”, and 056 “Goods and services for routine household maintenance”. Blue solid lines report point estimates and blue shaded regions report 90% heteroskedasticity-robust confidence bands. Sample period: 2000:1 to 2024:12.

Source: Statistics Sweden.

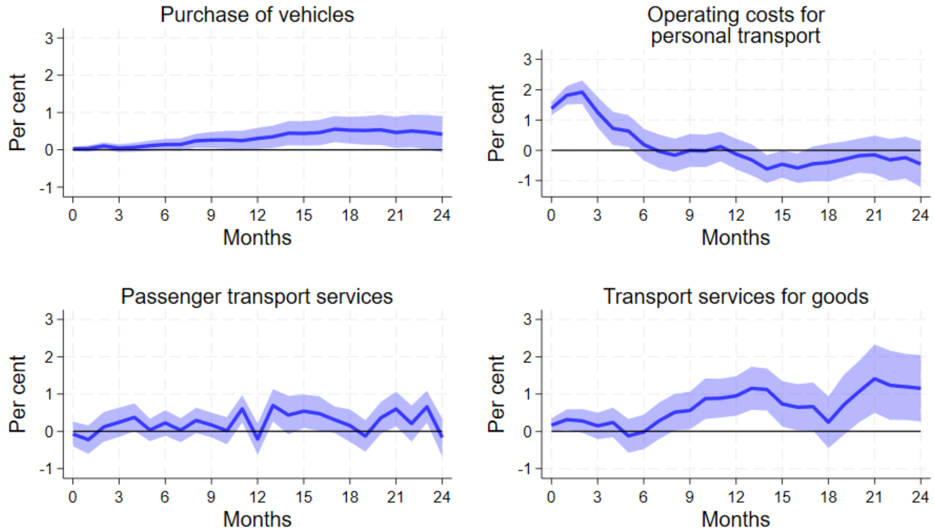
Figure 13. Impulse response functions of healthcare to changes in the oil price



Notes: Impulse response functions to a 10 per cent increase in the real oil price driven by an oil supply news shock estimated using the instrumental variable local projections specification in Equation (1). The outcome variables are COICOP 061 “Medicines and health products” and 062 “Public care”. Blue solid lines report point estimates and blue shaded regions report 90% heteroskedasticity-robust confidence bands. Sample period: 2000:1 to 2024:12.

Source: Statistics Sweden.

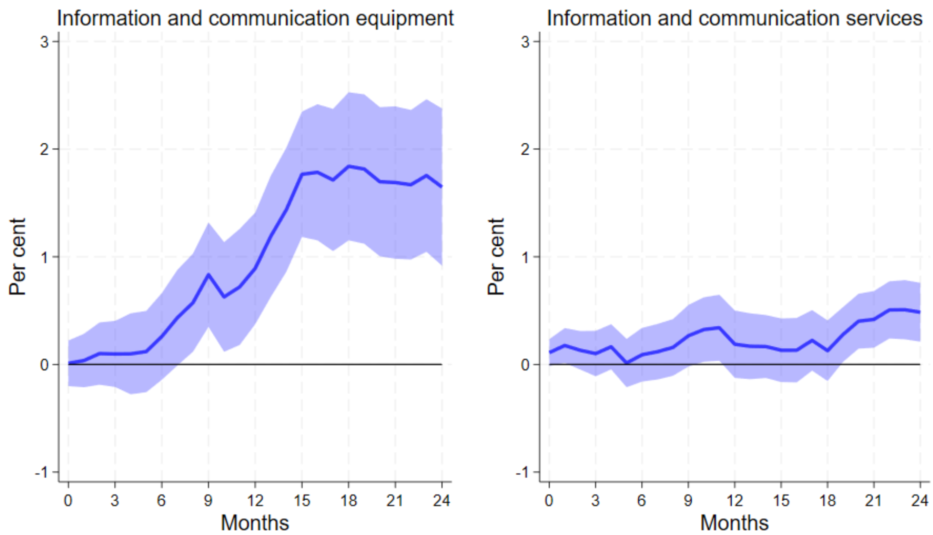
Figure 14. Impulse response functions of transport to changes in the oil price



Notes: Impulse response functions to a 10 per cent increase in the real oil price driven by an oil supply news shock estimated using the instrumental variable local projections specification in Equation (1). The outcome variables are COICOP 071 “Purchase of vehicles”, 072 “Operating costs for personal transport”, 073 “Passenger transport services”, and 074 “Transport services for goods”. Blue solid lines report point estimates and blue shaded regions report 90% heteroskedasticity-robust confidence bands. Sample period: 2000:1 to 2024:12.

Source: Statistics Sweden.

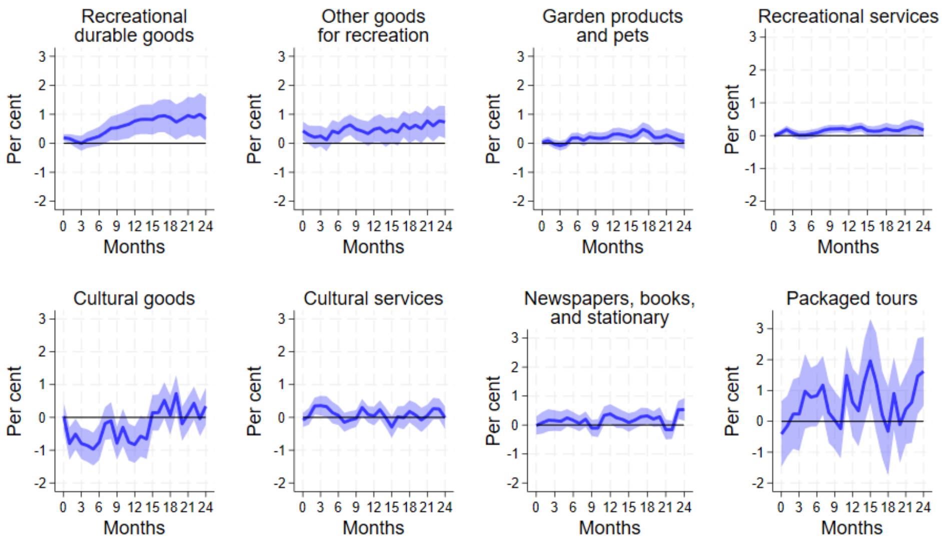
Figure 15. Impulse response functions of communication to changes in the oil price



Notes: Impulse response functions to a 10 per cent increase in the real oil price driven by an oil supply news shock estimated using the instrumental variable local projections specification in Equation (1). The outcome variables are COICOP 081 “Information and communication equipment” and 083 “Information and communication services”. Blue solid lines report point estimates and blue shaded regions report 90% heteroskedasticity-robust confidence bands. Sample period: 2000:1 to 2024:12.

Source: Statistics Sweden.

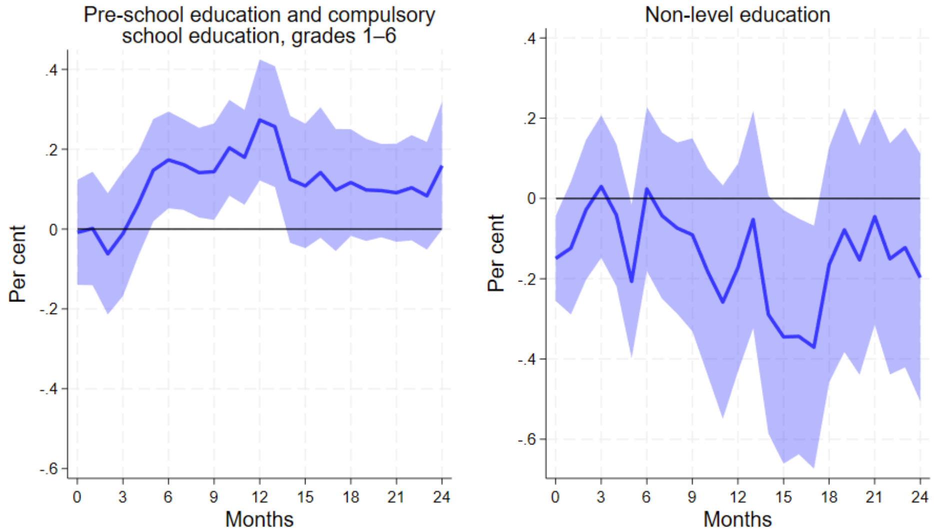
Figure 16. Impulse response functions of recreation and culture to changes in the oil price



Notes: Impulse response functions to a 10 per cent increase in the real oil price driven by an oil supply news shock estimated using the instrumental variable local projections specification in Equation (1). The outcome variables are COICOP 091 "Recreational durable goods", 092 "Other goods for recreation", 093 "Garden products and pets", 094 "Recreational services", 095 "Cultural goods", 096 "Cultural services", 097 "Newspapers, books, and stationary", and 098 "Packaged tours". Blue solid lines report point estimates and blue shaded regions report 90% heteroskedasticity-robust confidence bands. Sample period: 2000:1 to 2024:12.

Source: Statistics Sweden.

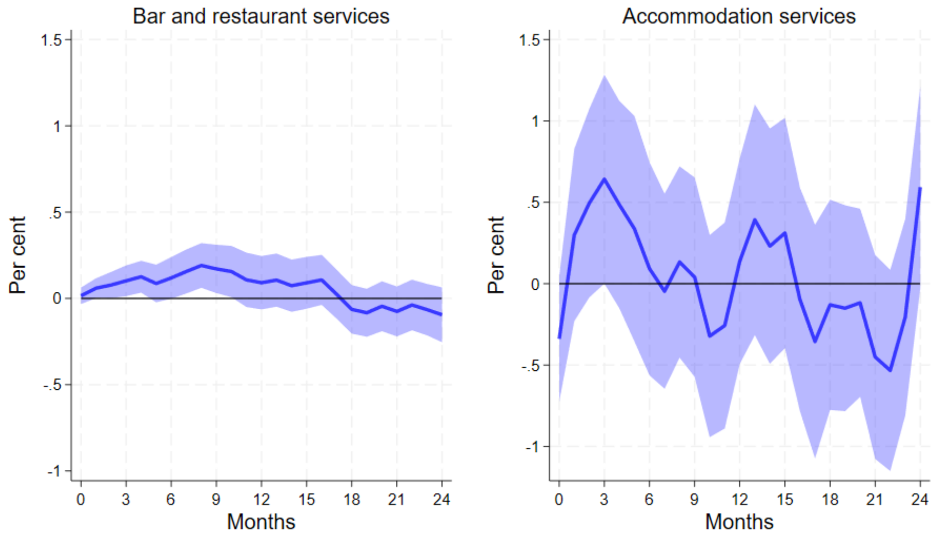
Figure 17. Impulse response functions of education to changes in the oil price



Notes: Impulse response functions to a 10 per cent increase in the real oil price driven by an oil supply news shock estimated using the instrumental variable local projections specification in Equation (1). The outcome variables are COICOP 101 "Pre-school education and compulsory school education, grades 1–6" and 105 "Non-level education". Blue solid lines report point estimates and blue shaded regions report 90% heteroskedasticity-robust confidence bands. Sample period: 2000:1 to 2024:12.

Source: Statistics Sweden.

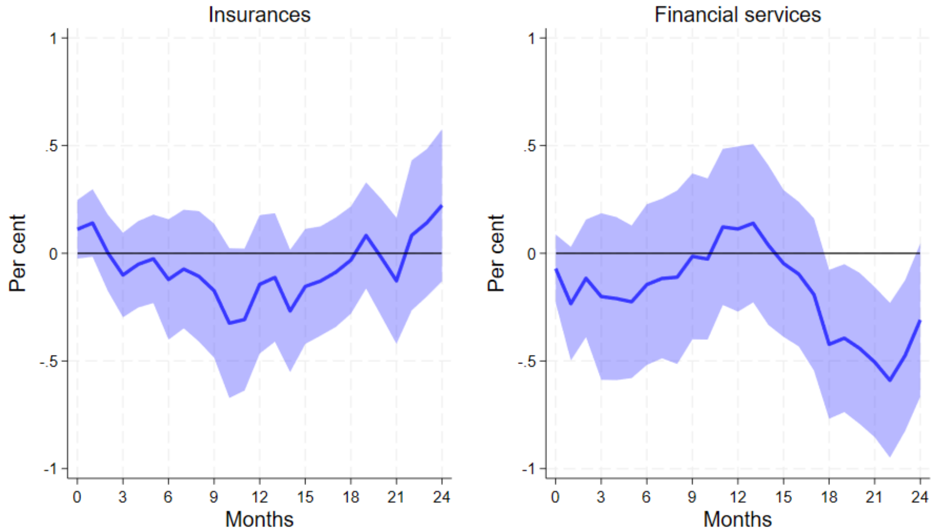
Figure 18. Impulse response functions of restaurants and hotels to changes in the oil price



Notes: Impulse response functions to a 10 per cent increase in the real oil price driven by an oil supply news shock estimated using the instrumental variable local projections specification in Equation (1). The outcome variables are COICOP 111 "Bar and restaurant services" and 112 "Accommodation services". Blue solid lines report point estimates and blue shaded regions report 90% heteroskedasticity-robust confidence bands. Sample period: 2000:1 to 2024:12.

Source: Statistics Sweden.

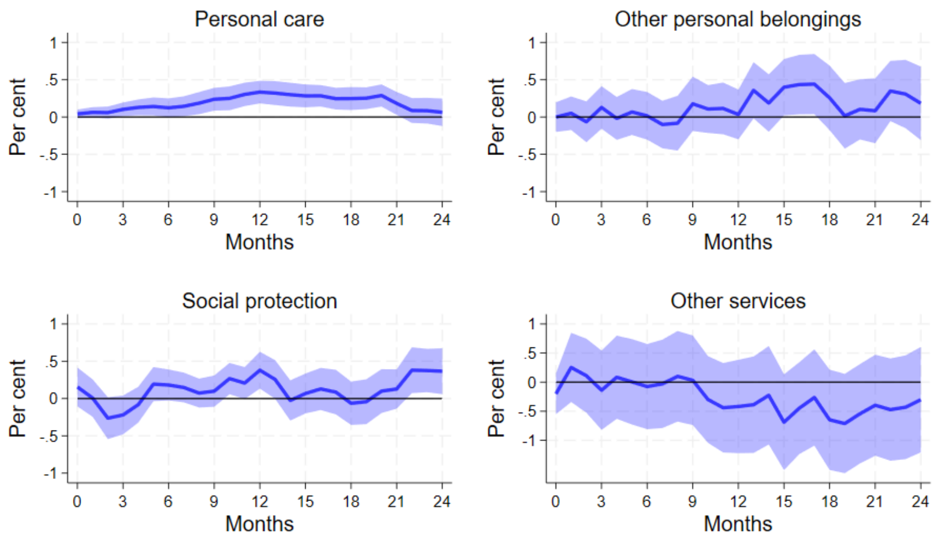
Figure 19. Impulse response functions of financial services to changes in the oil price



Notes: Impulse response functions to a 10 per cent increase in the real oil price driven by an oil supply news shock estimated using the instrumental variable local projections specification in Equation (1). The outcome variables are COICOP 121 "Insurances" and 122 "Financial services". Blue solid lines report point estimates and blue shaded regions report 90% heteroskedasticity-robust confidence bands. Sample period: 2000:1 to 2024:12.

Source: Statistics Sweden.

Figure 20. Impulse response functions of miscellaneous goods and services to changes in the oil price

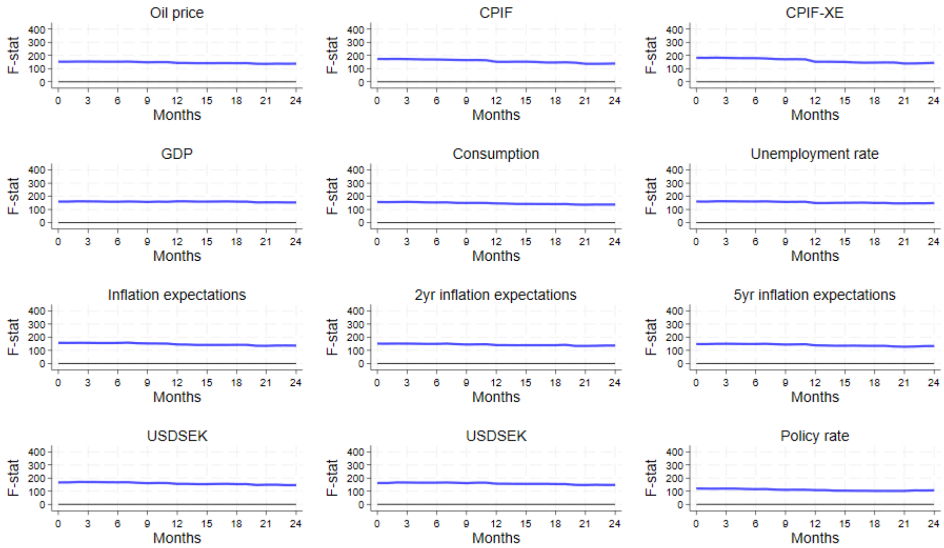


Notes: Impulse response functions to a 10 per cent increase in the real oil price driven by an oil supply news shock estimated using the instrumental variable local projections specification in Equation (1). The outcome variables are COICOP 131 "Personal care", 132 "Other personal belongings", 133 "Social protection", and 139 "Other services". Blue solid lines report point estimates and blue shaded regions report 90% heteroskedasticity-robust confidence bands. Sample period: 2000:1 to 2024:12.

Source: Statistics Sweden.

APPENDIX C – First-stage F-statistics

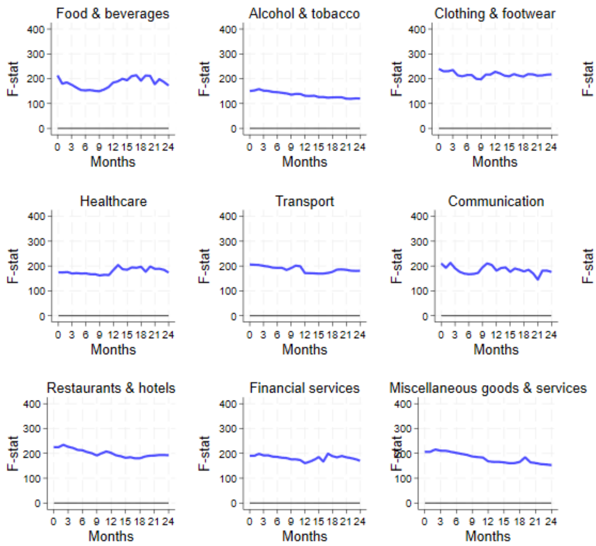
Figure 21. First-stage F-statistics: Aggregate data



Notes: First-stage F-statistics from the instrumental variable local projection specification in Equation (1). These F-statistics correspond to the impulse response function of the variables in Figure 2.

Source: Own calculations.

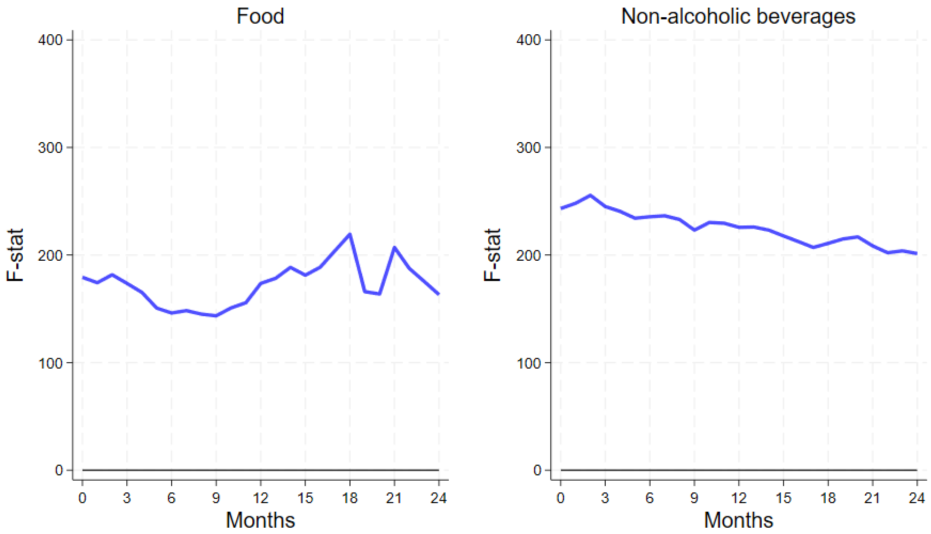
Figure 22. First-stage F-statistics: Subcategories of CPIF at the 2-digit COICOP level



Notes: First-stage F-statistics from the instrumental variable local projection specification in Equation (1). These F-statistics correspond to the impulse response function of the variables in Figure 3.

Source: Own calculations.

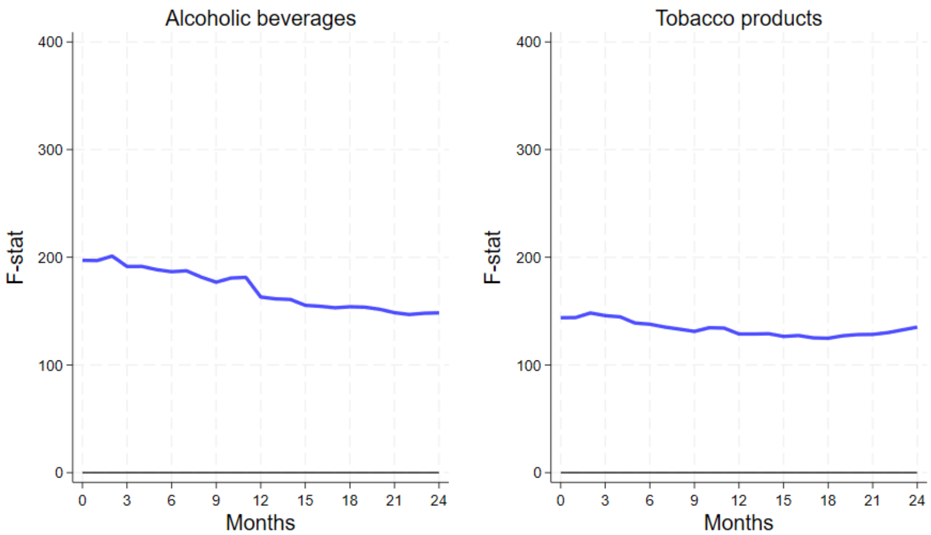
Figure 23. First-stage F-statistics: Food and beverages



Notes: First-stage F-statistics from the instrumental variable local projection specification in Equation (1). These F-statistics correspond to the impulse response function of the variables in Figure 8.

Source: Own calculations.

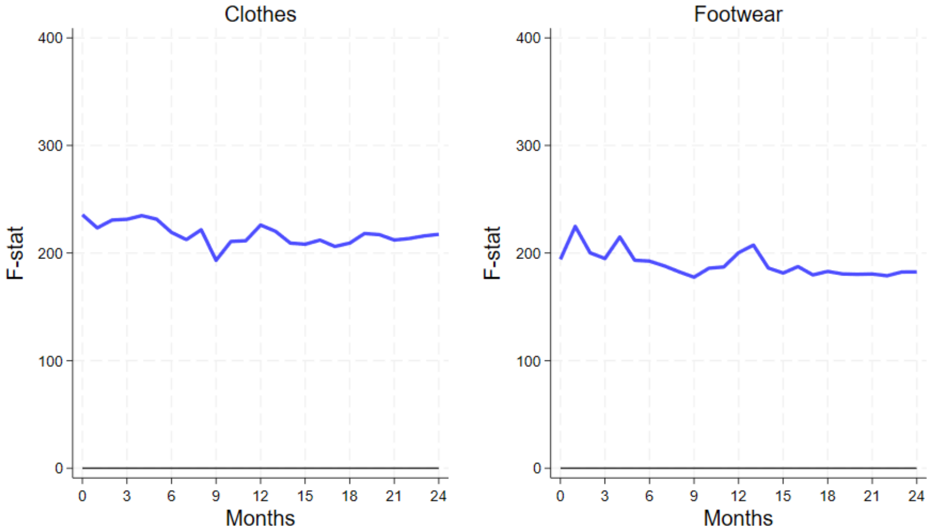
Figure 24. First-stage F-statistics: Alcohol and tobacco



Notes: First-stage F-statistics from the instrumental variable local projection specification in Equation (1). These F-statistics correspond to the impulse response function of the variables in Figure 9.

Source: Own calculations.

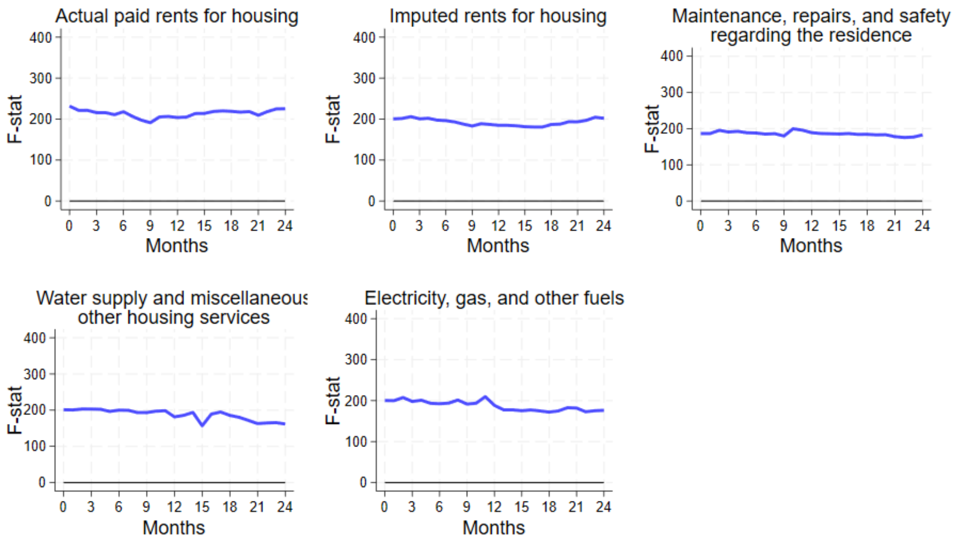
Figure 25. First-stage F-statistics: Clothing and footwear



Notes: First-stage F-statistics from the instrumental variable local projection specification in Equation (1). These F-statistics correspond to the impulse response function of the variables in Figure 10.

Source: Own calculations.

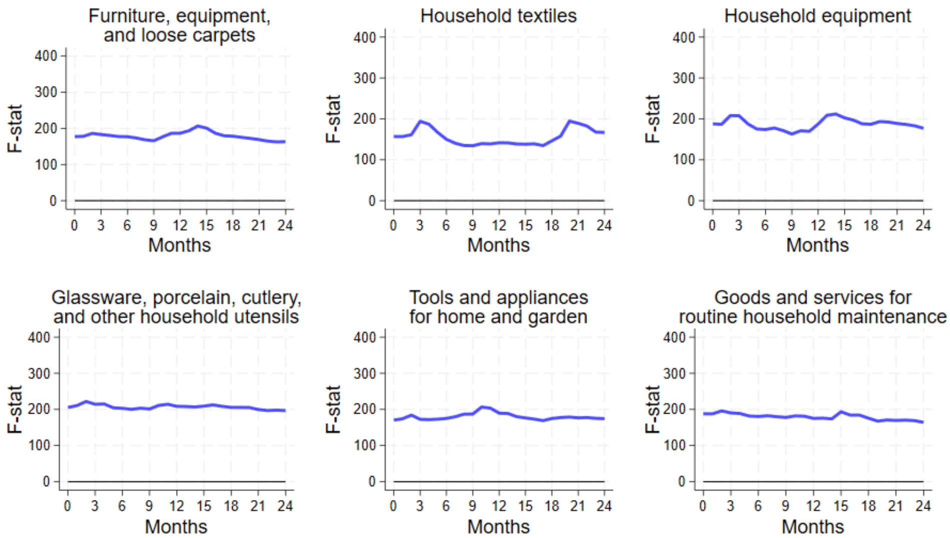
Figure 26. First-stage F-statistics: Housing and utilities



Notes: First-stage F-statistics from the instrumental variable local projection specification in Equation (1). These F-statistics correspond to the impulse response function of the variables in Figure 11.

Source: Own calculations.

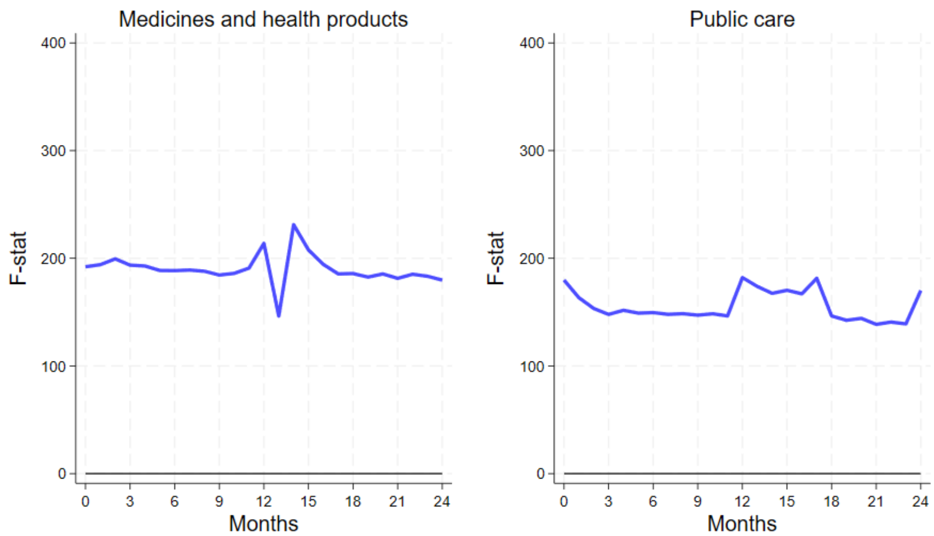
Figure 27. First-stage F-statistics: Household goods



Notes: First-stage F-statistics from the instrumental variable local projection specification in Equation (1). These F-statistics correspond to the impulse response function of the variables in Figure 12.

Source: Own calculations.

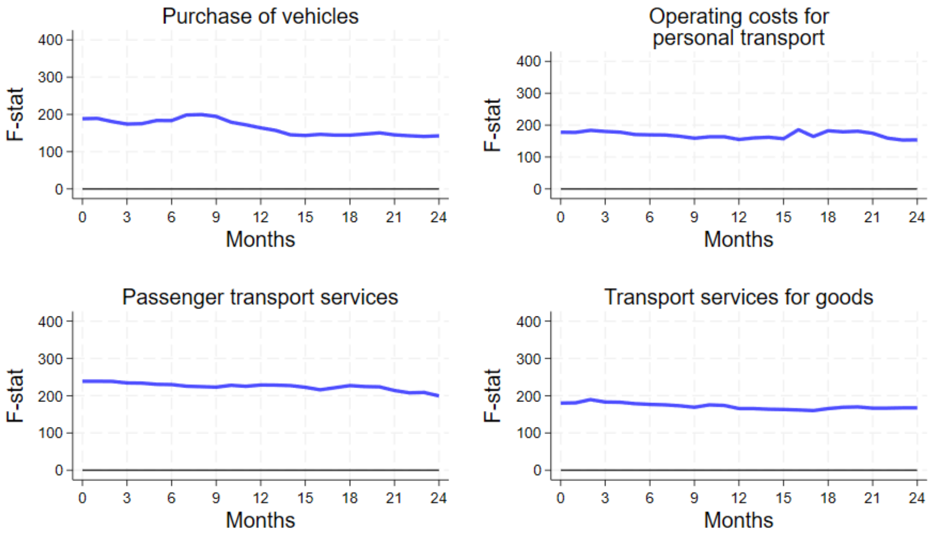
Figure 28. First-stage F-statistics: Healthcare



Notes: First-stage F-statistics from the instrumental variable local projection specification in Equation (1). These F-statistics correspond to the impulse response function of the variables in Figure 13.

Source: Own calculations.

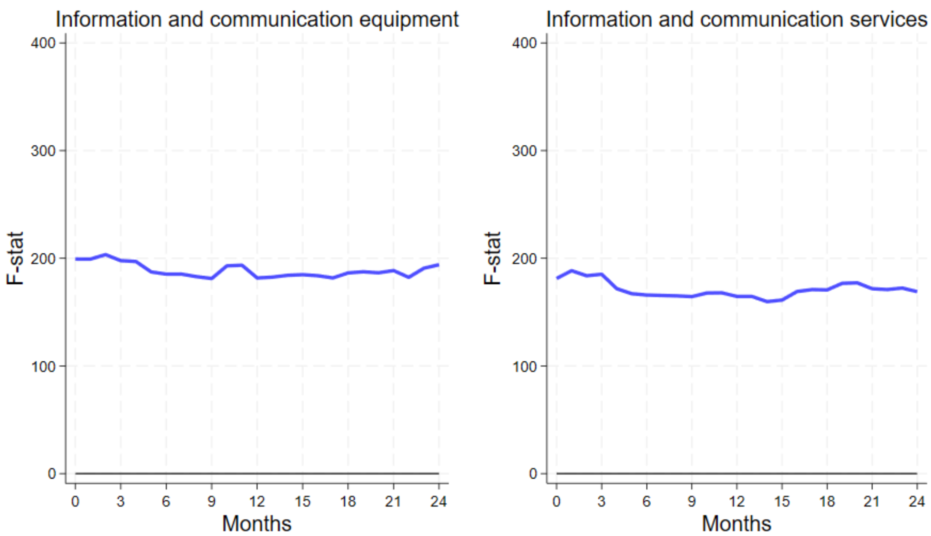
Figure 29. First-stage F-statistics: Transport



Notes: First-stage F-statistics from the instrumental variable local projection specification in Equation (1). These F-statistics correspond to the impulse response function of the variables in Figure 14.

Source: Own calculations.

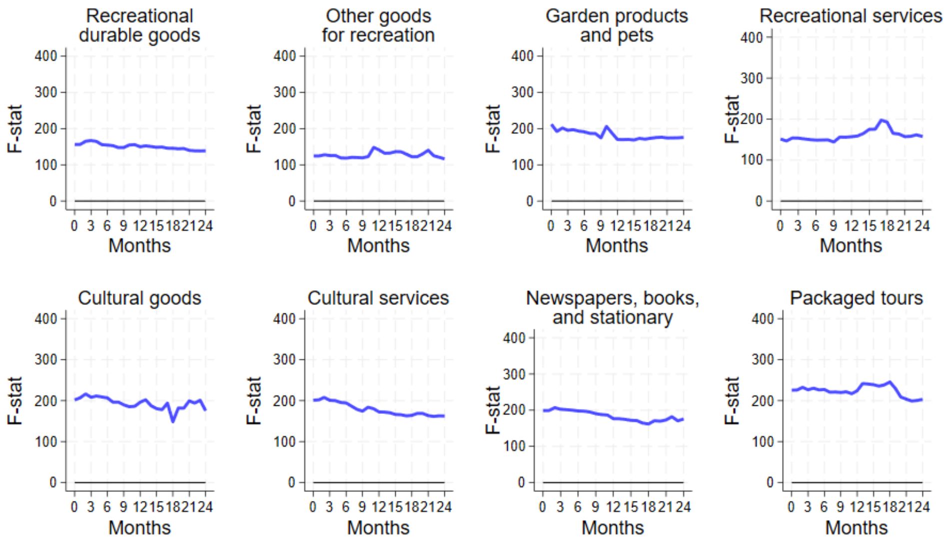
Figure 30. First-stage F-statistics: Communication



Notes: First-stage F-statistics from the instrumental variable local projection specification in Equation (1). These F-statistics correspond to the impulse response function of the variables in Figure 15**Fel! Hittar inte referenskälla.**.

Source: Own calculations.

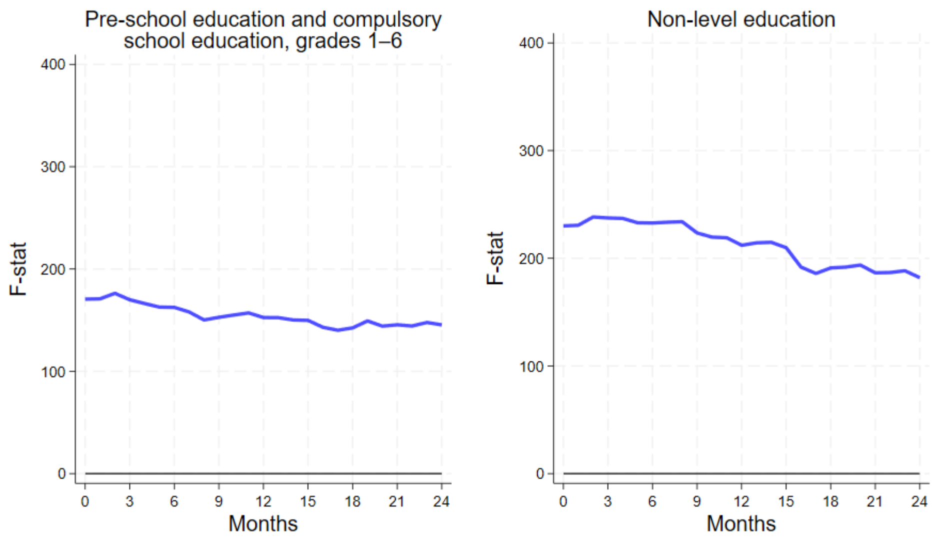
Figure 31. First-stage F-statistics: Recreation and culture



Notes: First-stage F-statistics from the instrumental variable local projection specification in Equation (1). These F-statistics correspond to the impulse response function of the variables in Figure 16.

Source: Own calculations.

Figure 32. First-stage F-statistics: Education



Notes: First-stage F-statistics from the instrumental variable local projection specification in Equation (1). These F-statistics correspond to the impulse response function of the variables in Figure 17.

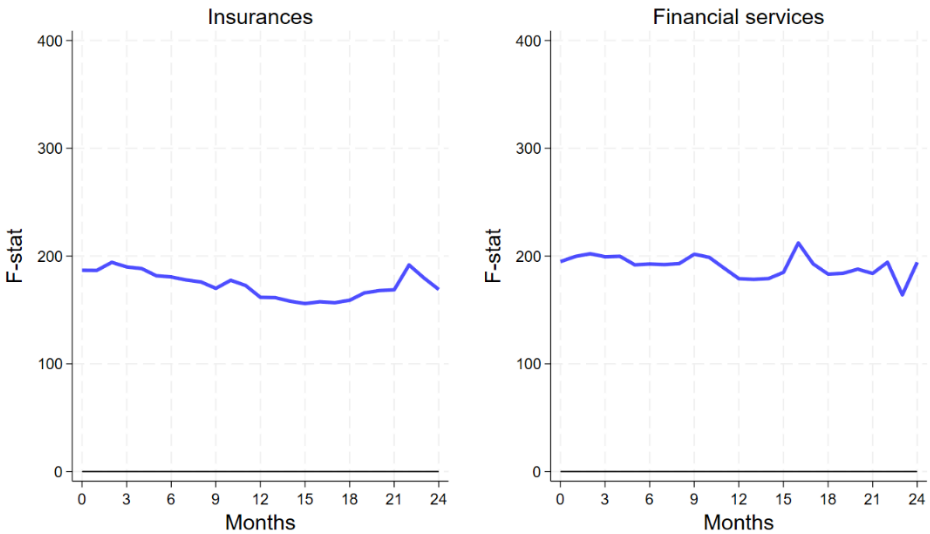
Source: Own calculations.

Figure 33. First-stage F-statistics: Restaurants and hotels

Notes: First-stage F-statistics from the instrumental variable local projection specification in Equation (1). These F-statistics correspond to the impulse response function of the variables in Figure 18.

Source: Own calculations.

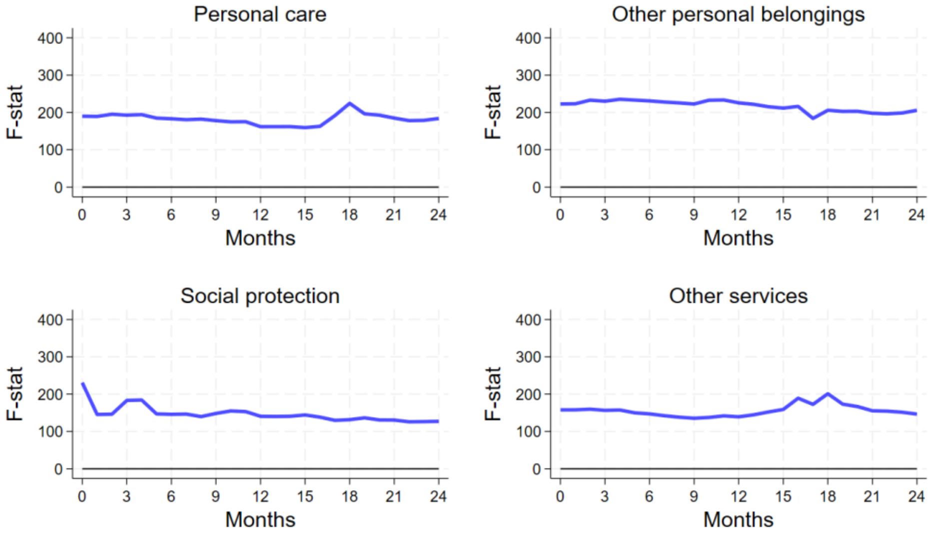
Figure 34. First-stage F-statistics: Financial services



Notes: First-stage F-statistics from the instrumental variable local projection specification in Equation (1). These F-statistics correspond to the impulse response function of the variables in Figure 19.

Source: Own calculations.

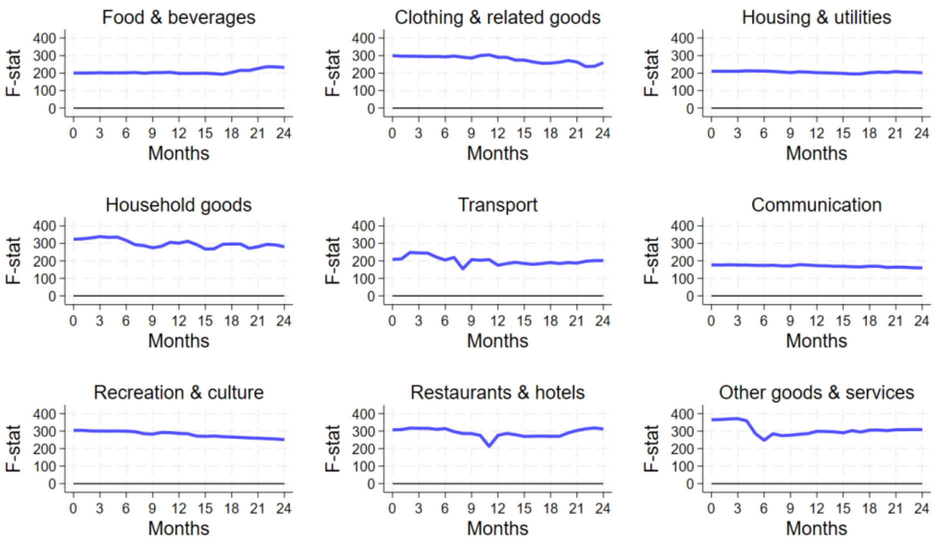
Figure 35. First-stage F-statistics: Miscellaneous goods and services



Notes: First-stage F-statistics from the instrumental variable local projection specification in Equation (1). These F-statistics correspond to the impulse response function of the variables in Figure 20.

Source: Own calculations.

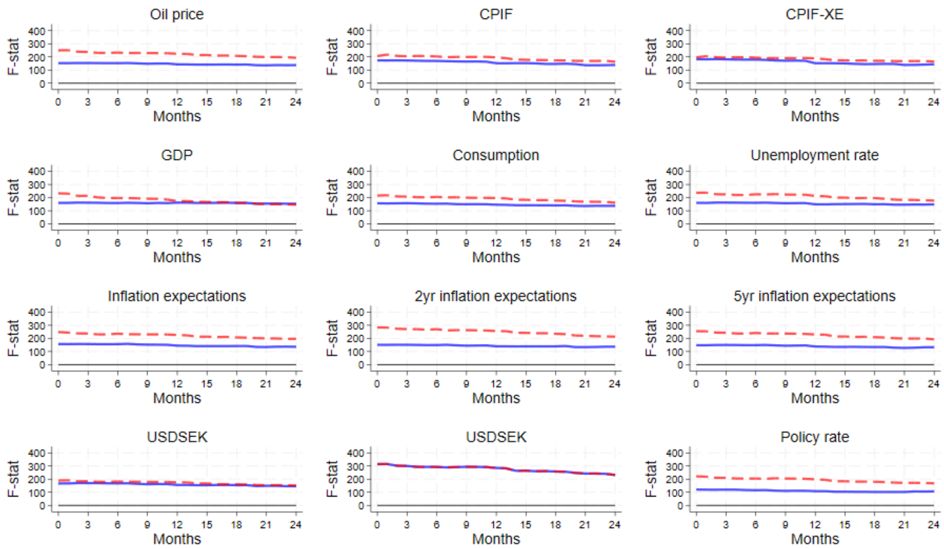
Figure 36. First-stage F-statistics: Subcategories of consumption



Notes: First-stage F-statistics from the instrumental variable local projection specification in Equation (1). These F-statistics correspond to the impulse response function of the variables in Figure 4.

Source: Own calculations.

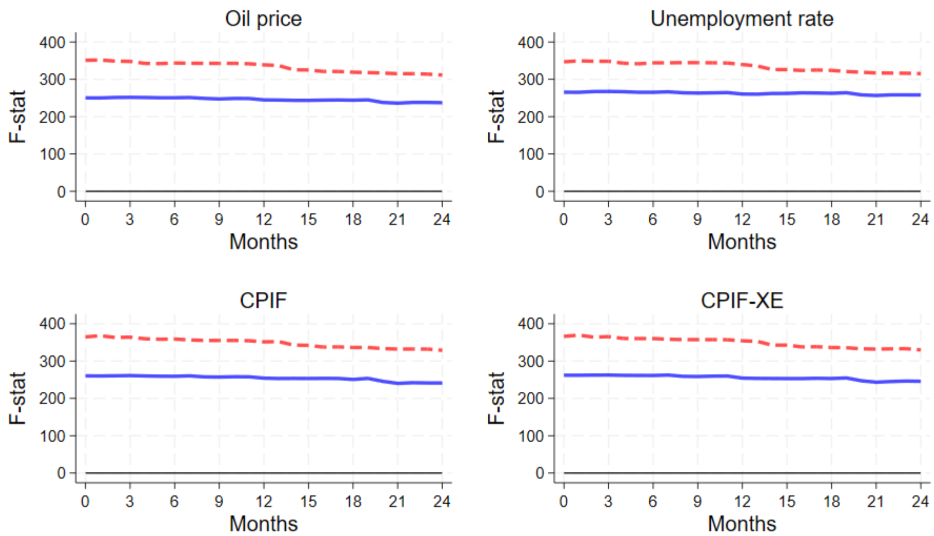
Figure 37. First-stage F-statistics: Aggregate data 2000:1 to 2019:12/2024:12



Notes: First-stage F-statistics from the instrumental variable local projection specification in Equation (1). These F-statistics correspond to the impulse response function of the variables in Figure 5. Blue line: 2000:1 to 2024:12 sample period. Red line: 2000:1 to 2019:12 sample period.

Source: Own calculations.

Figure 38. First-stage F-statistics: Aggregate data 1987:1 to 2019:12/2024:12



Notes: First-stage F-statistics from the instrumental variable local projection specification in Equation (1). These F-statistics correspond to the impulse response function of the variables in Figure 6. Blue line: 1987:1 to 2024:12 sample period. Red line: 1987:1 to 2019:12 sample period.

Source: Own calculations.

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