Short Lags of Monetary Policy in a Small Open Economy *

Jonas M. Bruhin[a], Winfried Koeniger[b,c],

and Lion Szlagowski[b]

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Abstract

We estimate the transmission of monetary policy to expenditures in a small open economy using novel, granular, transactional data. We find that monetary policy shocks trigger exchange-rate movements, and have significant short run effects on expenditures. A restrictive shock of one standard deviation *increases* expenditures by up to 0.75 percentage points 1 – 1.5 months after the shock, consistent with the real income channel of monetary policy. We quantify the contribution to the expenditure response by expenditure category, country of residence of the purchaser, and distance to the border of the location of purchase.

Keywords: Monetary Policy Transmission, Consumption, Expenditures, Transactional Payment Data, Switzerland, Germany.

JEL-codes: D12, E21, E52.

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a: Swiss National Bank; *b*: SEW-HSG; *c*: Department of Economics, University of St.Gallen; CESifo, CFS, IZA, and Swiss Finance Institute.

1 Introduction

The transmission of monetary policy has been analyzed for centuries. Transactional data, which have become available in recent years, allow to have a fresh look at this transmission. The granular, high frequency data on transactions provide new insights on the speed with which monetary policy shocks affect the economy, and the composition of the response across expenditure categories and locations.

We contribute to the literature by estimating the short-run expenditure response to monetary policy shocks in a small open economy. To the best of our knowledge, we are the first to provide evidence on the short-run effects of monetary policy on expenditures in a textbook small open economy. We find that expenditures *increase* after a restrictive monetary policy shock in the short run, which is consistent with the income channel associated with exchange-rate movements triggered by monetary policy shocks.

A restrictive monetary policy shock of one standard deviation *increases* expenditures by up to 0.75 percentage points 1 – 1.5 months after the shock. Analogously, an expansionary monetary shock *decreases* expenditures in the short run. We illustrate how much different expenditure categories, foreign and domestic purchasers, or locations with different distance to the border, contribute to the short-run response of expenditures.

We find that (i) expenditures in regions closer to the border contribute more than proportionally to the positive expenditure response after a restrictive monetary policy shock, suggesting a stronger income channel in these regions; and that (ii) shifts of domestic purchases by foreign residents change the short-run expenditure response by up to 15 basis points (about a third of the overall short-run response at the same horizon), illustrating the quantitative importance of such expenditure shifts in a small open economy.

We estimate the expenditure response to monetary policy shocks in Switzerland, a textbook small open economy. We benchmark the responses to those estimated for Germany, the largest economy in the euro area. Germany is similar to Switzerland in many respects but has an asymmetry in the exposure of expenditures to movements in the CHF/EUR exchange rate that is useful for interpreting the estimation results. Indeed, we estimate negative expenditure responses to restrictive monetary policy shocks in Germany.

Our analysis proceeds in the following steps. After discussing the most closely related literature, we describe the transactional payment data and the monetary policy shocks in Section 2. In Section 3, we then provide a conceptual framework to decompose the aggregate expenditure response across expenditure categories, the residence of the purchaser, and the location of purchase. We discuss the estimated specification in Section 4, and show in Section 5 how exchange rates respond to the monetary policy shocks. In Section 6, we present the expenditure response to monetary policy shocks, including a decomposition by expenditure category, residence of the purchaser, and the location of purchase. We conclude in Section 7.

Related literature

The literature on monetary policy transmission is vast so that we focus on the most closely related, recent literature in the following paragraphs. Our analysis builds on the literature that estimates the short-run responses to monetary policy shocks using transactional data (Buda et al., 2025, Brandt et al., 2025, Grigoli and Sandri, 2026). Focusing on a small open economy, we show that exchange-rate movements modify monetary policy transmission, changing the sign of the expenditure response to monetary policy shocks in the short run.

Auer et al. (2021, 2024), Brown et al. (2025) and Felber (2026) analyze the expenditure response to the large exchange-rate shock in Switzerland in 2015. We analyze the transmission of monetary policy through unexpected interest-rate changes, of which the associated exchange-rate movements are a part.

Using high-frequency data, e.g., Ranaldo and Rossi (2010) have shown that monetary policy announcements transmit to exchange rates. Although the exchange-rate movements associated with typical monetary policy shocks are smaller than the large exchange-rate shock in 2015, our evidence suggests significant short-run effects of these exchange-rate movements on the monetary policy transmission to expenditures. We focus on the later sample period 2018-2025, for which we have granular transactional data on expenditures both for Switzerland and Germany.

We provide evidence for the quantitative importance of the income channel implied by the exchange-rate movements triggered by monetary policy in the short run. These findings relate to the quantitative results for a small open economy in a heterogeneous agent New Keynesian (HANK) model by Auclert et al. (2024). They show that the currency appreciation associated with restrictive monetary policy shocks makes imports cheaper, increases the real income of domestic residents, and can thus reverse the sign of the consumption response to monetary policy shocks.

Our findings further relate to Conrad et al. (2025) who find that inflation forecasts are not predictable beyond 3 quarters, consistent with empirically relevant short lags of monetary policy transmission.

2 Data

We use transactional expenditure data for Switzerland and Germany together with data on interest-rate futures for our analysis. We briefly present these two main data sources.

2.1 Transactional expenditure data

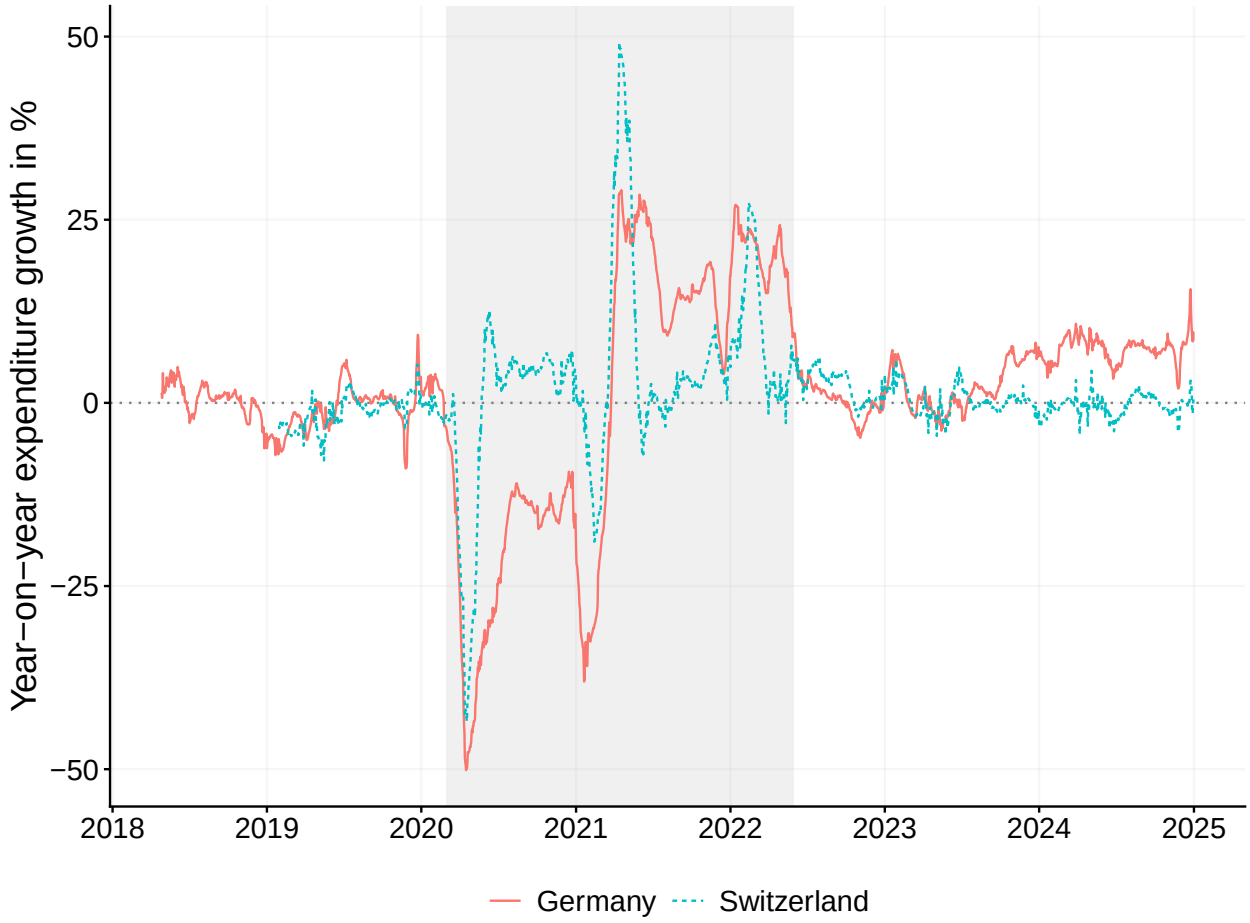
We use transactional data from Worldline for Switzerland, and from Fable Data for Germany in the period 2018-2025. Both data sets contain detailed information on expenditures made with cards. The data sets cover expenditures that are not made by bank transfers

or cash, and capture variation in aggregate expenditures well. See Brown et al. (2023) and Bruhin et al. (2025) for a descriptive analysis and validation of the transactional data from Worldline for Switzerland, and Koeniger et al. (2025) for the analogous analysis for the transactional data from Fable Data for Germany.

Although the two data sets are quite similar in terms of the information they contain, there are some differences that are relevant for our analysis. The transactional data provided by Worldline are so-called acquiring data, i.e., data from the merchant terminals used either at the point of sale or for e-commerce. The transactional data from Fable Data are so-called issuing data instead, i.e., data from the card providers.

This implies slight differences in terms of coverage of the expenditure. Whereas the acquiring data for Switzerland allow us to measure expenditures in Switzerland by domestic and foreign cardholders, we do not observe the expenditures of Swiss cardholders abroad. The issuing data for Germany instead allow us track the expenditures of German cardholders abroad but we do not observe the expenditures of all foreign cardholders in Germany.

Figure 1: Year-on-year real expenditure growth rates



Notes: Year-on-year real expenditure growth rates after applying a 28-day backward-looking moving average. Nominal expenditures are deflated with the CPI. The excluded time period from March 1, 2020 to May 31, 2022 is shaded.
Sources: Own computations based on the data from Fable Data and Worldline.

Figure 1 illustrates the year-on-year expenditure growth rates in Switzerland and Germany, after applying a 28-day backward-looking moving average to the transactional data. The figure shows large swings in the expenditure growth because of the COVID-19 pandemic. These large swings imply that we cannot identify expenditure responses resulting from monetary policy shocks in a robust way during this time period, as further discussed in Appendix A.2. We thus exclude the time period from March 1, 2020 to May 31, 2022 for the analysis of spending responses to monetary policy shocks, as illustrated by the shaded period in Figure 1. Table 1 provides summary statistics for the real expenditure growth rates, showing a quantitatively similar volatility as the comparable high-frequency expenditure data in Buda et al. (2025).

Table 1: Summary statistics for year-on-year real expenditure growth rates (in %)

	Mean	SD	Min	Max
Panel A: Full sample				
Switzerland	1.37	8.72	-43.50	49.21
Germany	1.17	13.03	-50.14	28.86
Panel B: Excluding Covid period				
Switzerland	0.02	2.19	-7.86	6.09
Germany	2.15	3.88	-8.95	15.58

Notes: Summary statistics of year-on-year real expenditure growth rates at a daily frequency, after applying a 28-day backward-looking moving average. Nominal expenditures are deflated with the CPI. The excluded time period in Panel B is from March 1, 2020 to May 31, 2022.
Sources: Own computations based on the data from Fable Data and Worldline.

2.2 Monetary policy shocks

As is common in the literature, we use data on price changes for contracts of interest-rate futures to construct monetary policy shocks in tight time windows around monetary policy announcements (e.g., Altavilla et al., 2019). We use monetary policy shocks based on the announcements of the Swiss National Bank (SNB), European Central Bank (ECB) and the Federal Reserve (Fed). Using shocks of the SNB as well as the ECB and the Fed not only results in more events for the estimation but also allows us to analyze expenditure effects through exchange-rate movements further, given that the euro area and the US are the main trading partners of Switzerland. We use the futures contracts on the three-month SARON to construct the monetary policy shocks for the SNB because the policy rate targets the three-month SARON (or the LIBOR before 2022). Analogously, we use the three month Euribor for the ECB, and the three-month federal funds rate for the Fed.

We follow Buda et al. (2025) and Jarociński and Karadi (2020) and use the first principal component of surprises in the price of futures contracts maturing in quarters up to four quarters ahead, and then purge the monetary policy shocks from possible information effects as proposed by Jarociński and Karadi (2020). The black bars in Figure 2 display the monetary policy shocks during the sample period, which are not always associated with movements of the policy rate in the same direction. This is because the shocks capture the unexpected component, which is also purged from possible unexpected information effects.

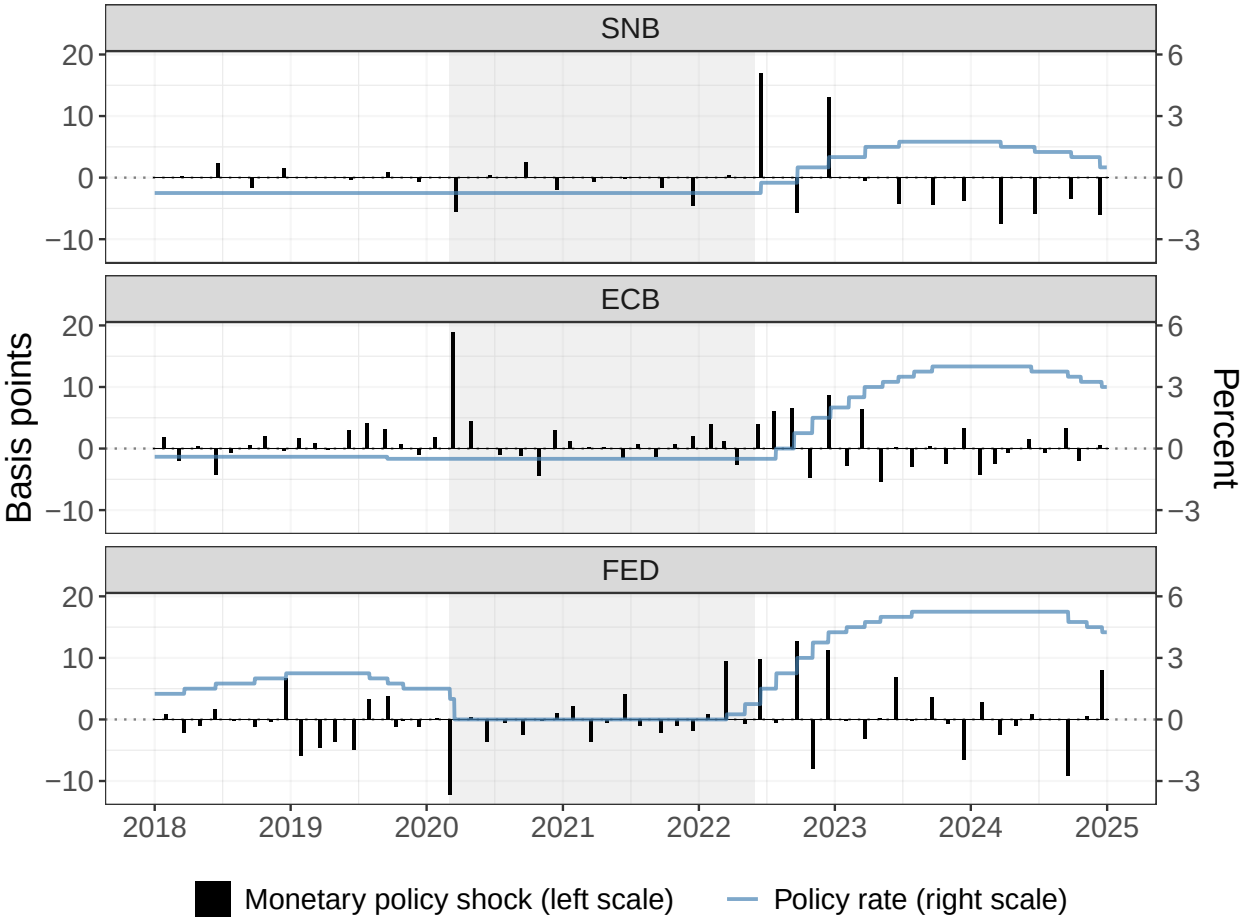
Figure 2 reveals that there are very few monetary policy shocks resulting from monetary policy announcements of the SNB in the period from 2018 to 2021, when the policy rate was in negative territory at –0.75% in Switzerland and close to, if not at, the effective lower bound.

As mentioned above, we exclude the time period from March 1, 2020 to May 31, 2022 because expenditure swings during the COVID-19 pandemic do not allow to identify expenditure responses resulting from monetary policy shocks in a robust way. We thus exclude the shocks in the period that is shaded in Figure 2.

Table 2 provides summary statistics for the monetary policy shocks in units of basis points. The shocks are approximately zero on average (less than a basis point) and the standard deviation of the shocks is slightly larger for the SNB than for the ECB and Fed. This is associated with the more frequent monetary policy announcements of the ECB or Fed, implying twice as many announcements of the ECB or Fed than of the SNB in our sample period.

Table 3 displays the cross-correlations between the monetary policy shocks of the three central banks (the SNB, ECB, and the Fed), after we consolidate the shocks at a quarterly frequency by summing them within a quarter. The table shows that the *unexpected* component of monetary policy is uncorrelated across the three considered central banks, particularly in the sample period we consider that excludes the COVID-19 crisis. The sys-

Figure 2: Monetary policy shocks and the policy rates during the sample period



Notes: Unexpected changes of the monetary policy rate, calculating unexpected changes of the 3-month futures on the respective interest rats mentioned in the main text, between the end of the announcement day and the day before. We apply the standard identification of monetary policy shocks, based on the first principal component of surprises to futures' contracts up to four quarters ahead, and apply the median rotation as described in the latest update of the shock series by Jarociński and Karadi (2020). We thus obtain pure monetary policy shocks (black bars). The shaded period is the period excluded in the estimation. The policy rates are the SNB policy rate, the rate on the deposit facility (ECB), and the lower limit of the federal funds target range (FED).
Sources: SNB: Own computations based on data from Bloomberg; updated shock series from Nitschka and Ramelet (2023) and Koeniger et al. (2022), based on Jarociński and Karadi (2020). ECB and FED: Updated shock series provided by Jarociński and Karadi (2020).

tematic component of monetary policy is highly correlated instead, as illustrated by the similar path of the policy rates in Figure 2. Because the monetary policy shocks across the three central banks are not correlated much, the estimates of the local projections in our benchmark specification remain essentially unchanged if we estimate the expenditure responses to the monetary policy shocks of the three central banks jointly or separately.[1]

[1]The results of this robustness check are not reported for brevity.

Table 2: Summary statistics for monetary policy shocks in basis points

	N	Mean	Median	SD	Min	Max
Panel A: Full sample						
SNB	28	-0.74	-0.73	5.25	-7.51	16.92
ECB	56	0.87	0.47	3.87	-5.44	18.99
FED	58	0.12	-0.33	4.67	-12.31	12.74
Panel B: Excluding Covid period						
SNB	19	-0.48	-0.70	6.19	-7.51	16.92
ECB	38	0.63	0.47	3.31	-5.44	8.74
FED	40	0.48	-0.28	4.87	-9.18	12.74

Notes: Summary statistics for pure monetary policy shocks. The excluded period in Panel B is the time period from March 1, 2020 to May 31, 2022.
Sources: Own computations based on the monetary policy shocks described above.

Table 3: The correlation of monetary policy shocks

	SNB	ECB	FED
Panel A: Full sample			
SNB	1.00		
ECB	-0.02	1.00	
FED	0.29	-0.14	1.00
Panel B: Excluding Covid period			
SNB	1.00		
ECB	0.00	1.00	
FED	0.03	-0.20	1.00

Notes: Correlations for pure monetary policy shocks, consolidated by quarter. The excluded period in Panel B is the time period from March 1, 2020 to May 31, 2022.
Source: Own computations based on the monetary policy shocks described above.

3 Conceptual background

Before we present the estimation strategy, it is instructive to provide a conceptual framework to structure our analysis. In a small open economy, monetary policy transmission to expenditures not only has an intensive but also an extensive margin. Monetary policy then does not only change the relative price between current and future consumption but also the relative price between spending domestically or abroad through changes of the exchange rate. After an increase in the policy rate that induces a currency appreciation, for example, domestic residents may take advantage of the relative price change and shop abroad or spend their vacation in foreign destinations. An exchange-rate appreciation may

also induce foreigners to spend their vacation elsewhere or cut down on their spending during their visits. Thus, an analysis of the monetary policy transmission depends on elasticities that capture the strengths of the (cross-border) expenditure shifts triggered by behavioral adjustments of domestic residents and foreigners at the extensive as well as intensive margin.

To fix ideas, denote consumption expenditure of domestic residents in the small open economy, i.e., the home country h, by c_h^d and their consumption abroad by $c_{\tilde{h}}^d$. Analogously, denote consumption expenditures of foreigners in country h, in units of currency of country h, as c_h^f and their other consumption as $c_{\tilde{h}}^f$. Thus, consumption expenditures of items in category j in the home country h is composed of consumption by domestic residents and foreigners as given by

$$c_{j,h} = c_{j,h}^d + c_{j,h}^f. \tag{1}$$

The consumption share $\alpha_{j,h} \equiv c_{j,h}^d / c_{j,h}$ tells us how much domestic residents contribute to expenditures in each category j in the home country.

The consumption expenditures $c_{j,h}^d$ and $c_{j,h}^f$ can be further decomposed into expenditures that are produced domestically or imported from abroad. That is,

$$c_{j,k}^x = c_{j,k}^{x,d} + c_{j,k}^{x,f} \ , \tag{2}$$

with $x \in \{d, f\}$ and $k \in \{h, \tilde{h}\}$, and the second superscript denotes the country where the good is produced. The share $\delta_{j,h}^x \equiv c_{j,h}^{x,d} / c_{j,h}^x$ denotes the expenditure share of domestically produced goods in category j for domestic residents if $x = d$, and for foreign residents if $x = f$. The expenditures $c_{j,h}^{d,f}$ denote spending of domestic residents on imports in the home country (in local currency, after applying the exchange rate), which account for share $1 - \delta_{j,h}^d$ of the spending of domestic residents in category j. We distinguish imports because movements in the exchange rate do not only change the relative price of imported goods (especially if these goods are priced at the source) but also imply income effects. An appreciation can make imports cheaper and thus increase the real income of domestic residents. This channel can reverse the sign of the consumption response to monetary policy shocks (Auclert et al., 2024).

Aggregate expenditures in the small country are given by

$$c_h = \sum_{j=1}^{J} c_{j,h} \ , \tag{3}$$

where $\omega_j \equiv c_{j,h} / c_h$ denotes the share of expenditures in category j in the home country.

Based on the notation introduced above for the expenditure components, aggregate expenditures in the home country are thus:

$$c_h = \sum_{j=1}^{J} \left(c_{j,h}^{d,d} + c_{j,h}^{d,f} + c_{j,h}^{f,d} + c_{j,h}^{f,f} \right) \ . \tag{4}$$

Aggregate expenditures consist of expenditures by domestic and foreign residents in the home country on domestically and foreign produced goods and services, respectively. In terms of percentage changes,

$$\begin{aligned}\frac{\Delta c_h}{c_h} &= \sum_{j=1}^{J}\left(\frac{c_{j,h}^{d,d}}{c_h}\frac{\Delta c_{j,h}^{d,d}}{c_{j,h}^{d,d}}+\frac{c_{j,h}^{d,f}}{c_h}\frac{\Delta c_{j,h}^{d,f}}{c_{j,h}^{d,f}}+\frac{c_{j,h}^{f,d}}{c_h}\frac{\Delta c_{j,h}^{f,d}}{c_{j,h}^{f,d}}+\frac{c_{j,h}^{f,f}}{c_h}\frac{\Delta c_{j,h}^{f,f}}{c_{j,h}^{f,f}}\right) \\ &= \sum_{j=1}^{J}\left(\delta_{j,h}^{d}\alpha_{j,h}\omega_j\frac{\Delta c_{j,h}^{d,d}}{c_{j,h}^{d,d}}+(1-\delta_{j,h}^{d})\alpha_{j,h}\omega_j\frac{\Delta c_{j,h}^{d,f}}{c_{j,h}^{d,f}}+\delta_{j,h}^{f}(1-\alpha_{j,h})\omega_j\frac{\Delta c_{j,h}^{f,d}}{c_{j,h}^{f,d}}+(1-\delta_{j,h}^{f})(1-\alpha_{j,h})\omega_j\frac{\Delta c_{j,h}^{f,f}}{c_{j,h}^{f,f}}\right),\end{aligned} \tag{5}$$

where the second equation decomposes the share of the respective expenditure component in terms of aggregate expenditures into the sequence of shares defined above.

Changes in aggregate expenditures thus depend on the changes of the expenditure components. Percentage changes of the expenditure components contribute more to aggregate expenditure changes in percent if the share of the respective expenditure component in terms of aggregate expenditures is higher.

Making the composition of expenditures in the home country explicit, it becomes clear that monetary policy does not only transmit through intertemporal spending shifts but also through interregional cross-border spending shifts, by affecting both expenditures of domestic residents and foreigners.

Specifically, a change of the policy rate with an associated change in the exchange rate transmits to the expenditures in the home country by affecting spending of domestic residents and foreigners where differences of the dynamic responses by domestic residents and foreigners imply changes of the shares $\alpha_{j,h}$ over time. Changes of exchanges rates may transmit to the prices of imports relative to domestically produced goods and thus change the shares $\delta_{j,h}^{x}$ over time. Because the dynamic responses generally will differ across expenditure items j, the shares ω_j will also change over time.

In other words, the dynamic aggregate response of expenditures to monetary policy shocks depends on compositional changes, both because expenditure categories may become more or less important for the aggregate response over time, and because, within an expenditure category, the response of domestic residents or foreigners may become quantitatively more or less important. The response is determined both by the usual intertemporal shifts of expenditures that are present also in a closed economy, as well as interregional shifts between expenditures at home and abroad triggered by exchange-rate movements.

Ideally, we would estimate the dynamic response of $c_{j,h}^{d}$, $c_{j,\tilde{h}}^{d}$, $c_{j,h}^{f}$, and $c_{j,\tilde{h}}^{f}$, i.e., the response of expenditures per category j for domestic residents d and foreigners f, both in the home country h and elsewhere ($\tilde{h}$).

Our main data from Worldline covers expenditures in the home country by domestic residents and foreigners. We use information from Fable Data on expenditures of German cardholders in their home country to estimate the shifts between $c^f_{j,h}$, and $c^f_{j,\tilde{}h}$ for that subgroup. We further use differences in the response of expenditures of domestic residents in the home country, across regions that are close or further away from the border, together with supplementary information from the household budget survey (HBS). This allows us to gauge the quantitative importance of expenditure shifts from the home country to countries abroad.

As a result, we will estimate the short-run response of consumption expenditures together with the estimated contribution of expenditure by domestic residents and foreigners per expenditure category. Understanding the composition effects is crucial for interpreting the dynamic response of expenditures at the aggregate level.

4 Estimation

We estimate the short-run response of expenditures to monetary policy shocks. We focus on the monetary policy transmission to expenditures in Switzerland and Germany for a horizon up to 100 days after the shock (i.e., slightly more than a quarter after the shock).

The acquiring data of Worldline implies that we estimate the effect of monetary policy shocks on expenditures in Switzerland, including the expenditures of foreign residents who visit Switzerland but excluding the expenditure of Swiss residents abroad. This is the expenditure measure that is relevant to monetary policy makers if they have the goal to stimulate or dampen demand in Switzerland. The data allow us to distinguish how much of the response of expenditures in Switzerland to monetary policy shocks can be attributed to Swiss residents versus foreign residents. We can also estimate to which extent monetary policy shocks of the European Central Bank (ECB) transmit to expenditures in Switzerland by foreign residents from the euro area.

We estimate the standard local projection for year-on-year expenditure growth rates (e.g., Buda et al., 2025) at the daily frequency:

$$\begin{aligned} g^c_{t+h} =& \alpha_h + \beta_{SNB,h}\text{shock}_{SNB,t} + \beta_{ECB,h}\text{shock}_{ECB,t} + \beta_{FED,h}\text{shock}_{FED,t} \\ &+ \sum_{\ell=1}^{p} \phi_{h,\ell} g^c_{t-\ell} + \gamma_h X_t + \epsilon_{t+h} \end{aligned} \tag{6}$$

where g^c is the year-on-year expenditure growth rate, p is set to allow lags up to 90 days, the horizon $h \in \{0, ..., 100\}$, and X_t contains further controls that we add to disentangle the effect of exchange-rate and interest-rate shocks, and controls for the incidence of the COVID-19 pandemic.[2] The latter are particularly relevant when we assess the robustness of

[2]The (log) expenditure level depends on the interest rate so that (unexpected) changes of the interest rate affect the expenditure growth rate. As mentioned in Section 2, we apply a 28-day backward-looking moving

the results to including the pandemic episode into the sample period (see Appendix A.2).

We estimate specification (6) for Switzerland and Germany. We expect differences in the short-run monetary policy transmission across the two countries because the exchange-rate channel of monetary policy transmission should be more important in a textbook small open economy such as Switzerland relative to Germany. We further explore whether the monetary policy shocks of the ECB and the Fed play a distinct role in Switzerland through their effect on spending of foreign cardholders in Switzerland, and how this compares to Germany.

5 The response of exchange rates to monetary policy shocks

We illustrate to which extent monetary policy shocks result in exchange-rate shocks in our sample period.[3] Exchange-rate shocks imply changes of relative prices for goods produced abroad within the first quarter after the shock, as shown by Auer et al. (2021) in the context of the appreciation of the Swiss franc in 2015. The pass-through becomes stronger over an annual horizon, also extending to prices of goods produced domestically.

A swift pass through of exchange-rate shocks to prices of consumer goods, which is expected to propagate over time, implies salient price changes for consumers. Such changes potentially trigger shifts in the composition of domestic expenditures, as discussed in Section 3.[4] This transmission channel of monetary policy in a small open economy is stronger in Switzerland than in Germany because of the larger exchange-rate exposure of consumers indicated by (i) the higher import content of final consumption in Switzerland than in Germany (OECD, 2025) and (ii) the larger share of imports from countries outside the own currency area in Switzerland (100%) than in Germany. This may explain the different short-run expenditure responses to monetary policy shocks in Switzerland relative to Germany, which we document in Section 6.

We proceed by providing evidence on the exchange-rate shocks associated with the monetary policy announcements. Figure 3 illustrates the effect of the SNB's monetary policy announcement on the CHF/EUR and CHF/US-$ exchange rate, on which we focus because the euro area and the US are the main trading partners of Switzerland. We also display the US-$/EUR exchange rate in the figure because it should be unaffected by the SNB's monetary policy announcement. To identify the exchange-rate shock implied by the monetary policy announcement as, e.g., in Kearns and Manners (2006) and Faust et al. (2007), we follow Jarociński and Karadi (2020) and use a half-hour window, beginning 10 minutes before and ending 20 minutes after the announcement.

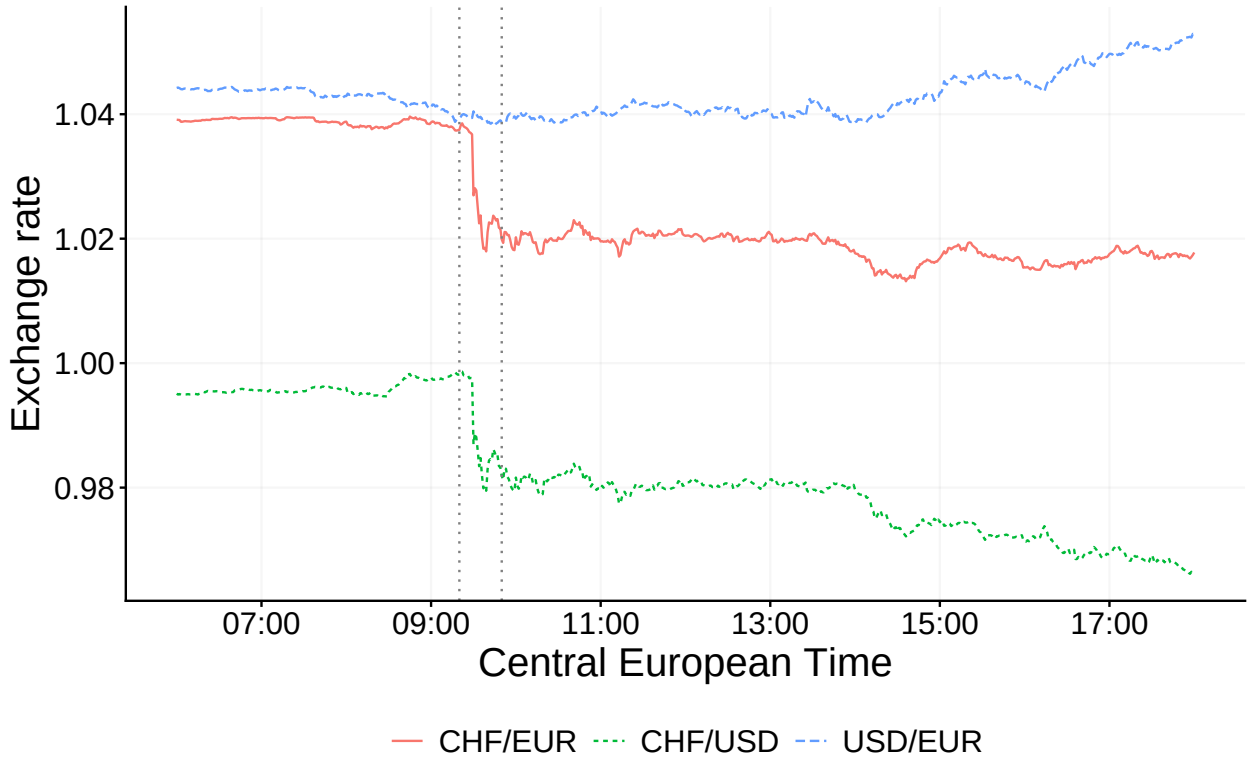
Figure 3 shows that the unexpected monetary policy shock of 17 basis points, associated with the announcement on June 16, 2022, triggered a sizable appreciation of the Swiss franc

average to the expenditure levels as in Buda et al. (2025).

[3]The transmission to interest rates with different maturities is documented, for example, in Nakamura and Steinsson (2018) for the US and in Koeniger et al. (2022) for the Germany and Switzerland.

[4]Indeed, Auer et al. (2021) provide evidence for expenditure switching in retail using Nielsen homescan data, in the context of the appreciation of the Swiss france in 2015.

Figure 3: Exchange rates on the day of the SNB monetary policy announcement on June 16, 2022



Notes: The time window of the monetary policy announcement is indicated with dotted vertical lines. The monetary policy announcement implied an unexpected positive monetary policy shock of 17 basis points. The decrease of the CHF/EUR and CHF/USD exchange rates after the announcement imply an appreciation of the CHF against the Euro and the USD.
Source: Own computations based on https://www.dukascopy.com/swiss/english/marketwatch/historical/, accessed in December 2025.

of almost 2 percent. As expected, the US-$/EUR exchange rate remained unchanged.

Table 4 shows that these patterns extend to the other monetary policy announcements in our sample, and that the shocks to the CHF/EUR and CHF/US-$ exchange rates are highly correlated. The lack of correlation with the EUR/US-$ exchange rate confirms that the exchange-rate movements triggered by the SNB's monetary policy announcements are driven by changes of the valuation of the Swiss franc rather than the euro or US-$.

Figure 4 illustrates that, across monetary policy announcements, the monetary policy shocks and the exchange-rate shocks are negatively correlated in our benchmark sample period labeled as *No Covid*.[5] The correlation coefficient is −0.73. Thus, as one may expect, restrictive SNB monetary policy shocks are associated with an appreciation of the Swiss franc, whereas expansionary SNB monetary policy shocks are associated with a depreciation of the Swiss franc.

Table 6 in Appendix A.4 shows that the exchange-rate shocks triggered by monetary

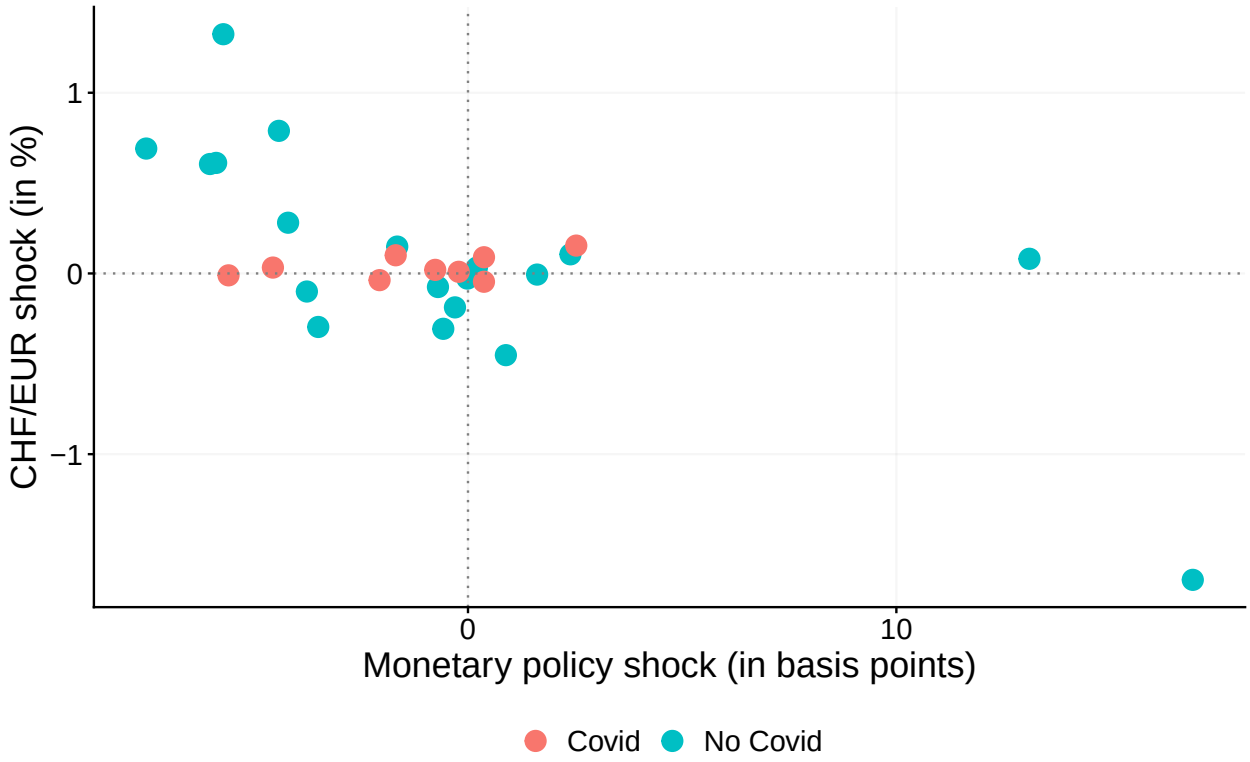
[5]We show the scatterplot for the shocks to the CHF/EUR exchange rate. The scatterplot with the shocks to the CHF/US-$ exchange rate looks very similar, given the high correlation between the two exchange-rate shocks.

Table 4: The correlation of exchange-rate shocks at monetary policy announcements

	CHF/EUR	CHF/USD	USD/EUR
Panel A: Full sample			
CHF/EUR	1.00		
CHF/USD	0.99	1.00	
USD/EUR	0.10	-0.06	1.00
Panel B: Excluding Covid period			
CHF/EUR	1.00		
CHF/USD	0.99	1.00	
USD/EUR	0.12	-0.01	1.00

Notes: The exchange-rate shocks are the differences in the exchange rate before and after the 30-minute time window around the monetary policy announcement. The excluded time period in Panel B is from March 1, 2020 to May 31, 2022.
Source: Own computations based on https://www.dukascopy.com/swiss/english/marketwatch/historical/, accessed in December 2025.

Figure 4: The CHF/EUR exchange-rate shock and the monetary policy shock



Notes: *No Covid*: benchmark sample period; *Covid*: excluded period from March 1, 2020 to May 31, 2022.
Source: Own computations based on the constructed monetary policy shocks and exchange-rate shocks.

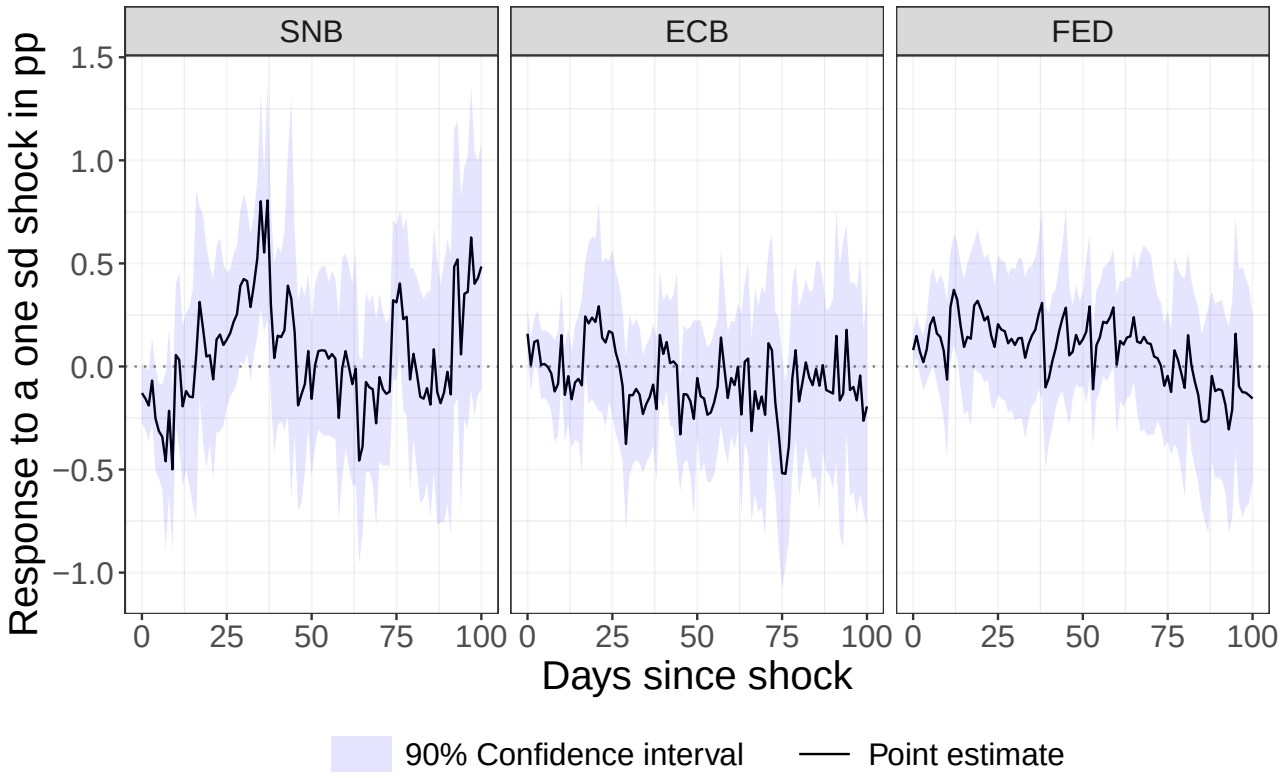
policy are not systematic in our sample period. They are approximately zero on average.

The standard deviation of the exchange-rate shocks after SNB announcements implies a change of the exchange rate of 0.62 percent in our benchmark sample, which is twice as large as the standard deviation of the exchange-rate shocks after announcements of the ECB or the Fed. Figure 21 in Appendix A.4 illustrates the exchange-rate shocks in the sample period.

6 The response of expenditures to monetary policy shocks

6.1 Aggregate response

Figure 5: The short-run expenditure response to monetary policy shocks in Switzerland



Notes: The figure labeled *SNB* shows the expenditure response to the SNB's monetary policy shocks for a horizon up to 100 days. Analogously, the other two figures show the response to the ECB's and the Fed's monetary policy shock, respectively.
Source: Own computations based on transactional data by Worldline and the constructed monetary policy shocks.

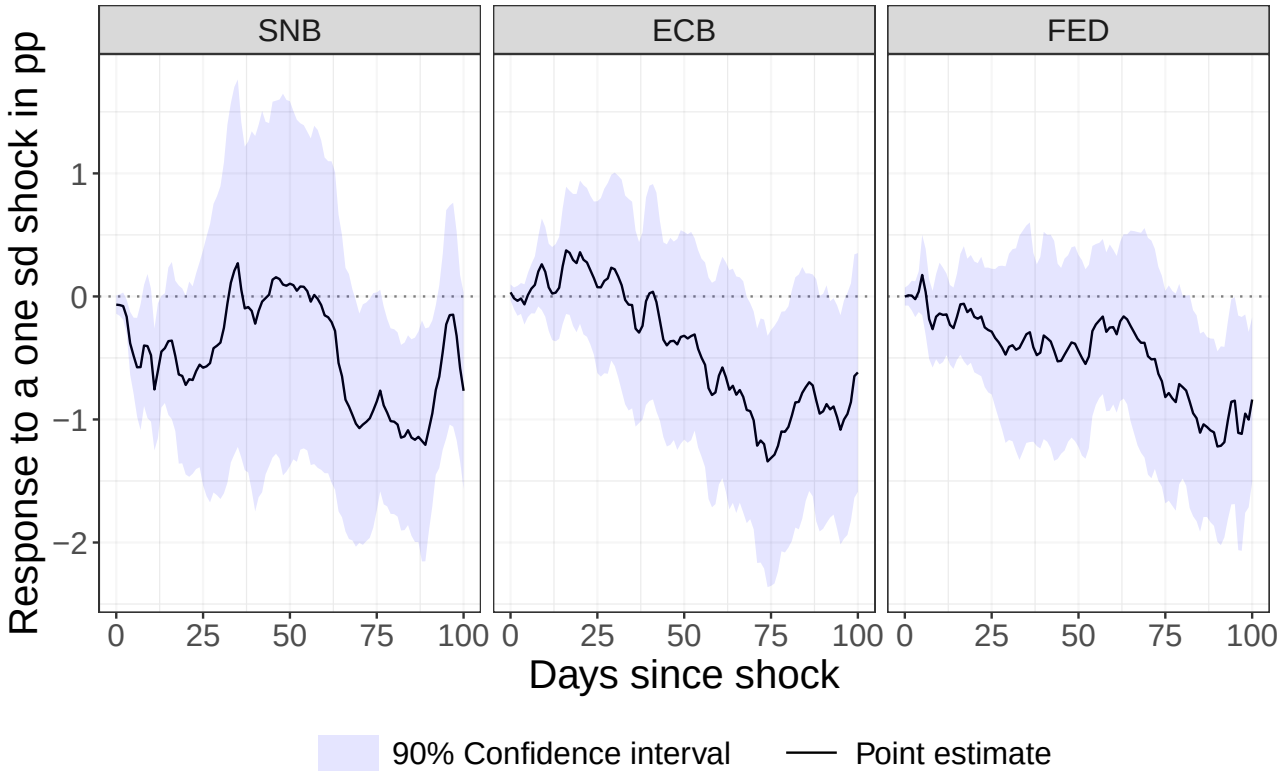
Figure 5 displays the expenditure response in Switzerland to a monetary policy shock of one standard deviation, associated with monetary policy announcements from the SNB, ECB, and Fed, respectively. The figure shows that expenditure growth in Switzerland *increases* by up to 0.75 percentage points (pp) 1 – 1.5 months after a restrictive monetary policy shock of the SNB.[6] The monetary policy shocks of the ECB instead have less strong

[6] As shown in appendix E of Buda et al. (2023), the estimated effect of the shock on the year-on-year growth rate of expenditure corresponds to the effect on the expenditure level (in logs), up to a horizon of 365 days

effects on total expenditures in Switzerland. The statistically significant point estimates at certain horizons are negative rather than positive. The response to the monetary policy shocks of the Fed, in terms of the size of the point estimates, is even smaller than the response to the monetary policy shocks of the ECB.

We will shed further light on the determinants of the expenditure responses by distinguishing the responses by expenditure category, country of cardholder residence, and location of purchase. For now, we emphasize that the SNB's monetary policy shocks have economically and statistically significant effects already in the first quarter after the shock, and that restrictive monetary policy shocks have positive short-run effects associated with exchange-rate movements after the monetary policy shock.

Figure 6: The short-run expenditure response to monetary policy shocks in Germany



Notes: The figure labeled *SNB* shows the expenditure response to the SNB's monetary policy shocks for a horizon up to 100 days. Analogously, the other two figures show the response to the ECB's and the Fed's monetary policy shock, respectively.
Source: Own computations based on transactional data by Fable Data and the constructed monetary policy shocks.

Figure 6 shows that the transmission of monetary policy shocks to expenditures is also fast in Germany but more standard in terms of the sign, as may be expected given that the exposure to exchange-rate changes in Germany is relatively smaller than in Switzerland. The figure shows that expenditure growth in Germany *decreases* by up to 1.3 percentage points (pp) after a restrictive monetary policy shock of the ECB. The response to monetary policy shocks of the Fed or SNB are qualitatively similar but the point estimates are

for the response. The reason is that the expenditure with a lag of one year, which enters the year-on-year growth rate, is unaffected by the shock up to that horizon.

somewhat smaller in size.

The fast transmission of monetary policy shocks to expenditures may be surprising for some, given the traditional paradigm that monetary policy affects the economy with long and variable lags (Friedman, 1961). Our results reveal that the transmission at long lags may be accompanied by a fast transmission in the short run, as unexpected changes in the policy rate pass through quickly not only to exchange rates (as documented in Section 5) but also also mortgage interest rates (Koeniger et al., 2022).

Our estimated responses for Germany are qualitatively similar to those reported by Grigoli and Sandri (2026) who also use the transactional expenditure data provided by Fable Data. Quantitative differences, such as the faster expenditure response during the first 100 days after the monetary policy shock, likely result from the different sample period. We focus on the monetary policy transmission in normal times, excluding the COVID-19 period, as our sample period extends to the end of 2025 rather than 2021.

Our estimates for Germany are also qualitatively similar to short-run expenditure responses to monetary policy shocks estimated for Spain (Buda et al., 2025) and the UK (Brandt et al., 2025) based on high-frequency transactional data, but there are some differences. Our estimated expenditure response to ECB monetary policy shocks for Germany shows significant effects starting in the second month after the shock whereas the estimated expenditure responses for Spain and the UK are significant already in the first month after the shock. Further research may investigate whether these differences are caused by differences in the coverage of expenditure items in the respective data sets or by structural differences between the economies.

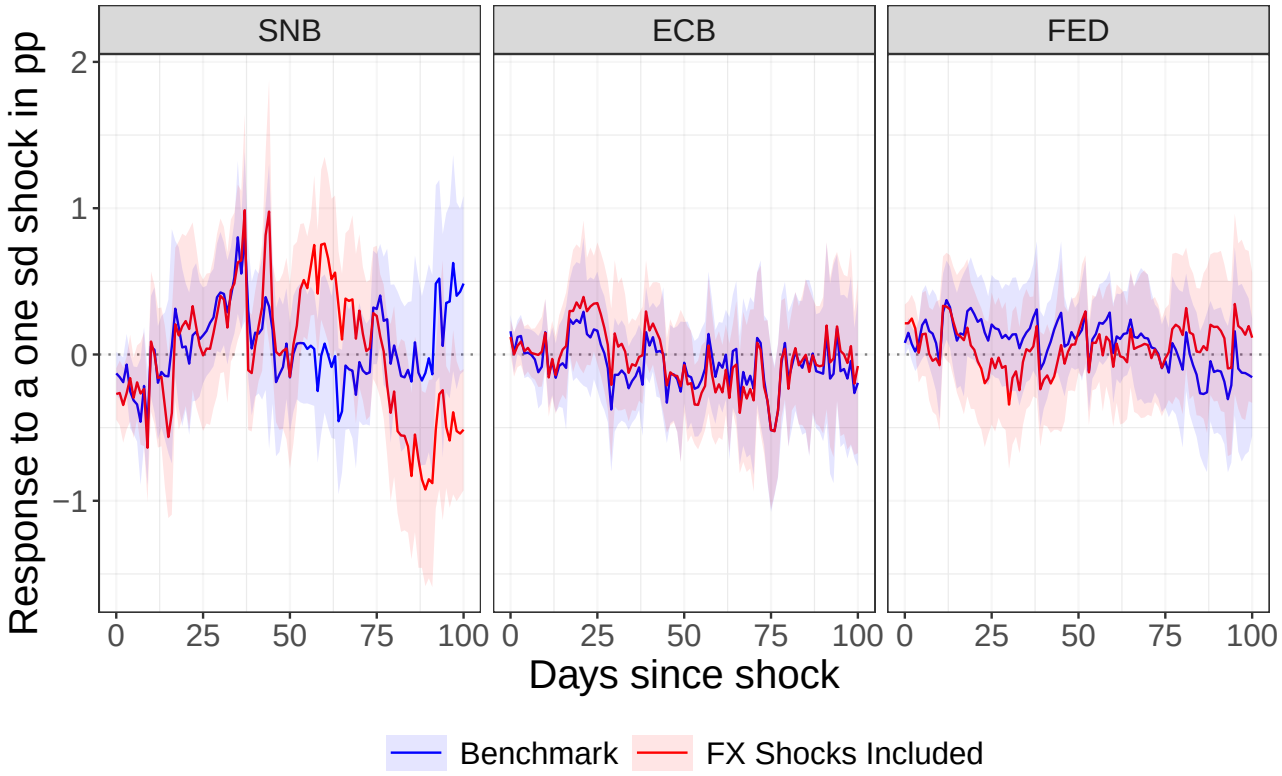
6.1.1 Response conditional on the associated exchange-rate shock

In Figure 7, we compare the expenditure responses to the monetary policy shocks in Switzerland in the benchmark with the responses based on specification (6), in which we include the exchange-rate shocks during the short time window around the monetary policy announcements as controls (labeled as *FX shocks included*). These exchange-rate shocks plausibly are as exogenous to the subsequent changes in expenditures as the monetary policy shocks. Furthermore, the short time window around the announcements should be sufficient to capture the exchange-rate movement induced by the monetary policy announcement because the exchange rate responds very quickly to news (e.g., Kearns and Manners, 2006, Faust et al., 2007).

Note that this approach has the flavor of a mediation analysis but, on purpose, uses a parsimonious specification. Focusing on changes of exchange rates only in the narrow time intervals around the monetary policy announcement, minimizes concerns that changes of other determinants than the monetary policy announcement cause the exchange-rate movements, which would confound the estimation results.

Figure 7 shows that controlling for the exchange-rate shocks makes little difference for the expenditure responses in Switzerland to the monetary policy shocks of the ECB or

Figure 7: The short-run expenditure response to monetary policy shocks in Switzerland, conditional on the associated exchange-rate shocks



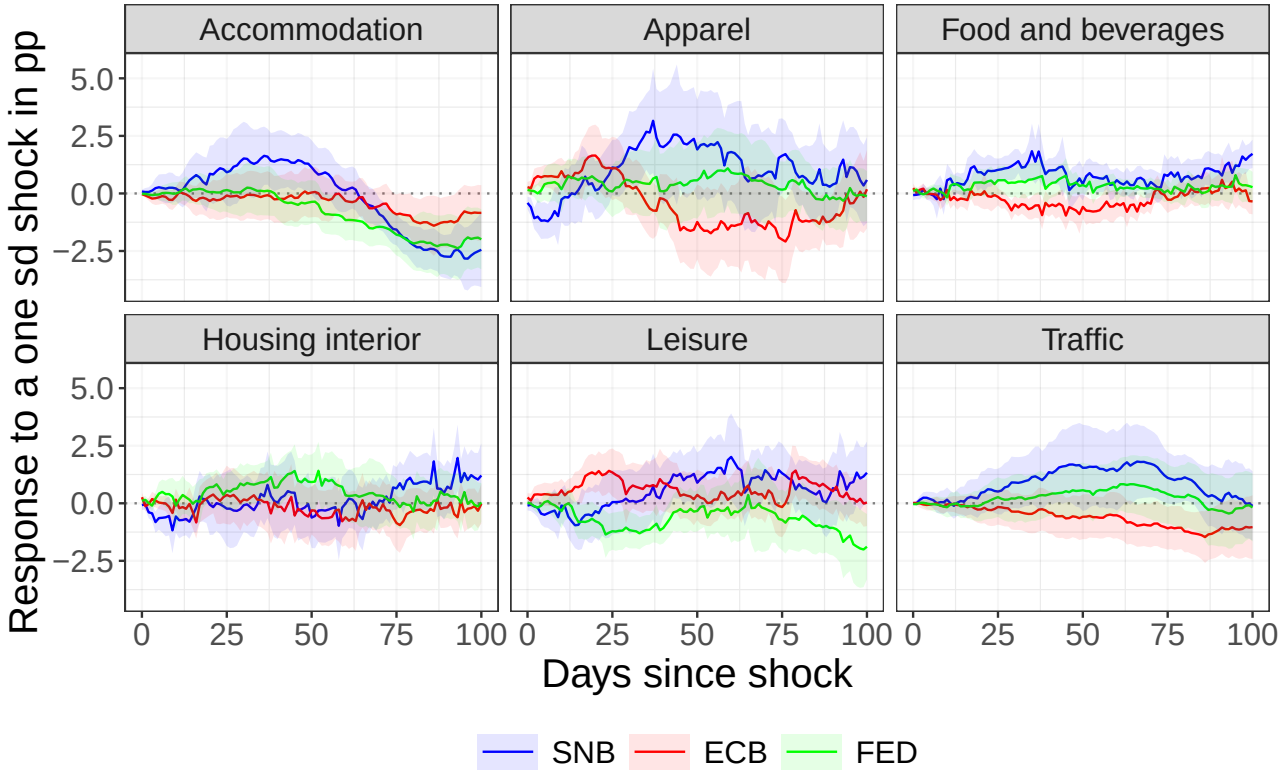
Notes: The figure labeled *SNB* shows the expenditure response to the SNB's monetary policy shocks for a horizon up to 100 days. Analogously, the other two figures show the response to the ECB's and the Fed's monetary policy shock, respectively. The response in the benchmark specification is labeled as *Benchmark* and the responses based on specification (6), in which we include the exchange-rate shocks during the short time window around the monetary policy announcements as controls, are labeled as *FX shocks included*.
Source: Own computations based on transactional data by Worldline and the constructed monetary policy shocks.

the Fed. The expenditure response to the monetary policy shocks of the SNB, however, becomes more similar to the textbook response for closed economies once we control for the associated exchange-rate shock: the response turns negative in the third month after the shock.

Figure 22 in Appendix A.4 shows qualitatively similar results for Germany. Quantitatively, the expenditure response to the monetary policy shocks of the ECB becomes more negative in the first and second month after the shock once we control for the associated exchange-rate shocks. To better understand the findings at the aggregate level, we proceed by analyzing the responses by expenditure category.

6.2 Response by expenditure category

Figure 8: The short-run expenditure response to monetary policy shocks in Switzerland, by expenditure category



Notes: 90% confidence bands. The graphs labeled *SNB* shows the expenditure response to the SNB's monetary policy shocks for a horizon up to 100 days. Analogously, the other two figures show the response to the ECB's and the Fed's monetary policy shock, respectively. The expenditure categories are defined in Table 5, Appendix A.1.
Source: Own computations based on transactional data by Worldline and the constructed monetary policy shocks.

Figures 8 and 9 show that the responses of expenditures are quite heterogeneous across expenditure categories and, for a given expenditure category, different between Switzerland and Germany. In the figures, we focus on the six largest expenditure categories in the transactional expenditure data which account for 83% of all expenditures covered by the transactional data for Switzerland, and for 76% of all expenditures covered by the transactional data for Germany. Table 5 in Appendix A.1 maps the COICOP categories to the expenditure categories displayed in the figures.

Figure 8 shows that the positive expenditure response in Switzerland after a restrictive SNB monetary policy shock is visible, for example, in the expenditure responses for *accommodation* or *apparel* (containing semi-durables such as clothing). In the second month after a shock also expenditures in the categories *leisure* and *traffic* respond positively.

Interestingly, the response of expenditures on *accommodation* turns negative in the third month after the shock, possibly because domestic and foreign cardholders find it attractive to substitute relative more expensive stays in Switzerland (associated with the exchange

rate appreciation) with stays abroad, which are not contained in the transactional data from Worldline (which is based on merchant terminals in Switzerland as explained in Section 2). To gauge the contribution of the expenditure responses by category to the aggregate response, we need to account for the respective expenditure share of the category. We return to this below.

The expenditure responses in Switzerland to monetary shocks by the ECB and the Fed are less positive and even negative in some categories. A restrictive monetary policy shock of the ECB (Fed) implies that the Swiss franc depreciates against the euro (US-$) but, as mentioned in Section 5, the shocks to the Swiss-franc exchange rate triggered by the monetary policy announcements of the ECB or Fed are about half the size relative to those triggered by the SNB announcements.[7]

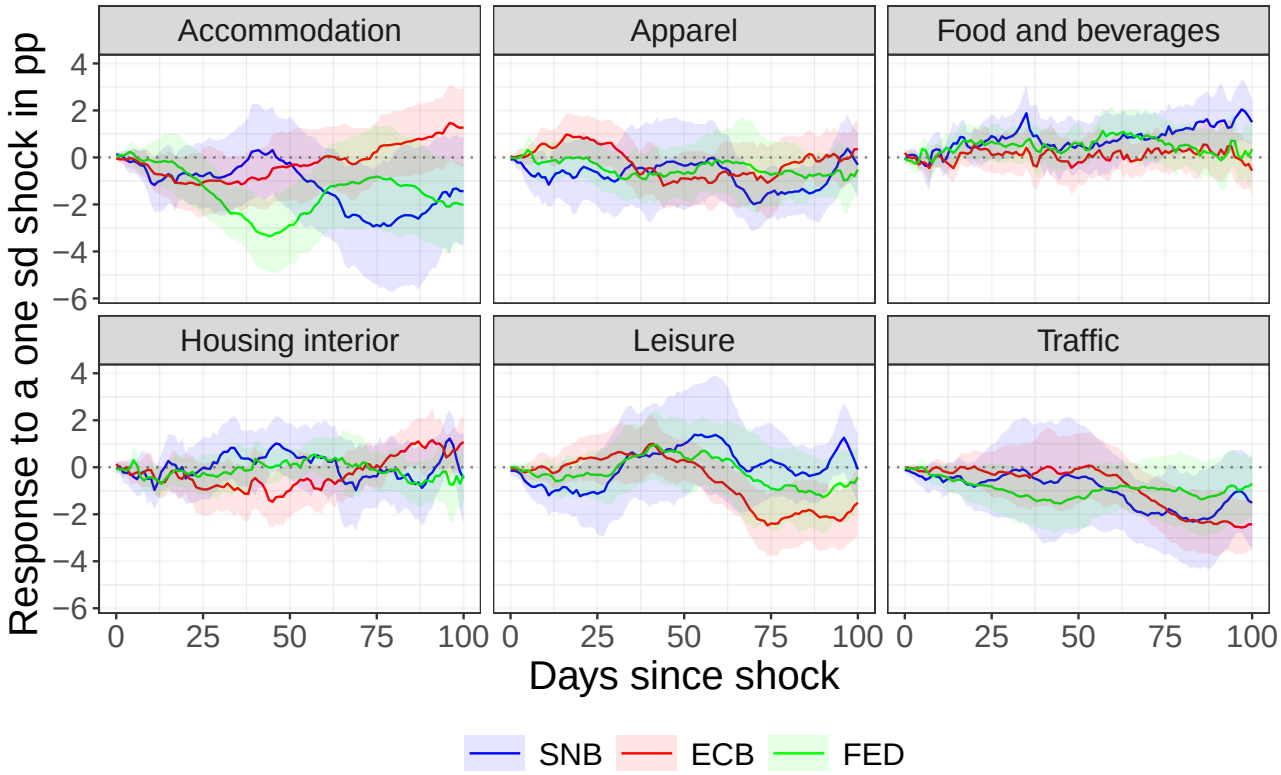
Turning to the evidence for Germany, Figure 9 shows that the negative expenditure responses after monetary policy shocks of the ECB are visible in the categories *apparel*, *housing interior*, and *leisure*. These categories contain semi-durables such as clothing and durables, as well discretionary spending items. In the third month after the shock, also the expenditure response in the category *traffic* turns significantly negative.

Figure 9 further shows a negative expenditure response in Germany to SNB shocks in the categories *accommodation* and *transport/traffic*. We will zoom into these categories and analyze whether these patterns change for cardholders close to the Swiss border.

Figure 9 also shows that expenditures of domestic cardholders in Germany on *accommodation* respond positively to a restrictive monetary policy shock in the third month after the shock. Given that the Fable data include the expenditures of German cardholders abroad, we conjecture that the fall in the expenditure response for *accommodation* observed for Switzerland in the third month after a SNB monetary policy shock may indeed be the result of shifts of expenditures on *accommodation* abroad.

[7]The patterns of exchange-rate movements after monetary policy announcements of the ECB or Fed also differ because monetary shocks of the Fed or the ECB may provide a signal about monetary policy by the SNB. We plan to investigate this further.

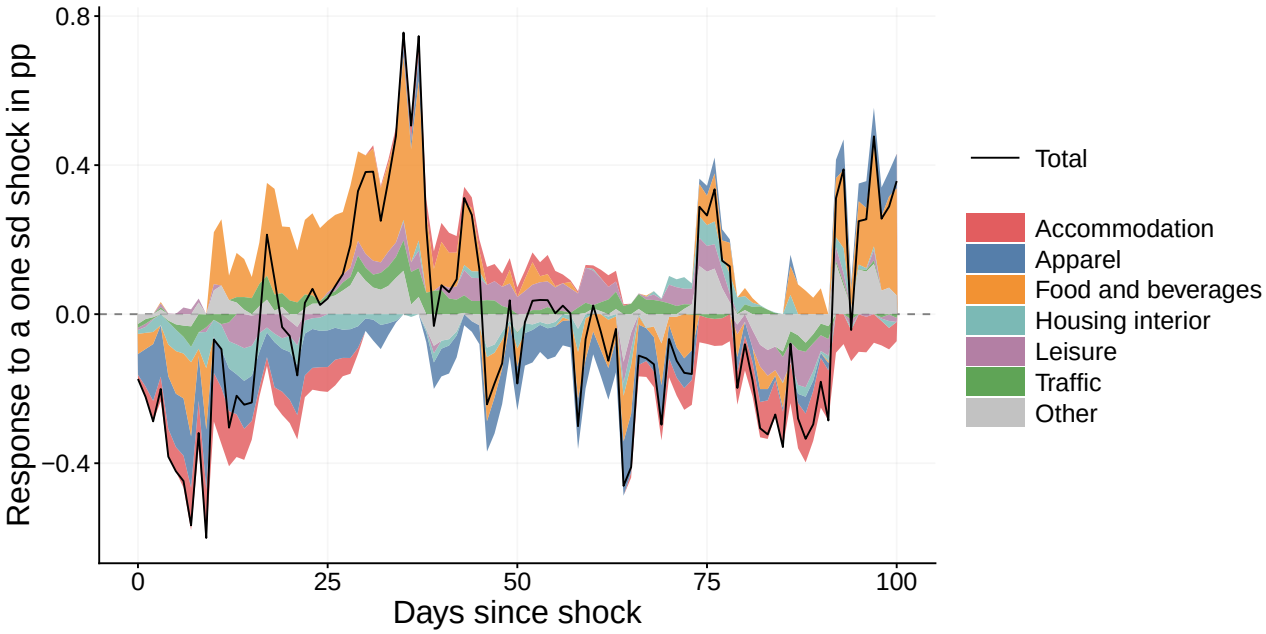
Figure 9: The short-run expenditure response to monetary policy shocks in Germany, by expenditure category



Notes: 90% confidence bands. The graphs labeled *SNB* shows the expenditure response to the SNB's monetary policy shocks for a horizon up to 100 days. Analogously, the other two figures show the response to the ECB's and the Fed's monetary policy shock, respectively. The expenditure categories are defined in Table 5, Appendix A.1.
Source: Own computations based on transactional data by Fable Data and the constructed monetary policy shocks.

6.2.1 Contribution of expenditure categories to the aggregate response

Figure 10: The contribution by category to the expenditure response in Switzerland, after a monetary policy shocks of the SNB



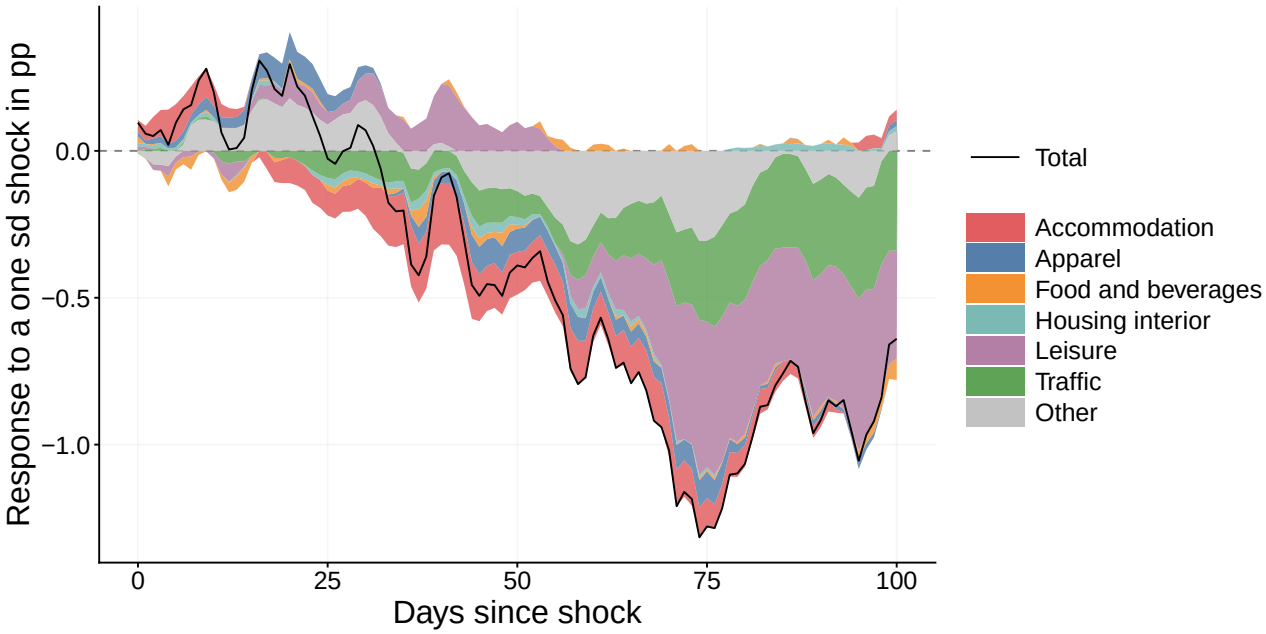
Notes: Contribution to the aggregate expenditure response after a monetary policy shock of the SNB, based on a specification of the local projection explained in Appendix A.3. The expenditure categories are defined in Table 5, Appendix A.1.
Source: Own computations based on transactional data by Worldline and the constructed monetary policy shocks.

Figures 10 and 11 illustrate how the different responses at the level of expenditure categories shape the aggregate expenditure response. Figure 10 shows the contributions of the responses per expenditure category to the overall expenditure response in Switzerland, after a monetary policy shock of the SNB that we displayed in the left panel of Figure 5. Analogously, Figure 11 shows the contributions by expenditure category to the overall expenditure response in Germany, after a monetary policy shock of the ECB that we displayed in the middle panel of Figure 6.[8]

Figure 11 shows that categories such as *accommodation*, *leisure*, and *traffic* drive the negative expenditure response after a restrictive monetary policy shock in Germany. For Switzerland instead, Figure 10 shows that expenditures in categories such as *food and beverages* account for a larger share of the expenditure response (also because the absolute size of the expenditure response is smaller in Switzerland than in Germany). Moreover, at different horizons of the expenditure response, expenditures in categories such as *accommodation*, *apparel*, *leisure*, and *traffic* contribute to a positive expenditure response after a

[8]Note that the sum of contributions in Figures 10 and 11 does not equal exactly the counterpart of the aggregate response shown in the Figures 5 and 6, respectively. We explain in Appendix A.3 that the small differences in the aggregate responses across the figures result from approximation errors of the decomposition. Note further that the contributions implied by the projections plotted in Figures 8 and 9 are not necessarily identical to those implied by Figures 10 and 11. The reason is the slightly different specification that we have to use for the local projections to construct the decomposition, as explained further in Appendix A.3.

Figure 11: The contribution by category to the expenditure response in Germany, after a monetary policy shocks of the ECB



Notes: Contribution to the aggregate expenditure response after a monetary policy shock of the ECB, based on a specification of the local projection explained in Appendix A.3. The expenditure categories are defined in Table 5, Appendix A.1.
Source: Own computations based on transactional data by Fable Data and the constructed monetary policy shocks.

restrictive monetary policy shock in Switzerland.

6.3 Response of domestic and foreign cardholders

In Figure 12 we distinguish the expenditure response of domestic and foreign cardholders in Switzerland, for which we observe all expenditures at Swiss merchants. Figure 12 reveals that an important part of the positive expenditure response in the second month after SNB monetary policy shocks is the response of foreign cardholders.

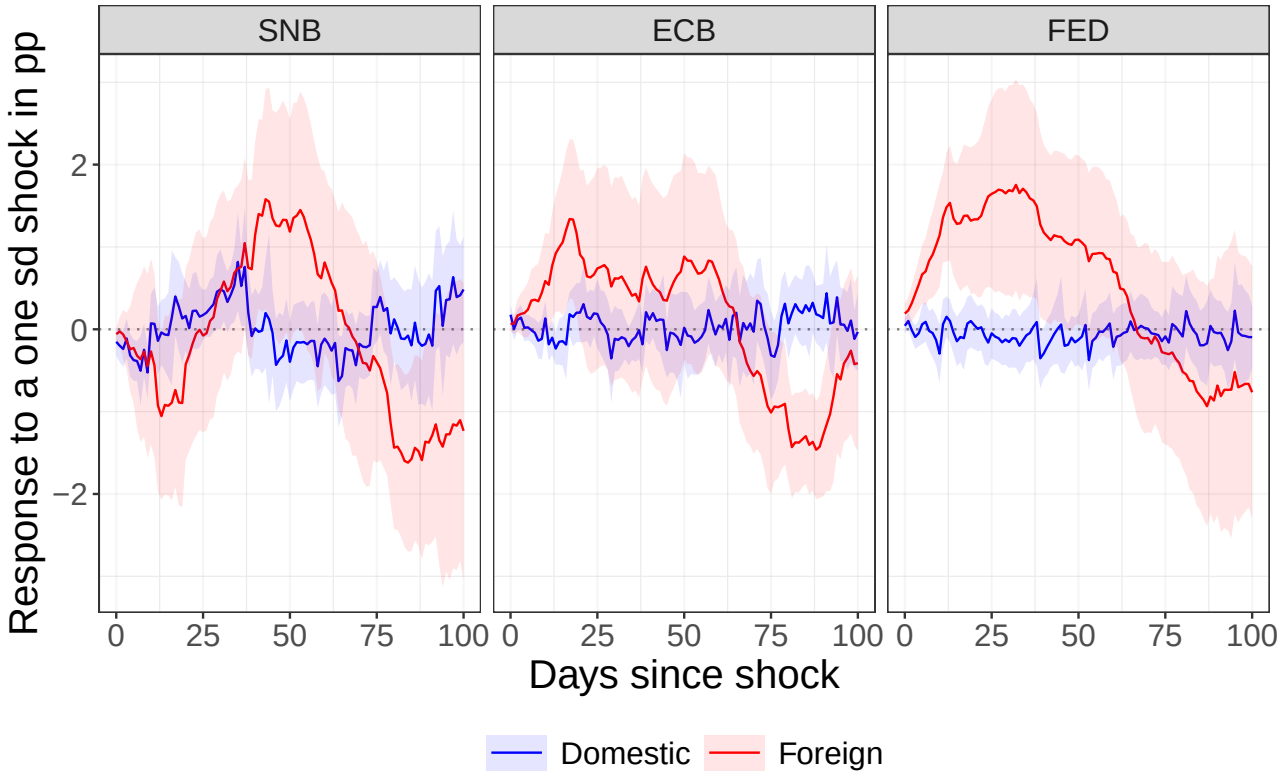
The figure further shows that the expenditure response of foreign cardholders is more volatile across different horizons. As visible in Figure 13, the fluctuations result from compositional effects as different expenditure categories (*accommodation*, *leisure*, *traffic*) drive the response of foreign cardholders at different horizons. Interestingly, the strong negative expenditure response of foreign cardholder in the category *leisure* is driven by spending in e-commerce.[9]

Figure 23 in Appendix A.4 shows that the response of domestic cardholders across expenditure categories is similar to the overall response (of both domestic and foreign cardholders) in Figure 8 because domestic cardholders account for 88% of the domestic spending, and thus for much more spending than foreign cardholders.

Figure 14 illustrates the contribution of expenditures of domestic and foreign cardhold-

[9]See Figure 17 for spending of foreign cardholders across categories at the point of sale.

Figure 12: The short-run expenditure response to monetary policy shocks in Switzerland, domestic versus foreign cardholders

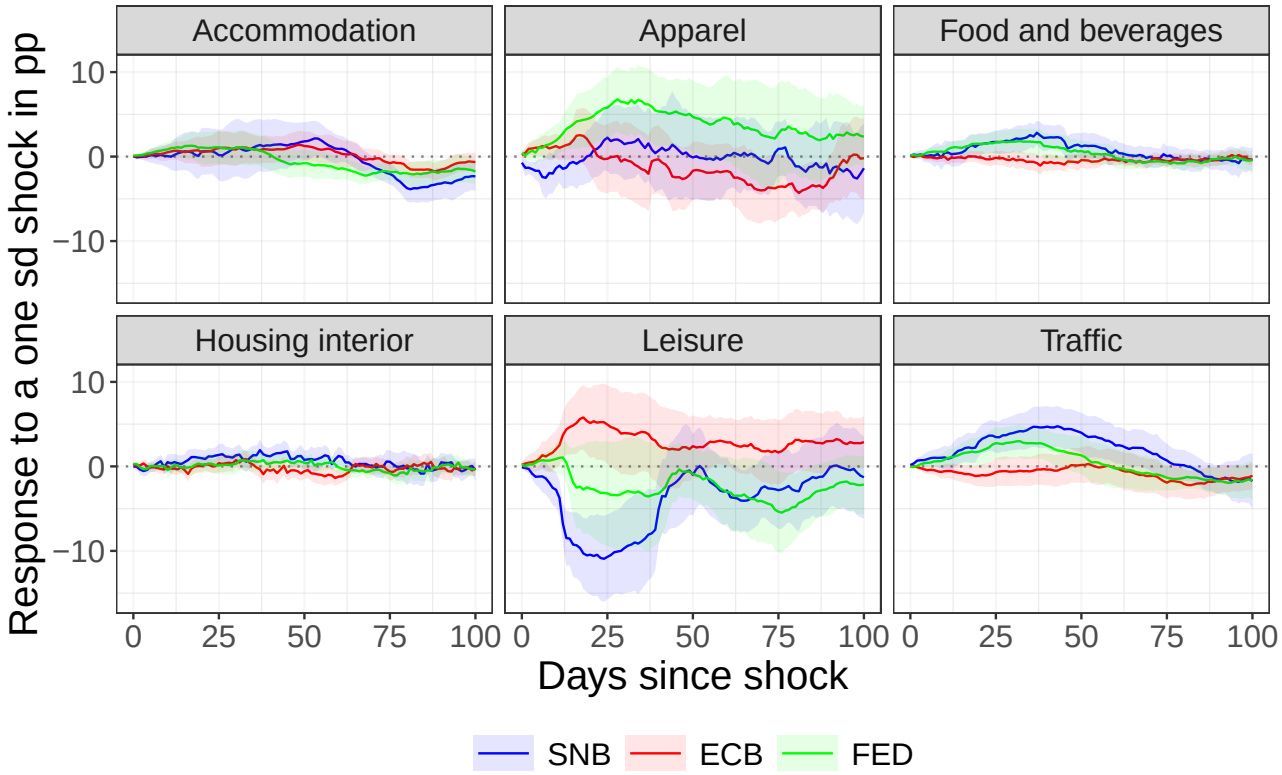


Notes: 90% confidence bands. The graphs labeled *SNB* shows the expenditure response to the SNB's monetary policy shocks for a horizon up to 100 days. Analogously, the other two figures show the response to the ECB's and the Fed's monetary policy shock, respectively.
Source: Own computations based on transactional data by Wordline and the constructed monetary policy shocks.

ers to the aggregate expenditure response. The figure shows that expenditures of domestic cardholders account for the bulk of the (positive) expenditure response after a restrictive monetary policy shock. The real income channel implies that domestic cardholders should drive the positive response because the exchange rate appreciation increases the real income of domestic cardholders.

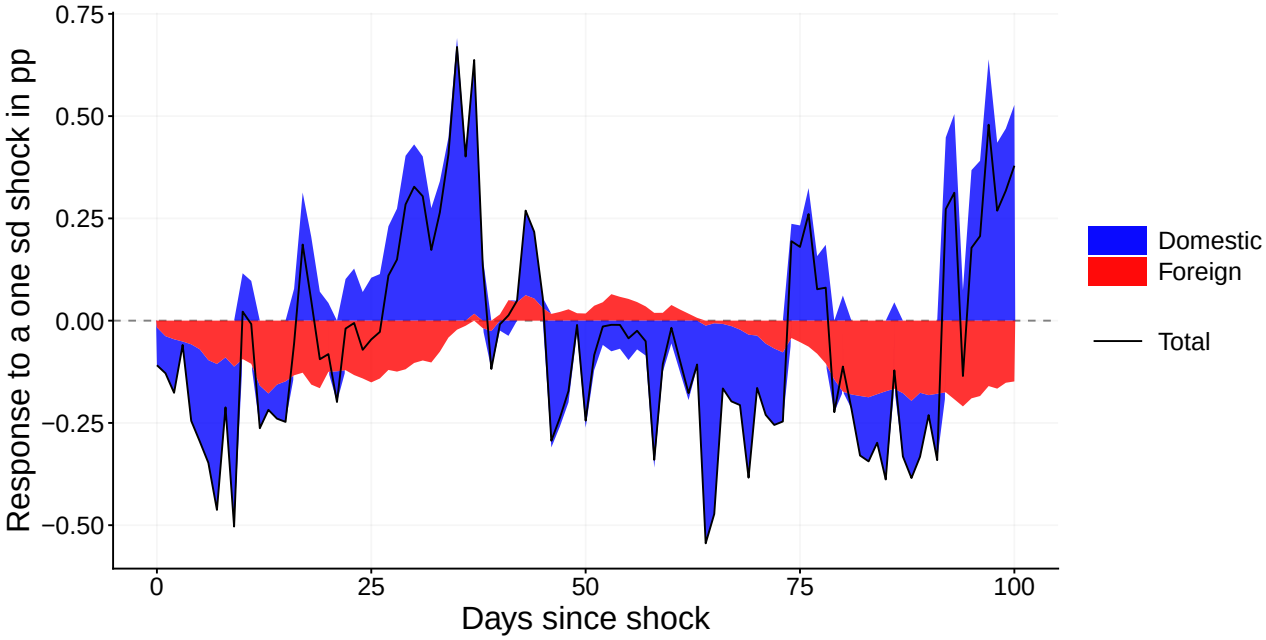
The expenditure response of foreign cardholders, however, also matters quantitatively for the aggregate response. Figure 14 shows that expenditures of foreign cardholders reduce the aggregate expenditure response by up to 15 basis points at certain horizons (accounting for about a third of the overall response at these horizons).

Figure 13: The short-run expenditure response to monetary policy shocks in Switzerland, foreign cardholders



Notes: 90% confidence bands. The graphs labeled *SNB* shows the expenditure response to the SNB's monetary policy shocks for a horizon up to 100 days. Analogously, the other two figures show the response to the ECB's and the Fed's monetary policy shock, respectively. The expenditure categories are defined in Table 5, Appendix A.1.
Source: Own computations based on transactional data by Wordline and the constructed monetary policy shocks.

Figure 14: The contribution by cardholder residence to the expenditure response in Switzerland, after a monetary policy shocks of the SNB

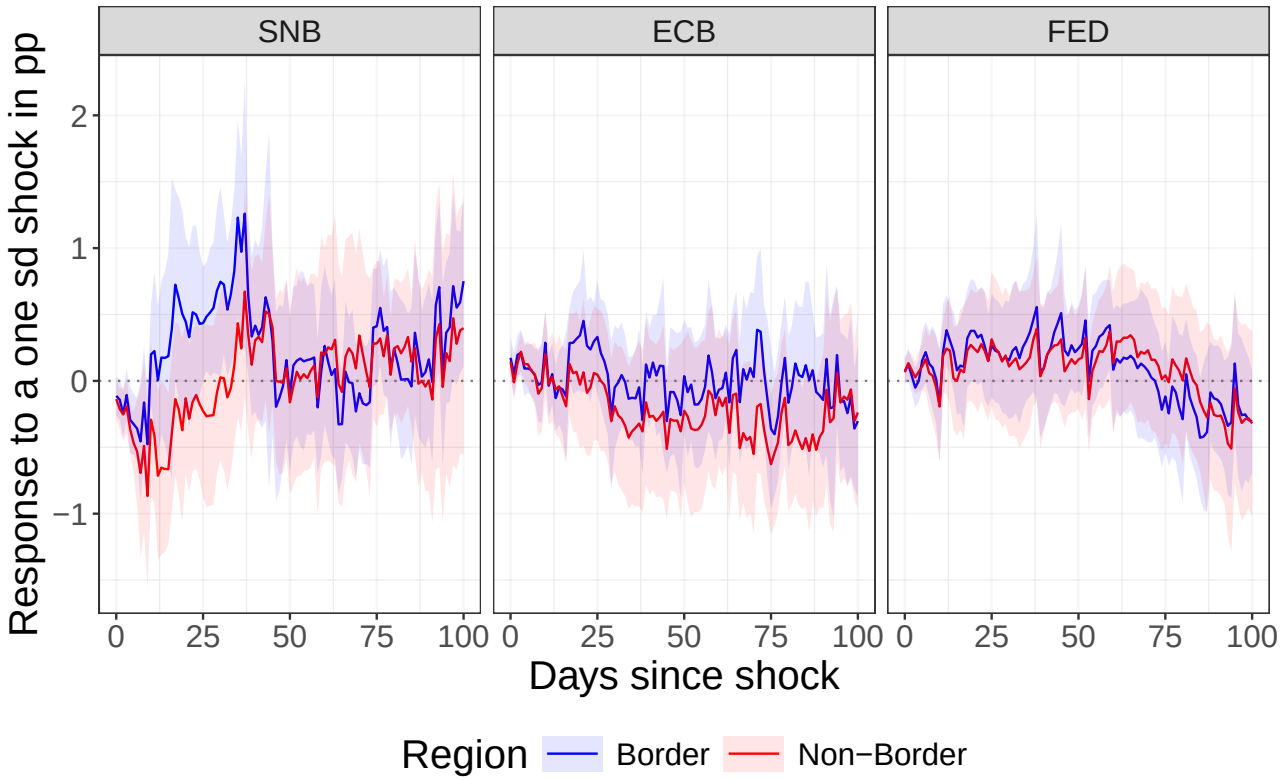


Notes: Contribution to the aggregate expenditure response after a monetary policy shock of the SNB, based on a specification of the local projection explained in Appendix A.3.
Source: Own computations based on transactional data by Worldline and the constructed monetary policy shocks.

6.4 Response in border versus non-border regions

We investigate whether there are significant differences in expenditure responses within Switzerland because cross-border shopping is common in Switzerland (e.g., Kluser, 2025) and changes in the exchange rate may trigger shifts in expenditures across borders (Felber, 2026). We classify a region as a *border* region if the location of spending is less than 50 minutes travel time away from the closest cross-border shopping location.[10] We classify a region as *non-border* instead if the travel time exceeds 75 minutes. This generates three equally sized bins of zip codes labeled as border, non-border and in-between, as illustrated in Figure 19 in Appendix A.1. The classification implies that around 33% of expenditures in the benchmark sample is accounted for by border regions relative to 22% in non-border regions.[11]

Figure 15: The short-run expenditure response to monetary policy shocks in Switzerland, by region

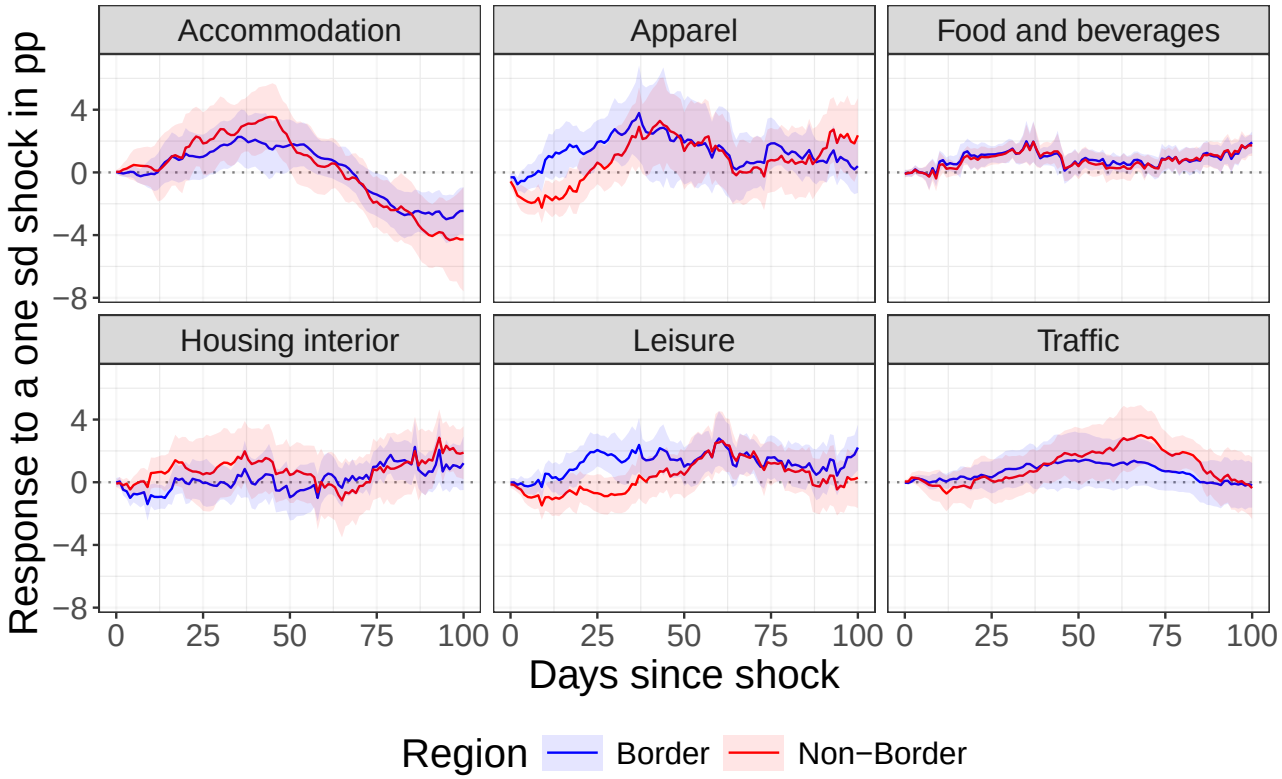


Notes: 90% confidence bands. Border is defined as 50 minutes or less travel time to the closest cross-border shopping location by car. Non-border is defined as 75 minutes or more travel time by car. The graphs labeled *SNB* shows the expenditure response to the SNB's monetary policy shocks for a horizon up to 100 days. Analogously, the other two figures show the response to the ECB's and the Fed's monetary policy shock, respectively.
Source: Own computations based on transactional data by Wordline and the constructed monetary policy shocks.

[10] Kluser (2025) defines a cross-border shopping location as a foreign municipality with at least three stores with some visibility and size, as approximated by at least 100 Google ratings.

[11] Regions in between border and non-border regions and e-commerce account for the remaining expenditure shares.

Figure 16: The short-run expenditure response to the SNB's monetary policy shocks in Switzerland, by region and expenditure category



Notes: 90% confidence bands. Border is defined as 50 minutes or less travel time to the closest cross-border shopping location by car. Non-border is defined as 75 minutes or more travel time by car. The expenditure categories are defined in Table 5, Appendix A.1.
Source: Own computations based on transactional data by Wordline and the constructed monetary policy shocks.

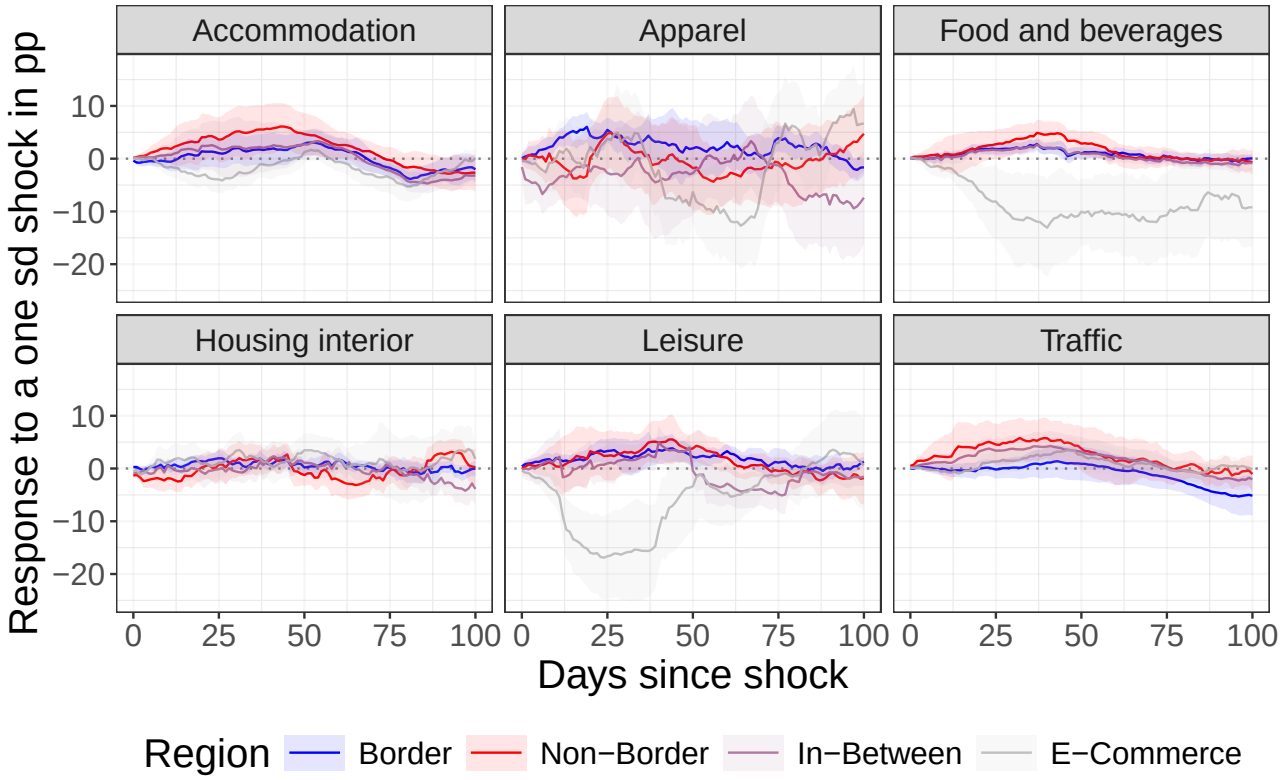
Figures 15 to 17 show that (i) the aggregate expenditure responses are qualitatively similar in border and non-border regions (Figure 15), (ii) heterogeneity in the expenditure responses across border and non-border regions is more pronounced in the categories *apparel*, *leisure*, and *traffic* (Figure 16), and (iii) foreign cardholders contribute to the heterogeneity of expenditure responses across border and non-border regions in the categories *accommodation*, *apparel*, and *traffic* (Figure 17) whereas domestic cardholders contribute to the heterogeneity of expenditure responses across border and non-border regions in the category *leisure* (Figure 24 in Appendix A.4).[12]

To put these results into further context, Figure 25 in Appendix A.4 shows the expenditure responses of German cardholders to SNB or ECB monetary policy shocks depending on whether they live within 50 km of the Swiss border or not.[13] The figure shows no significant differences in the response of German cardholders who live close to the border or not, which is similar to the quite homogeneous responses for domestic cardholders in

[12]Comparing Figures 17 and 13, note that the negative expenditure response of foreign cardholders in the category leisure in Figure 13 is accounted for by expenditures in e-commerce and not by expenditures at the point of sale.

[13]Natural barriers are less important in Southern Germany than in Switzerland so that distance and travel time are much more correlated than in Switzerland.

Figure 17: The short-run expenditure response to the SNB's monetary policy shocks in Switzerland, by region and expenditure category, foreign cardholders

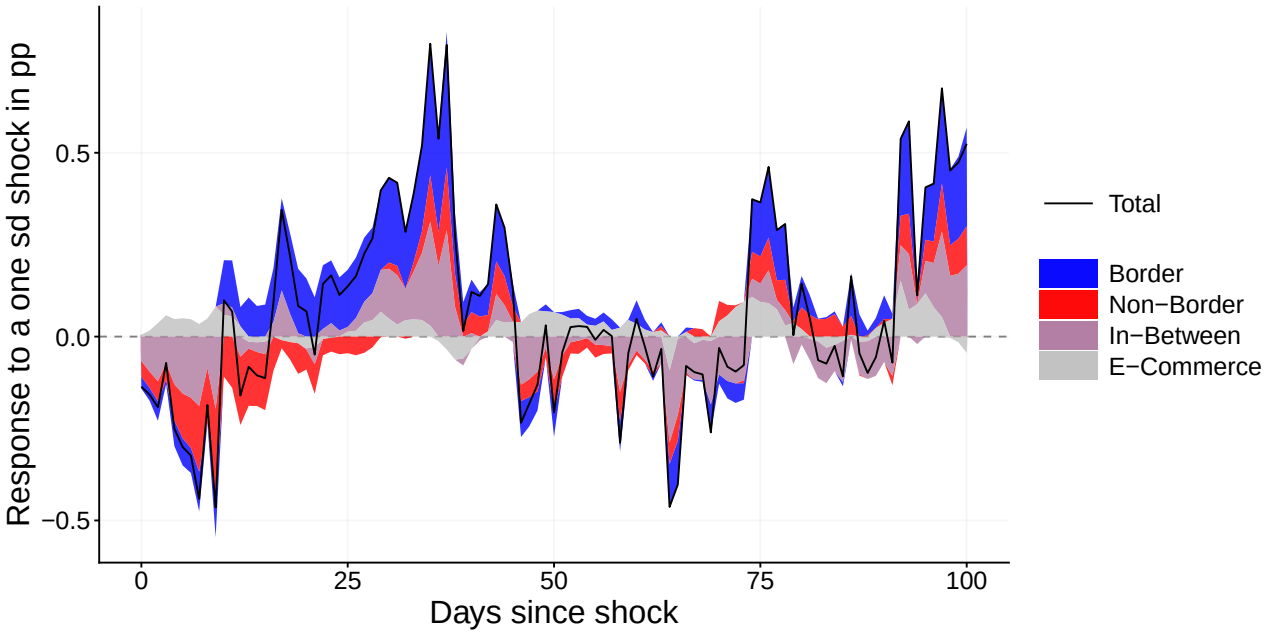


Notes: 90% confidence bands. Border is defined as 50 minutes or less travel time to the closest cross-border shopping location by car. Non-border is defined as 75 minutes or more travel time by car. The expenditure categories are defined in Table 5, Appendix A.1.
Source: Own computations based on transactional data by Wordline and the constructed monetary policy shocks.

Switzerland across border and non-border regions (documented in Figure 24 in Appendix A.4).

Finally, Figure 18 illustrates the contribution of expenditures in border versus non-border regions to the aggregate expenditure response. The figure shows that border regions contribute more than proportionally to the positive expenditure responses. The expenditure responses in border regions contribute almost 50% to positive responses although they only account for 33% of expenditures, whereas non-border regions contribute only 14% but account for 22% of spending. For the contribution to negative responses, the reverse is true: the border regions only contribute 14%, the non-border regions contribute 33% instead. This is consistent with a stronger real-income channel in border regions because an exchange rate appreciation associated with monetary policy tightening has a stronger effect on purchasing power in regions close to the border. This effects seems to outweigh leakages from border regions in Switzerland to adjacent regions abroad, highlighted by Felber (2026) for expenditures on retail goods.

Figure 18: The contribution by border versus non-border region to the expenditure response in Switzerland, after a monetary policy shocks of the SNB



Notes: Contribution to the aggregate expenditure response after a monetary policy shock of the SNB, based on a specification of the local projection explained in Appendix A.3. The expenditure categories are defined in Table 5, Appendix A.1.
Source: Own computations based on transactional data by Worldline and the constructed monetary policy shocks.

7 Conclusion

We have estimated the short-run responses of expenditures to monetary policy shocks in a textbook small open economy, Switzerland. We have shown that the short-run expenditure responses differ substantially from those of the largest euro area economy, Germany. We find that in both economies, monetary policy transmits to expenditures in the short run, i.e., in the first 100 days after the monetary policy shock.

We find that, in Switzerland, expenditures respond *positively* in the short run to a restrictive monetary policy shock. Regions close to the border contribute more than proportionally to the positive expenditure response, suggesting a stronger real income channel in the transmission of monetary policy. We further find that expenditure shifts of foreign residents contribute negatively to the expenditure response. They account for up to 15 basis points of the expenditure response at certain horizons, thus accounting for about a third of the overall short run response of expenditures at these horizons.

In Germany, the short-run expenditure responses are also economically and statistically significant but more standard in that a restrictive monetary policy shock of the ECB decreases expenditures. We find that the expenditure categories *accommodation*, *leisure*, and *traffic* contribute most to this short run response.

Documenting these short-run responses and understanding them in further detail is important for monetary policy making. The newly available transactional data on expen-

ditures allow to understand compositional effects in the aggregate expenditure responses across expenditure categories, foreign and domestic purchasers, and different locations of purchase. The sizable compositional changes, which we find, illustrate that aggregate responses cannot be interpreted readily without first uncovering the compositional changes that drive the aggregate responses.

Our findings illustrate challenges for the external validity of estimated expenditure responses to policy shocks because the composition as well as the size of the responses across expenditure categories may differ across countries. We hope that the estimates provided in this paper are a step towards understanding short-run monetary policy transmission better in a small open economy, paving the way for better informed policy making.

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A Appendix

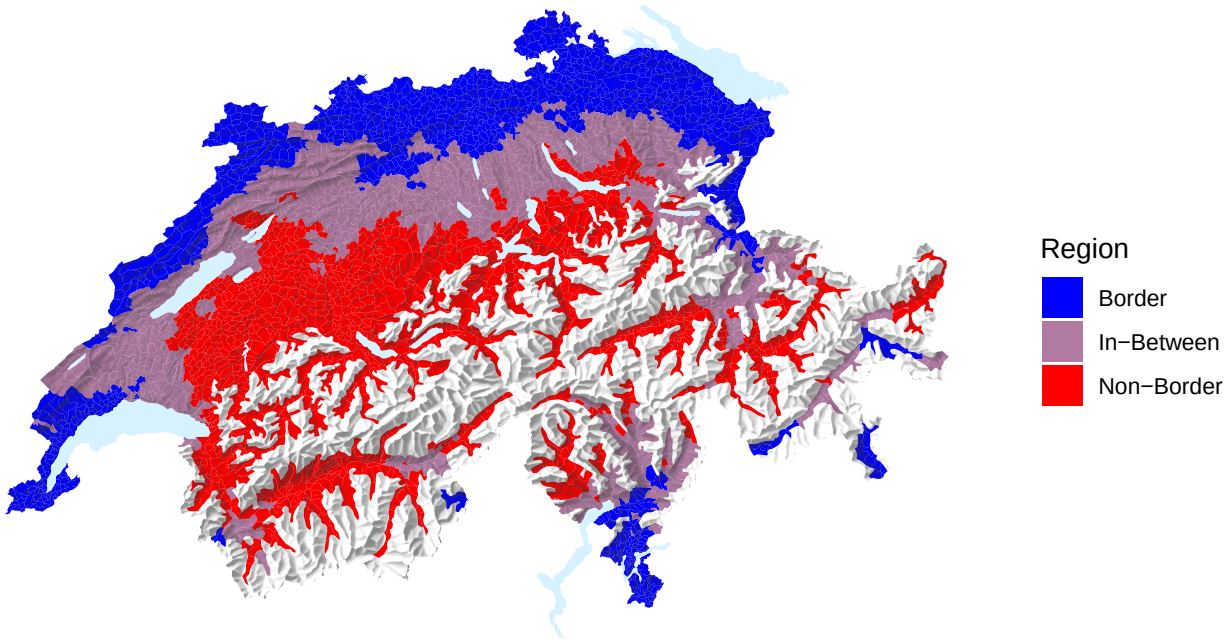
A.1 The mapping of COICOP categories, and a map of border vs. non-border regions

Table 5: COICOP classification and aggregated categories

COICOP	Category labels
01 Food and non-alcoholic beverages 02 Alcoholic beverages, tobacco and narcotics	Food and beverages
03 Clothing and footwear	Apparel
05 Furnishings, household equipment and routine household maintenance	Housing interior
07 Transport	Traffic
09 Recreation, sport and culture	Leisure
11 Restaurants and accommodation services	Accommodation

Notes: Mapping from COICOP categories to the category labels used in the paper.
Source: https://unstats.un.org/unsd/classifications/unsdclassifications/COICOP_2018_-_pre-edited_white_cover_version_-_2018-12-26.pdf, accessed in February 2026

Figure 19: Border versus non-border regions in Switzerland



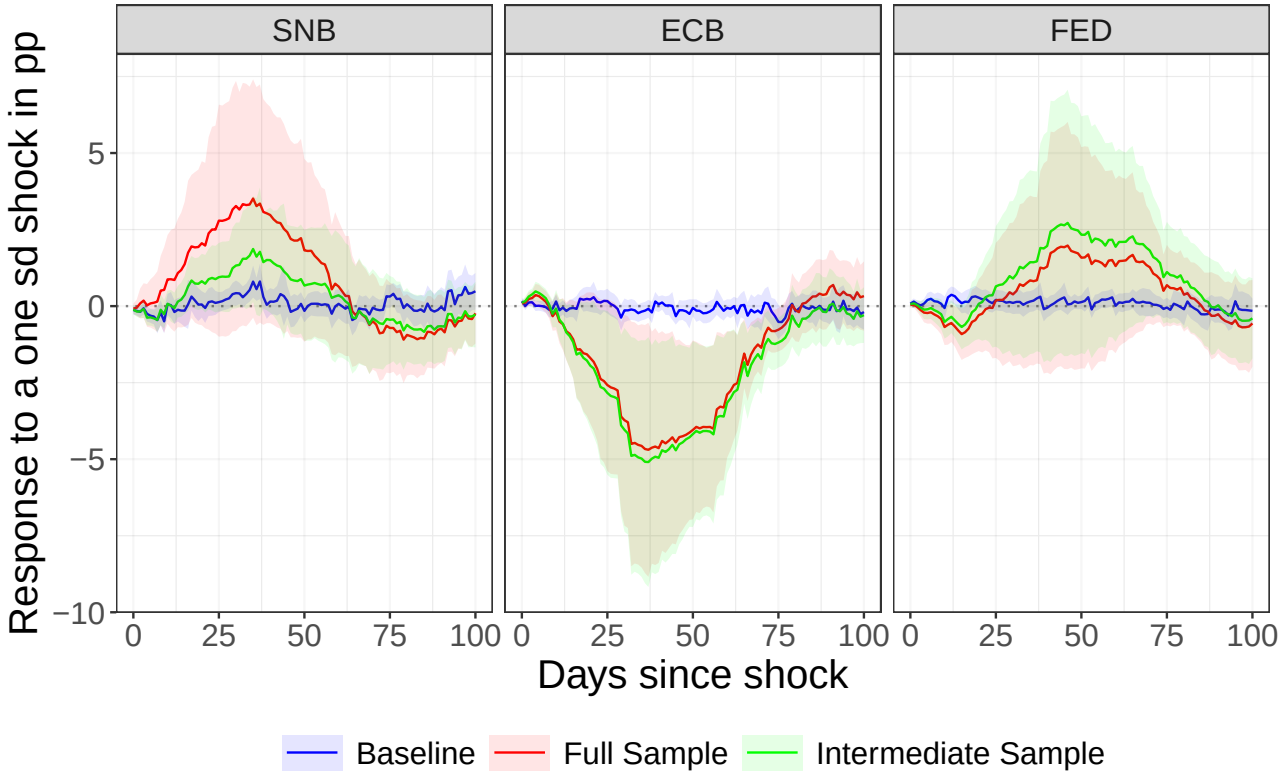
Notes: Border is defined as 50 minutes or less travel time to the closest cross-border shopping location by car. Non-border is defined as 75 minutes or more travel time by car. Accordingly, in-between is defined as between 50 and 75 minutes travel time by car.
Source: Own computations based on Kluser (2025).

A.2 Evidence for alternative choices of the sample period

Figure 20 displays the expenditure responses in Switzerland for different samples. The figure shows that including the period of the COVID-19 crisis, even in a milder form as in the intermediate sample, implies responses that are implausible in size. In our application, the controls for the COVID-19 pandemic, capturing the epedemiological incidence or the policy measures during the pandemic, only imperfectly account for the large swings in the expenditure growth rates visible in Figure 1. This biases the estimates, which attribute the large swings in expenditure growth rates to the monetary policy shocks. Based on inspection of the expenditure growth rates in Figure 1, this motivates why we choose to exclude the COVID-19 period between March 1, 2020 and May 31, 2022 in our benchmark sample, labeled *baseline* in Figure 20.

Specifically, we exclude observations in the local projection for which (i) the shock at time t occurs within the COVID-19 period defined above, or (ii) the outcome at horizon h at time $t+h$ falls into the COVID-19 period. This implies that for shocks, which occur shortly before the start of the COVID period, we do not estimate the full horizon of the response. This turns out to be necessary to prevent spurious effects of the COVID-19 period on the estimation results.

Figure 20: The short-run expenditure response to monetary policy shocks in Switzerland, for different samples



Notes: 90% confidence bands. *Baseline* denotes the sample in which we remove all observations between March 1, 2020 and May 31, 2022, as described in the main text. *Full Sample* denotes the sample in which we remove no observations. *Intermediate Sample* denotes the sample in which we remove all shocks between March 14, 2020 and October 30, 2020, constructing the sample period as described in Buda et al. (2025). The figure labeled *SNB* shows the expenditure response to the SNB's monetary policy shocks for a horizon up to 100 days. Analogously, the other two figures show the response to the ECB's and the Fed's monetary policy shock, respectively.
Source: Own computations based on transactional data by Worldline and the constructed monetary policy shocks.

A.3 Estimation of the contribution to the total expenditure response

In this appendix, we describe how we estimate the contributions of expenditure categories to the overall expenditure response, e.g., as shown in Figure 10. We then proceed analogously when we estimate the contributions of domestic or foreign cardholders, or of border or non-border regions to the overall expenditure responses.

Ideally, we would estimate a specification with the full set of 90 lags of expenditure growth in all expenditure categories. The lack of degrees of freedom and issues of multicollinearity do not allow us to implement this.

We thus modify specification (6) by allowing for category-specific heterogeneity in the first lag of expenditure growth and keeping the same number of further lags of aggregate expenditure growth. Accounting for expenditure-category heterogeneity only in the first lag preserves degrees of freedom. We have checked that the results are robust if we account for heterogeneity up to the tenth lag.

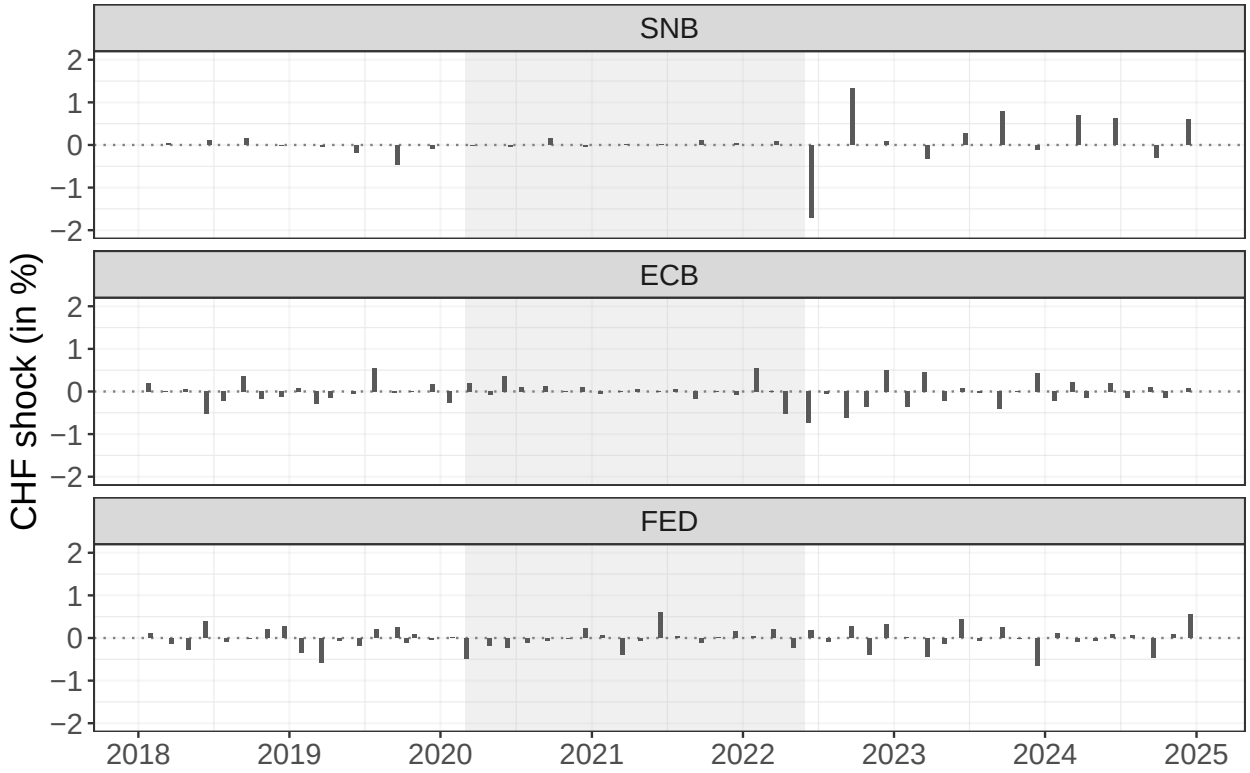
We estimate the local projections for each expenditure category, where the modified specification implies that we use the same right-hand side variables in the estimation of the projections for each category. This ensures that the estimated responses indeed add up to the aggregate response, up to a small error resulting from approximating expenditure growth rates with the log differences of expenditures.

Note that some differences in the quantitative contributions to the aggregate response shown in Figures 10 and 11 remain relative to the contributions that would be implied by the local projections by expenditure category shown in Figures 8 and 9, which are based on specifications with up to 90 lags of the expenditure growth in the respective expenditure category. The differences in the estimated specification (containing lags of expenditure growth only of the specific expenditure category) also imply, however, that the consolidated aggregate response based on the category-specific responses shown in Figures 8 and 9 is not equal to the aggregate responses shown in Figures 5 and 6.

The graphical illustrations of the contributions to the aggregate response are thus based on a compromise between capturing sufficiently the underlying heterogeneity and consistency with the aggregate response. To provide a more complete picture of our findings, we show both sets of results on the heterogeneity in Figures 8 and 9 as well as Figures 10 and 11. We proceed analogously when we illustrate the heterogeneity of the expenditure responses by residence of the cardholder or region of purchase.

A.4 Supplementary results

Figure 21: Swiss franc shocks during the sample period



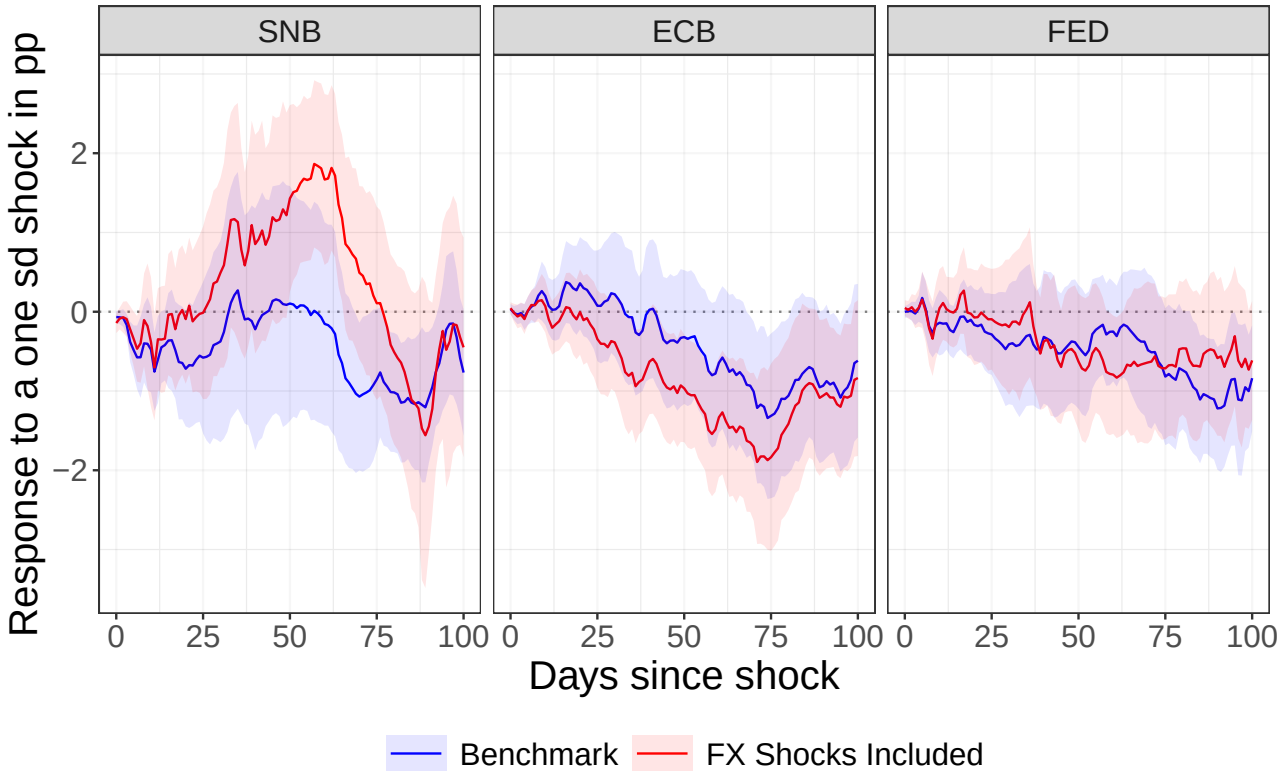
Notes: The shaded period is the period excluded in the estimation. The Swiss franc shocks are computed based on the difference in the exchange rate before and after the 30-minute time window around the respective monetary policy announcement. For the announcements of the *SNB* and *ECB*, we show the change against the EUR. For the announcements of the *FED* we show the change against the USD. A positive shock implies a depreciation of the Swiss franc.
Sources: Own computations based on https://www.dukascopy.com/swiss/english/marketwatch/historical/, accessed in December 2025.

Table 6: Summary statistics for Swiss franc shocks in percent

	N	Mean	Median	SD	Min	Max
Panel A: Full sample						
SNB	28	0.07	0.03	0.51	-1.70	1.32
ECB	56	-0.02	0.00	0.28	-0.74	0.55
FED	58	-0.01	-0.02	0.26	-0.65	0.60
Panel B: Excluding Covid period						
SNB	19	0.08	0.03	0.62	-1.70	1.32
ECB	38	-0.05	-0.04	0.30	-0.74	0.54
FED	40	0.00	-0.01	0.27	-0.65	0.54

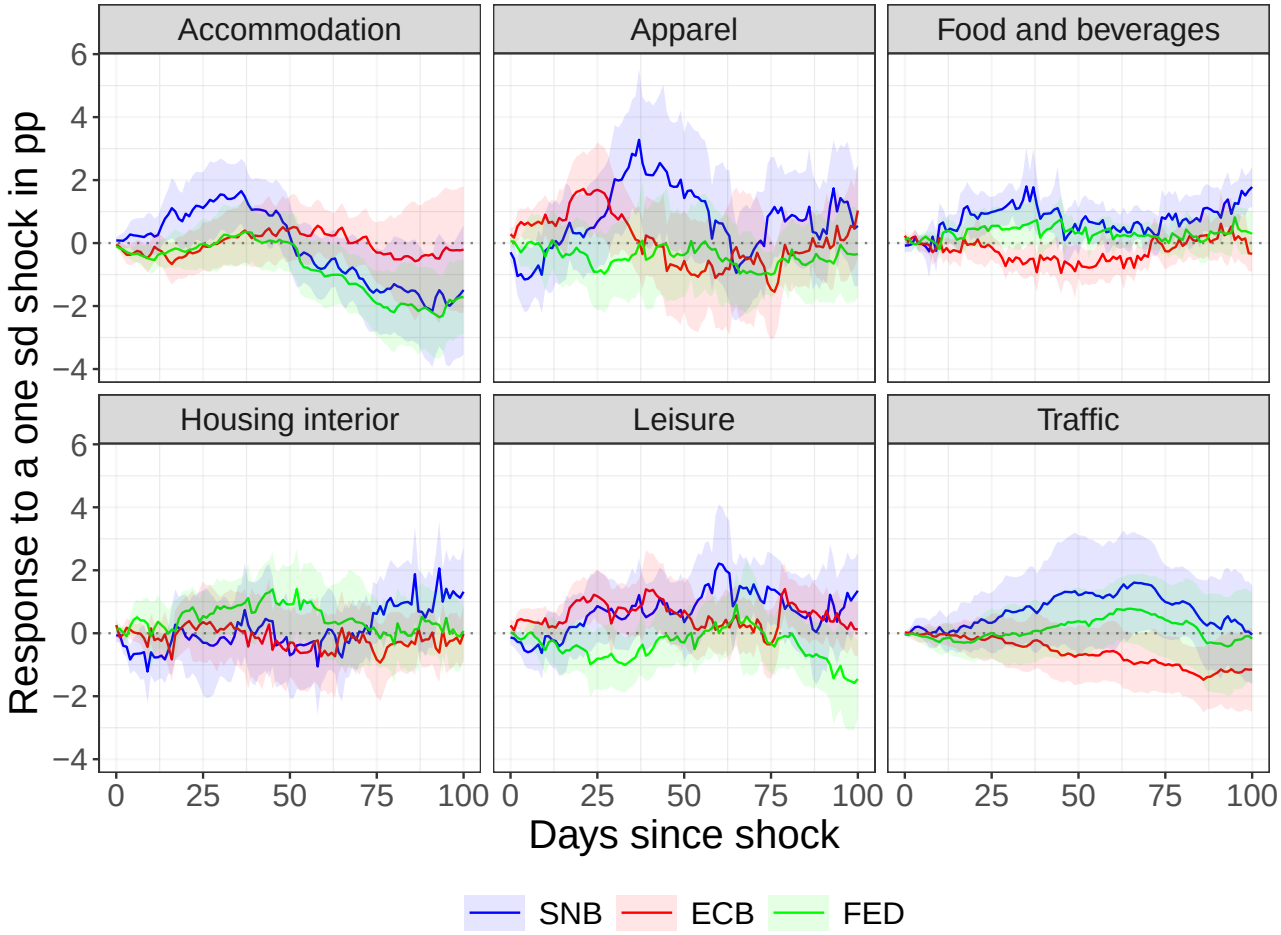
Notes: Summary statistics for Swiss franc shocks. The excluded time period in Panel B is from March 1, 2020 to May 31, 2022. The Swiss franc shocks are computed based on the difference in the exchange rate before and after the 30-minute time window around the respective monetary policy announcement. For the announcements of the *SNB* and *ECB*, we show the change against the EUR. For the announcements of the *FED* we show the change against the USD. A positive shock implies a depreciation of the Swiss franc. *Sources*: Own computations based on https://www.dukascopy.com/swiss/english/marketwatch/historical/, accessed in December 2025.

Figure 22: The short-run expenditure response to monetary policy shocks in Germany, conditional on the associated exchange-rate shocks



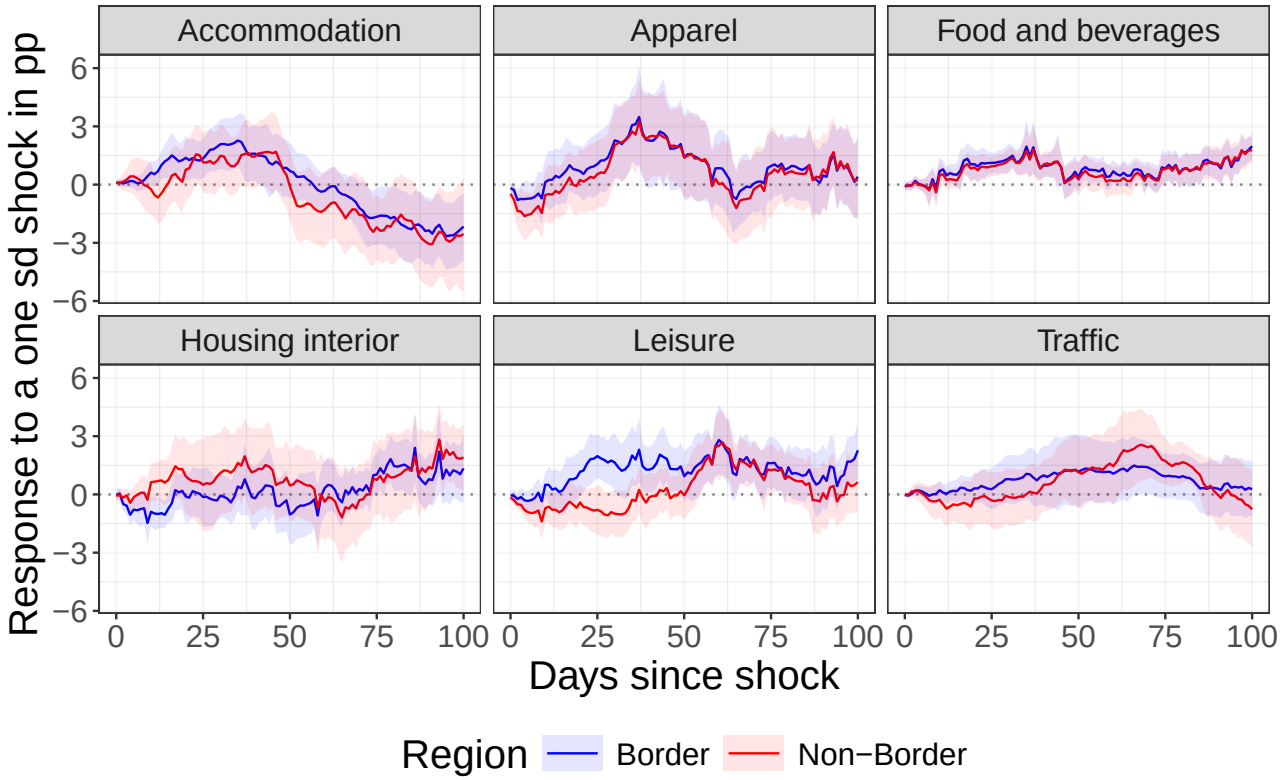
Notes: The figure labeled *SNB* shows the expenditure response to the SNB's monetary policy shocks for a horizon up to 100 days. Analogously, the other two figures show the response to the ECB's and the Fed's monetary policy shock, respectively. The response in the benchmark specification is labeled as *Benchmark* and the responses based on specification (6), in which we include the exchange-rate shocks during the short time window around the monetary policy announcements as controls, are labeled as *FX shocks included*.
Source: Own computations based on transactional data by Fable Data and the constructed monetary policy shocks.

Figure 23: The short-run expenditure response to monetary policy shocks in Switzerland, domestic cardholders



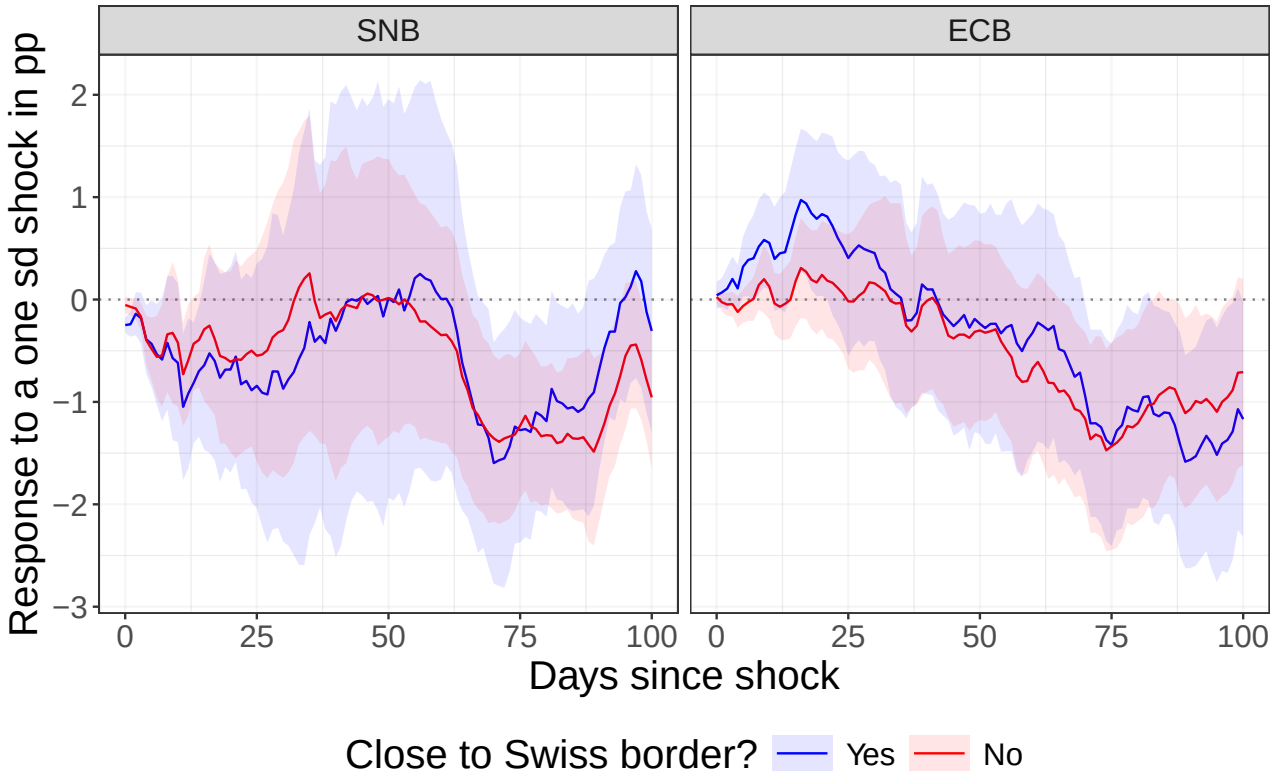
Notes: 90% confidence bands. The graphs labeled *SNB* shows the expenditure response to the SNB's monetary policy shocks for a horizon up to 100 days. Analogously, the other two figures show the response to the ECB's and the Fed's monetary policy shock, respectively. The expenditure categories are defined in Table 5, Appendix A.1.
Source: Own computations based on transactional data by Wordline and the constructed monetary policy shocks.

Figure 24: The short-run expenditure response to the SNB's monetary policy shocks in Switzerland, by region and expenditure category, domestic cardholders



Notes: 90% confidence bands. Border is defined as 50 minutes or less travel time to the closest cross-border shopping location by car. Non-border is defined as 75 minutes or more travel time by car. The expenditure categories are defined in Table 5, Appendix A.1.
Source: Own computations based on transactional data by Wordline and the constructed monetary policy shocks.

Figure 25: The short-run expenditure response to monetary policy shocks in Germany, by distance to Swiss border



Notes: 90% confidence bands. Close to the border is defined as living within 50 km of the Swiss border. The graphs labeled *SNB* shows the expenditure response to the SNB's monetary policy shocks for a horizon up to 100 days. Analogously, the other figure shows the response to the ECB's monetary policy shock.
Source: Own computations based on transactional data by Fable Data and the constructed monetary policy shocks.