The Distributional Effects of Oil Shocks

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Abstract

Through higher oil prices, negative oil supply shocks raised inflation and decreased aggregate activity in Germany since they 1980s. They also caused a moderate monetary contraction, presumably to fight their inflationary effects. Using 45 years of high-frequency German administrative data, we study the implications for labor-market outcomes (earnings of the employed and transitions in and out of unemployment) across the income distribution. At the bottom of the distribution, earnings growth falls by two percentage points two years after an exogenous 10-percent rise in oil prices, whereas the top of the distribution is hardly affected. Similarly, the job-finding probability falls significantly at the low end of the distribution while the top is unaffected. The responses of separation probabilities show a similar pattern but are less precisely estimated. This contrasts with the distributional effects of monetary policy shocks, whose incidence is also stronger at the bottom of the income distribution, but mainly through their effect on separation probabilities. We investigate how the systematic response of monetary policy to oil shocks shapes their effects. We find only a mild monetary tightening to counteract oil-shock-induced inflation, which has small effects on the aggregate responses to oil shocks and leaves their distributional effects essentially unchanged.

1 Introduction

The economic challenges of the early 2020s, such as supply-chain disruptions following the COVID-19 pandemic and sudden commodity price spikes triggered by Russia's invasion of Ukraine, have reignited debates on how supply-side shocks propagate through economies and affect different segments of society. Economists and policymakers have extensively explored the macroeconomic consequences of demand-side shocks—particularly those induced by monetary policy—but the aggregate effects of supply-side shocks and their distributional implications are less well understood. This paper fills this gap by studying how oil supply

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shocks affect labor market outcomes across the income distribution, leveraging nearly half a century of granular administrative data from Germany.

Identifying supply shocks is inherently challenging. Further, identifying the distributional implications of shocks requires long panels of high-frequency individual-level data. To take a first step towards understanding the distributional effects of supply fluctuations, we focus on exogenous fluctuations in a key input price to Western economies—that of oil (Känzig, 2021)—and use 45 years of high-frequency German administrative data on worker earnings and employment. Our approach mirrors methods widely used to examine demand-side shocks——such as monetary policy interventions——which have shown clear heterogeneous effects across the income distribution (e.g., Broer et al., 2022).

Supply-driven increases in oil prices caused significant increases in inflation and significant reductions in aggregate activity in the German economy, in line with the text-book view of supply shocks. In addition, our analysis reveals significant and persistent negative effects of oil price increases on employment stability, job-finding probabilities, and earnings of German workers. Importantly, this contractionary effect on the labor market disproportionately harmed workers at the lower end of the income distribution. Specifically, a small estimated negative effect of oil price increases on the average earnings of employed individuals is dominated by the small effects of oil prices on the income-rich. Earnings of individuals at the bottom of the income distribution, in contrast, decline substantially more, by about 2 percentage points two years after a 10 percent increase in the oil price. The probabilities of job-finding and of (future) employment for the currently employed also decline substantially more at the bottom of the distribution (although the effects are imprecisely estimated for the latter). These findings contrast with those in Broer et al. (2022) for monetary contractions and average business cycles, whose heterogeneous incidence works mainly through the probability of moving into unemployment, which responds more strongly at the bottom of the distribution. We complement our previous estimates in this paper by an analysis of the distributional impacts of monetary policy shocks before European monetary union. We find monetary policy shocks associated with the Bundesbank's monetary policy conduct (Cloyne et al., 2022) to have more homogeneous consequences on German labor-market outcomes. By directly comparing the impacts of oil supply shocks to those of monetary policy shocks, we thus elucidate similarities and differences in how demand and supply shocks affect employment, job transitions, and earnings growth.

Our empirical analysis of oil shocks also uncovers the systematic monetary policy response to those shocks. We find that, on average, policymakers in Germany responded with a moderate increase in interest rates to negative oil supply news and its inflationary consequences. Armed with our estimates of the effects of monetary policy innovations as well as oil supply news, we take the first step towards identifying the impact of oil shocks in the absence of such monetary contraction. How this is best done depends on the particular policy scenario one is interested in: on the one hand, policymakers might be interested in the economy's path should they decide to keep delaying their monetary response indefinitely, implying repeated surprises of non-reaction. Alternatively, they might want to know what path the economy would take if they were to credibly commit to not reacting to oil shocks ex-ante. These two policy scenarios correspond, respectively, to those studied in Sims and Zha (2006) and, more recently, McKay and Wolf (2023).

Reflecting our estimates of a moderate policy response, both methodologies find that the contractionary policy reaction plays only a small role for the economic consequences of oil supply shocks. An exception is inflation, which is more strongly affected by monetary policy, and thus 20-30 basis points higher in the medium term without a monetary reaction. Consequently, when we use our estimates of aggregate responses to both shocks to construct the two counterfactual 'monetary non-response' scenarios, we still find substantial contractionary effects of oil price increases. Because, in addition, monetary policy shocks have more homogeneous effects along the income distribution, in particular during the Bundesbank period that features heavily in our counterfactual analysis, the monetary policy reaction leaves the distributional effects of oil shocks essentially unchanged.

Related Literature

Our study relates, first, to previous work on the aggregate and individual-level effects of oil shocks. Many studies have tried to overcome the endogeneity problem arising from the response of oil prices to economic conditions, mostly using structural-vector-regression techniques (see Zhou (2020) for a recent contribution and a survey of the literature). Känzig (2021) investigates how news about oil supply, identified from high-frequency price changes around OPEC-announcements, affect the U.S. economy. He shows, using a vector autoregression (VAR) model, that U.S. aggregate activity falls and inflation rises in response to an increase in the price of oil. Relatedly, Känzig (2023) shows that carbon-price induced energy-price increases reduce aggregate activity in the EU. Further, he finds that, in UK data, they particularly reduce consumption of poor-income households, whose consumption baskets feature a higher share of energy. Relatedly, Pieroni (2023) and Labrousse and Perdereau (2023), among others, theoretically study the heterogeneous incidence of, respectively, energy shocks and carbon taxation, in dynamic general-equilibrium models with heterogeneous consumers.

Second, our study contributes to a growing literature on the distributional effects of aggregate shocks. Much of this literature has focused on monetary policy, including our own previous work (Broer et al., 2022). That study uses the same dataset as the present paper to investigate the incidence of monetary policy along the income distribution in Germany during the ECB period.[1] Three contemporaneous papers—Holm et al. (2021), Andersen

[1]See also Groiss (2023) for a similar analysis.

et al. (2023), Amberg et al. (2022) and Hubert and Savignac (2024) investigate this question for the cases of Norway, Denmark, Sweden, and France, respectively.

Two recent papers study the distributional consequences of oil shocks. Most related to this paper is Drossidis et al. (2024) who also study the heterogeneous incidence of Känzig (2021)'s oil-supply news, on individual incomes in the U.S. Like us, they find stronger effects at the bottom of the income distribution, but also at the top.[2] Apart from differences in the empirical method (they use a factor-augmented VAR with oil-supply news as an external instrument), our analysis differs in focus (on labor-earnings and employment transitions vs. labor and financial incomes in their paper), in the country under study (Germany vs. U.S.) and sample selection (attached workers vs. all individuals covered by Blanchet et al. (2022)'s distributional accounts). Also related to our study is Del Canto et al. (2023), who study the welfare effects of oil shocks throughout the distribution of households and find the oil-shock induced fall in equity prices to be an important determinant of its welfare effects. What sets our paper further apart is the comparison of the distributional effects of monetary policy and oil shocks. While both shocks affect the bottom of the income distribution more strongly, we show how the incidence of oil shocks is substantially heterogeneous both on earnings of the employed and on transitions in and out of unemployment. The heterogeneous incidence of monetary policy shocks, in contrast, is concentrated in the probability of transiting into unemployment.

Finally, our results relate to the literature that aims at separating the direct effects of supply shocks from those due to any monetary response. Following Sims and Zha (2006) (first published as a working paper 10 years earlier), Bernanke et al. (1997) study the effect of oil shocks (identified using the "net oil price increase" suggested by Hamilton (1996)) under a counterfactual scenario where monetary policy repeatedly surprises economic agents by not responding.[3] They find that much of the recession that follows oil-shocks is due to a contractionary monetary response (and could thus have been avoided with more expansionary policy). Their approach has been criticised by, e.g., Hamilton and Herrera (2004) as not being robust to the Lucas (1976)-critique that private-sector decision rules would change in response to an altered monetary policy reaction. Related, Kilian (2009) argues that the main episode underlying Bernanke et al. (1997)'s result, the oil shock in the late 1970s, coincides with the major change in monetary policy regime when Paul Volcker became chairman of the board of governors. Finally, Kilian (2009) argues that oil-price-based measures as those used by Bernanke et al. (1997) confound supply and demand factors.

To adress the Lucas (1976)-critique without a fully structural model, McKay and Wolf (2023) and Caravello et al. (2024) have shown how one can describe (conditional and

[2]We thank a referee for drawing our attention to this relevant paper.

[3]In contrast to Sims and Zha (2006), Bernanke et al. (1997) allow the counterfactual federal-funds rate shocks to affect the market interest rates that affect economic activity and inflation. Antolin-Diaz et al. (2021) provide a general framework for conditional forecasts based on structural VARs and discuss the link between conditioning paths for endogenous variables and the future structural shocks consistent with these.

unconditional) economic fluctuations under counterfactual policy rules based on VAR evidence. They use the shocks to U.S. monetary policy identified, respectively, by Romer and Romer (2004) and Gertler and Karadi (2015) together with simulated effects of oil shocks on the U.S. economy to estimate their effects under a counterfactual policy. Together with the contemporaneous Ider et al. (2024), we are, to our knowledge, the first to compare the McKay and Wolf (2023) approach to that proposed by Sims and Zha (2006) in an empirical study of the role of monetary policy for the effects of oil supply shocks. What sets us apart from that paper is our focus on the distributional effects. We find that the monetary response to oil shocks contributes only moderately to the employment contraction and inflation increase after oil shocks, with a somewhat larger share identified by the Sims and Zha (2006) method. Similar to Ider et al. (2024), we thus find a smaller role of contractionay monetary policy responses for the overall effect of oil-price increases in Europe than in the U.S. (Bernanke et al., 1997). In particular, the distributional effects of oil shocks only differ very mildly in the counterfactual non-response scenario.

The rest of the paper is organized as follows: Section 2 introduces the administrative data we use to compute labor market transitions and earnings, the monetary and oil shock variables, as well as the aggregate variables we use in our regressions. Section 3 presents the effects of oil supply shocks on the German economy, both in terms of aggregates and along the income distribution. Section 4 discusses our estimation of the counterfactual impulse responses to an oil shock without a monetary policy response. Section 5 concludes.

2 Data

Sample of Integrated Labor Market Biographies

Our source of administrative data on the German labor market is the Sample of Integrated Labor Market Biographies (SIAB), a two-percent subsample of all labor-market biographies in Germany, provided to us by the Research Data Center (FDZ) of the German Federal Employment Agency.[4] It covers the entire labor market history for all individuals included in our dataset, between 1975 and 2021. The data comprises information reported to the German tax authority and social-security administration, and includes information on employment status, job changes, unemployment benefit receipts, and average daily earnings within an ongoing employment relationship. The data do not cover employment spells of civil servants and do not contain self-employed individuals, as both groups are covered by special social security systems.

[4]We rely on the factually anonymous version of the Sample of Integrated Labour Market Biographies (SIAB-Regionalfile) – Version 7521. Research Data Centre (FDZ) of the Federal Employment Agency (BA) at the Institute for Employment Research (IAB). Data access was provided via a Scientific Use File supplied by the FDZ of the BA at the IAB.

The data is organized in labor market spells, which can, at most, be one year long, since an employer needs to report information to the German tax authority at least once per year (Schmucker et al., 2023). We convert our data to monthly observations of employment status and average monthly earnings. For individuals who hold multiple jobs during a single month, we keep the one with the highest remuneration. Information on pre-tax earnings is top censored. We impute it by using observable characteristics, using a Tobit regression (Dauth and Eppelsheimer, 2020).

We categorize an individual as unemployed if they receive unemployment benefit payments at the beginning of their non-employment spell. To the extent that changes in benefit eligibility over the course of our sample period were predominantly in terms of duration, this allows us to work with a relatively consistent unemployment definition.

We restrict attention to individuals who are closely attached to the labor market (i.e., employed or unemployed, according to the definition above), and between the ages of 25 and 60. We deflate pre-tax earnings using the German CPI. Further, we restrict our sample to only include individuals who have worked in West Germany, to avoid confounding effects from the German reunification in 1990.

Finally, when investigating the effects of oil shocks across the income distribution, we follow Guvenen et al. (2017) and sort individuals into deciles based on their average earnings over the previous five years. We view this as an approximation of permanent income.[5] When constructing the deciles, we condition on gender and five-year age brackets.

Table 1 provides summary statistics for relevant variables across deciles. As deciles are constructed conditional on age and gender, we do not report either of these statistics. Real monthly pre-tax earnings are expressed in 2015 Euros. Workers in the tenth decile of the permanent income distribution earn about 6 times more per month than those at the very bottom of the distribution.[6] The employment share rises from 75% in the lowest decile to 99% in the highest, but is already beyond 90% in the third decile. This pattern is accounted for by both an increasing job-finding probability (which averages about 30 percent in our sample) and a falling probability to move into unemployment (which averages 3 percent). The job-finding rates reported in the table are constructed as the share of unemployed workers in period $t-1$ who are employed in period $t+12$, i.e., one year later. The job-loss rates are calculated analogously. The total size of our dataset is close to 200 million person-month observations.

Regarding economic aggregates, we utilize the West Texas Intermediate crude oil price in U.S. dollars (Federal Reserve Bank of St. Louis, 2025b), deflated using the U.S. CPI (U.S. Bureau of Labor Statistics, 2025), the West German unemployment rate (OECD, 2023)

[5]Other measures of permanent income, such as the individual fixed effect in a Mincer regression, likely lead to similar results (Broer et al., 2022).

[6]The earnings figures are roughly in line with those reported by the Global Repository for Income Dynamics, which uses the same dataset for Germany (Guvenen et al., 2022).

Table 1: Descriptive statistics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Real monthly 2015 earnings	1260.09	1625.26	1952.03	2211.17	2457.56	2731.87	3065.66	3523.73	4360.08	5988.14
Employed	0.75	0.83	0.90	0.94	0.96	0.97	0.98	0.98	0.99	0.99
Job finding	0.26	0.28	0.30	0.32	0.33	0.33	0.34	0.33	0.33	0.34
Job loss	0.07	0.06	0.04	0.03	0.02	0.02	0.02	0.01	0.01	0.01
Observations	19575381	19563906	19571034	19544030	19538793	19541837	19528828	19502656	19532413	19524582

Note: The table summarizes decile-specific descriptive statistics in our sample. Deciles are constructed conditionally on age and gender. Real monthly pre-tax earnings are computed by dividing nominal monthly earnings by the price index, which is normalised to one in 2015. The variable *Employed* represents the employment share in each decile. The job-finding probability is computed as the share of unemployed individuals in period $t-1$ who are employed in period $t+12$, The job-loss probability is defined as the share of employed individuals in period $t-1$ who are observed as unemployed in period $t+12$. The sample period is 1975-2018.

and the German consumer price index (OECD, 2025). From the German registry data, we construct average pre-tax labor earnings of the employed and the aggregate employment share each month. We obtain the Bundesbank's discount rate and the ECB's rate for main refinancing operations from the Bundesbank's databank (Deutsche Bundesbank, 2023, 2024). In the appendix, we show the impact of an oil price shock on oil production and oil inventories, both of these come from the replication package in Känzig (2021). The real exchange rate between the German currency and the dollar is calculated by (i) translating the exchange rate between the German mark and the dollar into euros by dividing by 1.95583 (Federal Reserve Bank of St. Louis, 2025a) and (ii) by appending this with the euro-dollar exchange rate after 1998 (Board of Governors of the Federal Reserve System, 2025). Finally, we obtain data for the oil supply surprises from Känzig (2024).

Oil shocks and monetary policy surprises

In order to quantify the effect of unexpected oil supply shocks on macroeconomic outcomes, we use the series of oil supply surprises from Känzig (2021) as an instrument for changes in the price of oil in U.S. dollars. We compare the economic effects of these shocks to those of monetary policy surprises. Känzig (2021) shows that the oil supply surprises, when employed as external instruments in a VAR, suggest that an oil supply shock that raises the price of oil by 10% leads to a significant economic contraction in the U.S. and across the world, and an increase in U.S. inflation.

In order to quantify the effects of monetary policy, we take account of the fact that German monetary policy during our estimation sample was controlled by two central banks: the Bundesbank (until 1998) and the ECB. For each of these two institutions, we construct the impulse responses to monetary policy surprises separately.

For the Bundesbank, for the period from 1975 until the end of 1998, we use a series of variations in monetary policy constructed by Cloyne et al. (2022) as an instrument for the monetary policy rate.[7] In the spirit of Romer and Romer (2004), Cloyne et al. (2022) construct a series of monetary shocks by regressing the monetary policy rate on the information available to policy makers at the time, in addition to other variables.

For the time interval during which the ECB was responsible for German monetary policy, as well as the policy for other European countries, we construct the monetary policy impulse responses of our variables of interest by instrumenting the monetary policy rate using monetary policy surprises from Altavilla et al. (2019). More specifically, we utilize changes in the 3-month overnight indexed swap (OIS) rates during a narrow window around ECB monetary policy announcements.

3 The effects of oil supply shocks on the German economy

3.1 Aggregate effects of oil supply news shocks in Germany

To study the effect of oil shocks on aggregate economic conditions in Germany during our sample period, we estimate the following regression at the monthly frequency:

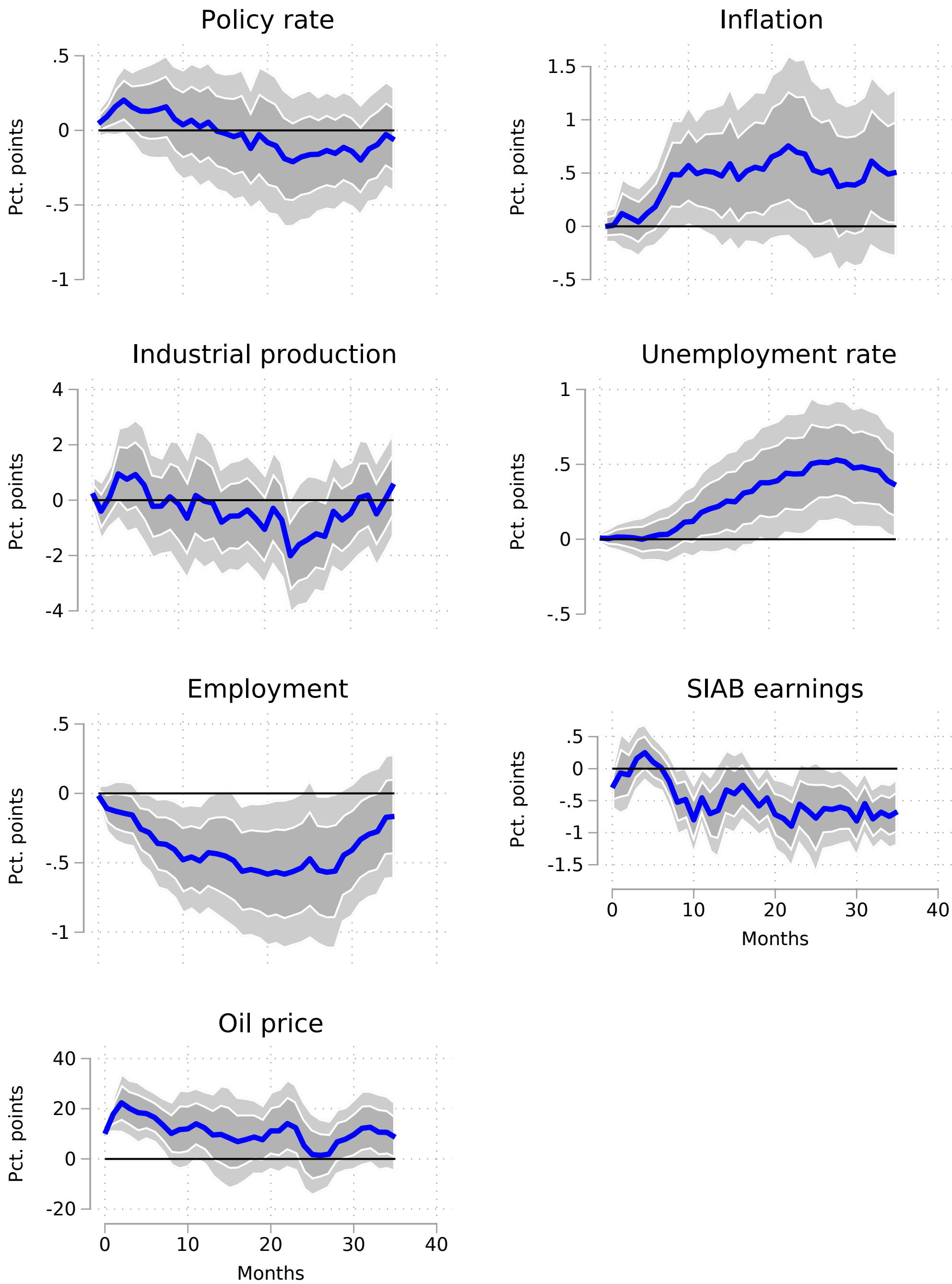
$$y_{t+h} - y_{t-1} = \alpha_h + \beta_h POIL_t + \sum_{l=1}^{L} \gamma_{h,l} X_{t-l} + \varepsilon_{t+h}, \tag{1}$$

where y is the variable of interest, $POIL_t$ is the real price of oil in period t in U.S. dollars, instrumented using the oil price surprise series from Känzig (2021), and X is a control vector containing lags of aggregate earnings and aggregate employment in our registry data sample, inflation, industrial production, unemployment, the oil price and the monetary policy rate. We set the number of lags to 6, as suggested by the Aikaike Information Criterion (AIC). For this specification, the robust F-statistic of the first stage regression is 10.283.

Figure 1 shows the results of this exercise. The oil price increase causes a contractionary monetary policy reaction, which peaks after 3 months at about 20 basis points, and then declines to turn expansionary during the second year of the response period. Unemployment rises slowly but persistently, with a peak response of 50 basis points after about 2.5 years. The employment response is an approximate mirror image of this, while industrial production follows a more volatile but declining path up to year 3. Average earnings of the employed in our micro-data also decline, with a trough response of about minus 80 basis points after two years. As expected after a negative supply shock, inflation rises and remains elevated by about 50 basis points throughout year 2. Together with the small response of policy interest

[7] We extract the shock series from Cloyne et al. (2022) using a PDF graph reader. Each point was manually marked to obtain the time-series values. We confirmed that the series closely reproduces the graphs in the original paper.

Figure 1: The aggregate effects of oil price news



Note: The Figure shows estimates of coefficients β_h in Equation (1) for different dependent variables y. We instrument the price of oil using the oil price surprises from Känzig (2021). Standard errors are heteroskedasticity robust. The shaded areas represent 68% and 90% confidence intervals. Impulse responses are scaled to a 10% increase in the monthly price of oil. Employment and average real earnings are constructed using German administrative data. The sample period is 1975-2018.

rates, this implies only a weak response of monetary policy to the inflationary consequences of oil shocks.

The results are in line with those reported by Känzig (2021) for the U.S. economy, where a negative oil supply shock causes inflation to rise and industrial production to fall; the magnitudes are similar. Figure 12 reports the impulse responses of oil-related variables such as oil inventories and oil production. In these regressions, for consistency, we do not alter the right-hand side control variables. Consistent with a supply shock, oil production decreases during the first year after the oil price increase.

In order to rule out large effects of exchange rate movements driving the effects reported in Figure 1, we estimate Equation (1) with (i) the real exchange rate (German currency/dollar) and (ii) the real oil price in German currency as the dependent variables. The results are reported in Figure 13. The oil shock has no significant effect on the real exchange rate for the first 2.5 years after impact. Towards the three-year mark, the euro depreciates slightly. Hence, the impulse response of the real oil price in German currency is very similar to that reported in Figure 1.

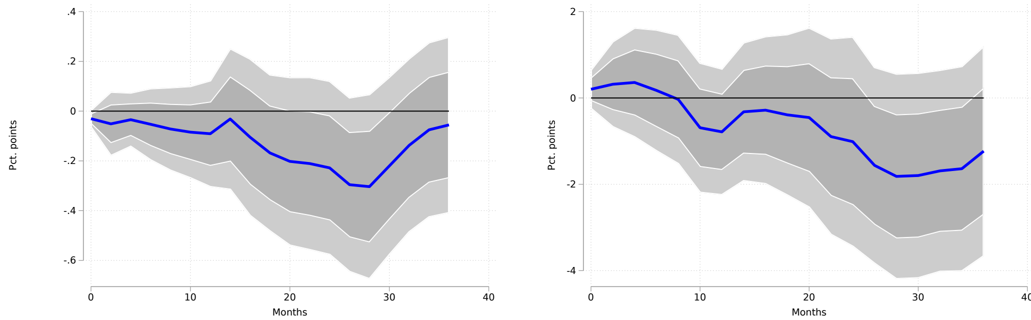
We also conduct our analysis with a modified oil supply surprise series, as suggested by Kilian (2024). In short, he raises two issues: (i) due to time aggregation issues in the monthly oil price series, the surprises from Känzig (2021) should be assigned to the months in which they affect the oil price, which are not necessarily the ones in which they occur; and (ii) due to limited liquidity in the oil futures market, the sample should start in 1989 instead of 1983. Figure 14 reports the results of this exercise; they closely match those in the baseline.[8] The impulse responses of inflation, industrial production and (un)employment are almost identical to the baseline estimates, exhibiting very similar shapes and magnitudes. The monetary policy response is, as in the baseline, contractionary on impact, but slightly less so. Further, it is more expansionary after three years. Overall, however, the results closely mirror those of the baseline estimation.

3.2 The effects of oil shocks on labor market transitions

In addition to the aggregate responses reported above, our data allow us to analyze the impulse responses of labor market transitions to oil supply shocks. Specifically, at the individual level, we can track monthly labor market transitions between employment and unemployment. By aggregating these individual transitions, we construct a time series of labor market transition probabilities over different horizons. Specifically, for a given horizon $t+h$ we are interested in the "job-finding probability", defined as the observed share of transitions to employment in $t+h$ for those unemployed in $t-1$; and in the "employment probability for the currently employed", defined as the share of transitions to employment in $t+h$ for those in employment in $t-1$.

[8]The robust F-statistic of the first stage when using the shock series suggested by Kilian (2024) is 20.149.

Figure 2: The labor market effects of oil price news



(a) Employment probability (b) Job-finding probability

Note: The Figure shows estimates of coefficients β_h in Equation (1) for different dependent variables y. We instrument the price of oil using the oil price surprises from Känzig (2021). Standard errors are heteroskedasticity robust. The shaded areas represent 68% and 90% confidence intervals. Impulse responses are scaled to a 10% increase in the monthly price of oil. The *Left Panel* shows the aggregate response of the probability of observing an individual as employed in periods $t-1$ and $t+h$. The *Right Panel* depicts the response of the probability of an unemployed individual in $t-1$ having a job in period $t+h$. The sample period is 1975-2018.

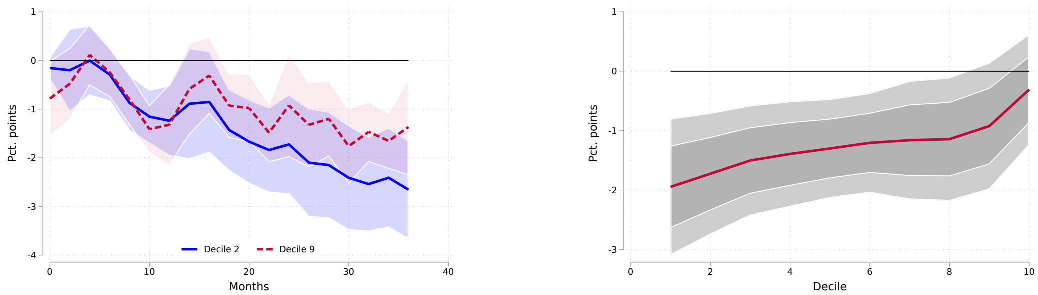
To operationalize this, we record each individual's labor market status $e \in \{U, E\}$ in period $t-1$ and again in period $t+h$, where h represents the impulse response horizon. Aggregating across all individuals enables us to estimate the effect of an oil price shock on labor market transition probabilities between $t-1$ and $t+h$, for each h, separately.

Figure 2 reports the estimated coefficients β_h from Equation (1). The left panel of Figure 2 illustrates the response of the employment probability for the currently employed . Following a 10% increase in oil prices due to a supply shock, this probability declines, reaching its lowest point (approximately -0.3 percentage points) after about 2.5 years. The right panel shows the job-finding probability, which also declines, reaching a trough of -2 percentage points. Note that, as a percentage of the unconditional probabilities depicted in Table 1, the two effects are approximately similar in size. Neither of them is precisely estimated.

3.3 Incidence of oil shocks across the income distribution

In this section, we investigate whether the aggregate labor market responses in Figure 2 mask heterogeneous incidences of oil supply shocks across the income distribution. To that end, as discussed in Section 2, we split individuals in our registry data into ten deciles, based on their average earnings over the previous five years. Subsequently, we estimate the following

Figure 3: The earnings response to oil price news



(a) Earnings response for deciles 2 and 9

(b) Earnings response at h=24, across deciles

Note: The Figure shows estimates of coefficients $\beta_{h,d}$ in Equation (2) for the earnings of the employed. We instrument the price of oil using the oil price surprises from Känzig (2021). Standard errors are heteroskedasticity robust. The coefficients are scaled to a 10% increase in the monthly price of oil. The *Left Panel* plots the coefficients for deciles 2 and 9 for all horizons. The shaded areas represent 68% confidence intervals. The *Right Panel* plots the coefficients across deciles at horizon $h = 24$. The shaded areas represent 68% and 90% confidence intervals. The sample period is 1975-2018.

regression, for each decile separately:

$$y_{t+h,i,d} - y_{t-1,i,d} = \alpha_{h,d} + \beta_{h,d} POIL_t + \sum_{l=1}^{L} \gamma_{h,l} X_{t-l} + \varepsilon_{t+h,i,d}. \tag{2}$$

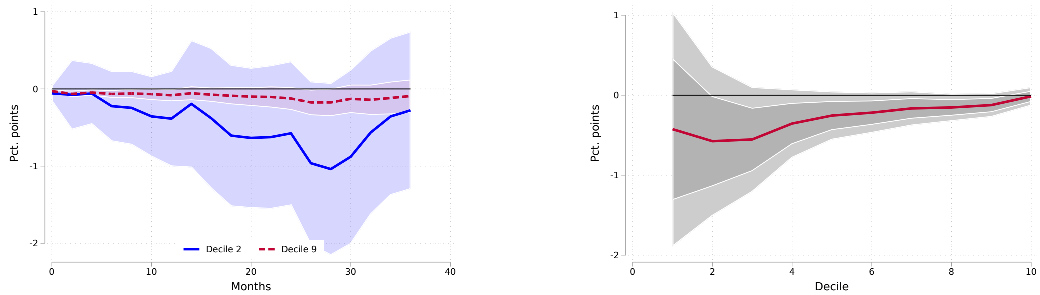
Our variables of interest y are individual level employment status $e \in \{U, E\}$ and earnings, $earn$. As before, we instrument the price of oil using the oil supply surprise series from Känzig (2021), X_{t-l} represents the same control variables as before, and, for consistency across estimations, we employ six lags, as in Equation (1). For the estimation of earnings changes of the employed, the estimation includes individuals employed in period $t-1$ and $t+h$, but does not require continuous employment.[9]

Figure 3 shows that the average response of earnings of the employed in response to an oil supply shock in Figure 1 masks important differences across the income distribution. The left panel plots the full impulse responses for the second and ninth deciles, in order not to clutter the figure. While earnings fall across the distribution, the fall in decile two is more pronounced, especially after two years. After three years, the earnings change for individuals at the bottom of the distribution is almost twice as large as the fall for individuals at the top.

The right panel of Figure 3 shows the coefficients for all deciles, two years after the shock ($h = 24$). The point estimates fall strongly in magnitude along the distribution, from an

[9]To save on computational resources, we estimate only every second horizon for Equations (2) and (4), i.e., $h \in \{0, 2, ..., 36\}$ and interpolate between the values.

Figure 4: Employment probability response to oil price news



(a) Pr(E-to-E) response for deciles 2 and 9

(b) Pr(E-to-E) at h=24, across deciles

Note: The Figure shows estimates of coefficients $\beta_{h,d}$ in Equation (2) for the probability of being employed in periods $t-1$ and $t+h$. We instrument the price of oil using the oil price surprises from Känzig (2021). Standard errors are heteroskedasticity robust. The coefficients are scaled to a 10% increase in the monthly price of oil. The *Left Panel* plots the coefficients for deciles 2 and 9 for all horizons. The shaded areas represent 68% confidence intervals. The *Right Panel* plots the coefficients across deciles at horizon $h = 24$. The shaded areas represent 68% and 90% confidence intervals. The sample period is 1975-2018.

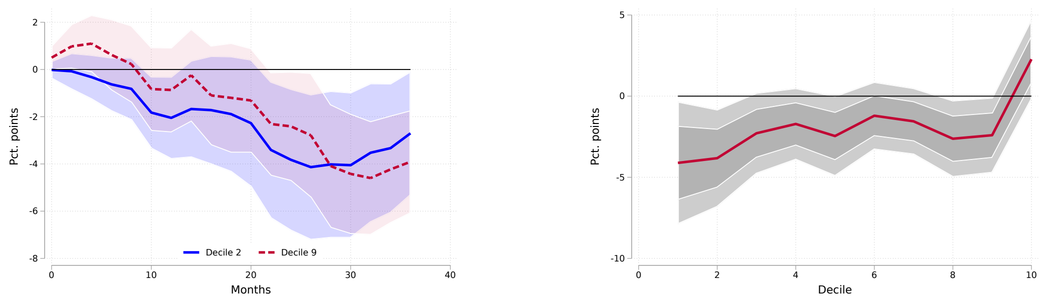
estimated two percentage point reduction at the bottom to a small and insignificant effect in the top decile.

Figure 4 plots the response to the oil price shock of the employment probability for the currently employed at horizon $t + h$. Again, there is substantial heterogeneity around the average response in Figure 2. The left panel of Figure 4 plots the impulse responses of that probability for deciles 2 and 9. The responses are imprecisely estimated, but suggest that the probability of being observed employed at horizons $t - 1$ and $t + h$ falls most for individuals at the low end of the income distribution. For the ninth decile, on the other hand, the probability barely decreases. The same picture emerges from the right panel of Figure 4: after 24 months, the probability of employment decreases by half of a percentage point below the median of the income distribution; above the median, the probability falls by less than half of that number.

Finally, we conduct an analogous analysis for the job-finding probability. The left panel of Figure 5 shows that job-finding probabilities decrease across the distribution, but, again, more so at the bottom. The impulse responses for the second and ninth decile move in parallel over the first 24 months, with a difference of about a percentage point. At the 24 months horizon, as shown in the right panel of Figure 5, job-finding probabilities are reduced across the whole distribution, but again substantially more at the bottom of the distribution: a siginificant decrease by four percentage points in the bottom quintile contrasts with a zero effect in the top quintile and with the smaller and insignificant average effect in Figure 2.

Our estimates thus paint a consistent picture on the distributional effects of oil shocks on the German labor market: although the average magnitudes and precise patterns across the

Figure 5: Job-finding probability response to oil price news



(a) Pr(U-to-E) response for deciles 2 and 9

(b) Pr(U-to-E) at h=24, across deciles

Note: The Figure shows estimates of coefficients $\beta_{h,d}$ in Equation (2) for the probability of being unemployed in period $t-1$ and employed in period $t+h$. We instrument the price of oil using the oil price surprises from Känzig (2021). Standard errors are heteroskedasticity robust. The coefficients are scaled to a 10% increase in the monthly price of oil. The *Left Panel* plots the coefficients for deciles 2 and 9 for all horizons. The shaded areas represent 68% confidence intervals. The *Right Panel* plots the coefficients across deciles at horizon $h = 24$. The shaded areas represent 68% and 90% confidence intervals. The sample period is 1975-2018.

income distributions differ, their contractionary effects are consistently felt more strongly below the median of the income distribution.

4 The effects of oil shocks without monetary policy

The response of aggregate economic conditions in Germany to a surprise oil supply contraction in Figure 1 includes the consequences of any monetary policy response to rising inflation or falling output. In this section, we aim to "clean" the responses from this systematic response using two different approaches.

A sequence of non-response surprises: Sims and Zha (2006)

The first approach relies on a method proposed by Sims and Zha (2006) and applied to oil shocks in Bernanke et al. (1997): each period after the oil price shock, there is a monetary policy surprise such that the policy rate remains at zero. All other variables in the economy evolve according to the combined effect of the oil price news shock *and* the sequence of surprising monetary (non-) responses. We conduct this exercise for each of our two monetary policy shocks (Bundesbank and ECB), separately.

Anticipated non-response: McKay and Wolf (2023)

The second approach follows McKay and Wolf (2023) and Caravello et al. (2024): in period zero, in addition to being hit by an oil supply news shock, the economy is hit by several different monetary policy shocks, calibrated to bring the policy rate's impulse response as close to zero as possible.[10] The appealing feature of this approach is that it does not rely on an economy continuously being surprised, as all unexpected monetary policy actions happen in period zero. The downside is that the ability to implement a given counterfactual policy scenario improves with the number of different identified policy shocks, and their estimated responses. We use the shocks identified, respectively, in Cloyne et al. (2022) for the Bundesbank from 1975 until 1998, and Altavilla et al. (2019), for the ECB period. Like McKay and Wolf (2023), who use the shocks to U.S. monetary policy identified, respectively, by Romer and Romer (2004) and Gertler and Karadi (2015), we thus use shocks identified by two different methods (narrative vs. based on high-frequency asset prices). In contrast to their work, we also consider shocks to the policies of different central banks but for the same economy. Specifically, we estimate the impulse responses of all variables of interest to monetary policy changes for the Bundesbank subsample (before 1999) and the ECB subsample, using local projections. This way of proceeding relies on two maintained assumptions: first, that the relevant structural features of the German economy are approximately identical over the two sub-samples. To make this more likely, we only include data on West Germany in our calculations, including after 1990.[11] Second, that the main assumption underlying McKay and Wolf (2023)'s method, that monetary policy innovations affect the economy only through the current level and expected path of the policy instrument, holds in both subperiods. This aligns with the common view that the ECB's mandate was modeled after the Bundesbank (see, e.g., Kaltenthaler, 2005), and that the interest rate was the key policy instrument for both.[12]

4.1 Aggregate effects of monetary policy in Germany

In order to implement the two approaches outlined above, we first need to estimate the impulse responses of all relevant variables, most importantly the monetary policy rate, to monetary policy shocks. We do so using an analogous regression to Equation (1), estimated at the monthly frequency:

$$y_{t+h} - y_{t-1} = \alpha_h + \beta_h i_t + \sum_{l=1}^{L} \gamma_{h,l} X_{t-l} + \varepsilon_{t+h}, \tag{3}$$

[10] In practice, we calibrate the shocks to minimize the policy rate's sum of squared deviations from zero over the 36 month horizon.

[11] This first assumption also presumes an alignment to German monetary policy by today's Euro Area countries, many but not all of whom followed the Bundesbank closely in its rate setting.

[12] This view goes against monetary targeting being a central element of Bundesbank policy, and is sustained, for example, by Clarida and Gertler (1997), who argue that "As is commonly understood by close observers of the Bundesbank, the [monetary] targets are meant as guidelines. In no sense do they define a strict policy rule. In terms of operating procedures, the Bundesbank chooses a path for short-term interest rates to meet its policy objectives, similar in spirit to the Federal Reserve Board."

where i_t is the monetary policy rate, instrumented either using the Bundesbank surprises from Cloyne et al. (2022), or the ECB surprises from Altavilla et al. (2019), y_t is an outcome variable of interest, and X is a vector of control variables. For consistency across estimations, we use six lags, as in Equation (1), and include all control variables from above: the price of oil, the German CPI, the German unemployment and employment rates, German industrial production, average earnings and the monetary policy rate.[13] We also add six lags of the instrument. For the Bundesbank period, the robust F-statistic of the first stage regression is 358.35, for the ECB period, it is 18.746.

Figure 6 summarizes the results of this exercise, for an unexpected ECB monetary policy tightening of 100 basis points (20 times larger than the standard deviation of the innovations induced by our instrument).[14] The policy rate initially stays elevated at around the level of the initial 100 basis points shock, but then declines rapidly, turning negative seven months after the shock, before it returns to zero after about two years.

After a brief initial increase, inflation starts to fall in response to the tightening with a considerable lag, by close to 2 percentage points after two years. Economic activity, in contrast responds somewhat faster: the growth rate of industrial production is reduced by close to five percentage points one year after the shock, before returning to baseline towards the end of the estimation period. The impulse response for industrial production, however, is volatile and imprecisely estimated.

The official unemployment rate starts to increase after about 5 months and attains its peak after about one year, at about 1 percentage point. It remains elevated for the next two years before falling back towards zero. In line with this, the employment rate of workers closely attached to the labor market falls by one percentage point and remains low for about two years, although its response is more volatile than that of the unemployment rate. The response of average earnings growth of the employed in our micro data is noisy and suggests that the earnings of the employed rise significantly but briefly after about 1.5 years. We attribute this to a selection effect, as low-earnings individuals are more likely to become unemployed. Finally, the impact of European monetary policy on the oil price is estimated to be initially positive before it turns negative. As in Ider et al. (2024) the point estimates are large, but very imprecisely estimated.

Figure 15, in the appendix, shows the estimation results for the Bundesbank sample period from 1975-1998. A 100 basis points monetary contraction is followed by an immediate steady decline in the policy rate, until it turns negative after about 1.5 years.[15] The rate of

[13] The results are robust to the inclusion of only 5 or 8 lags for the ECB and Bundesbank, respectively, which is the optimal number according to the AIC. The results are reported in Figures 24 and 25

[14] The standard deviation of the instrument is $\sigma_z = 3.93$, while the first stage coefficient on the instrument is $\beta_z = 0.014$, hence, a two standard deviation contraction would lead to an increase in the policy rate by about 10 basis points.

[15] The standard deviation of the monetary policy shocks from Cloyne et al. (2022) is $\sigma_z = 21.67$, and the first stage coefficient is $\beta_z = 0.009$. Thus, a two standard deviation monetary policy shock would induce a 39 basis point contraction.

Figure 6: The aggregate effects of ECB monetary policy

Note: The Figure shows estimates of coefficients β_h in Equation (3) for different dependent variables y. We instrument the monetary policy rate using the changes in 3-month OIS rates in a narrow window around monetary policy announcements from Altavilla et al. (2019). Standard errors are heteroskedasticity robust. The shaded areas represent 68% and 90% confidence intervals. Impulse responses are scaled to a 100 basis point monetary policy shock. Employment and average real earnings are constructed using German administrative data. The sample period is 1999-2018.

inflation reacts with a lag of about two years, but then falls significantly, by a similar amount but somewhat later compared to the ECB period. Industrial production, although volatile, falls by about two percentage points, with a trough after about two years. The unemployment rate mirrors this, increasing by close to 0.3 percentage points after one year (substantially less compared to its response during the ECB period) staying elevated until the end of the response horizon. The employment rate, as measured in our individual-level dataset, decreases by a similar magnitude (and thus, again, less then in response to ECB-period shocks) and remains low until about two years after the initial shock. Earnings changes are volatile and not significantly different from zero. Finally, in response to a monetary contraction in Germany the oil price decreases with a substantial lag of about one year, but remains volatile. Figure 16 shows the impact of monetary policy on the real exchange rate between the euro and the dollar.[16] Upon impact, the euro appreciates, but only briefly. After one year, the real exchange rate has returned to its initial value. Hence, the effect of German monetary policy on the oil price is similar when the oil price is measured in euros.

The responses of aggregate variables to ECB and Bundesbank policy are thus qualitatively similar, but activity responds substantially less during the Bundesbank period. Importantly, the paths of the short-term interest rate are rather different: while the policy rate stays elevated for 6 months after the ECB shock, it declines immediately and steadily after the Bundesbank shock. This will be important for the counterfactual policy scenarios in Section 4, where these shock paths are used to offset the monetary policy response to the oil shock.

4.2 The effects of monetary policy shocks on labor market transitions

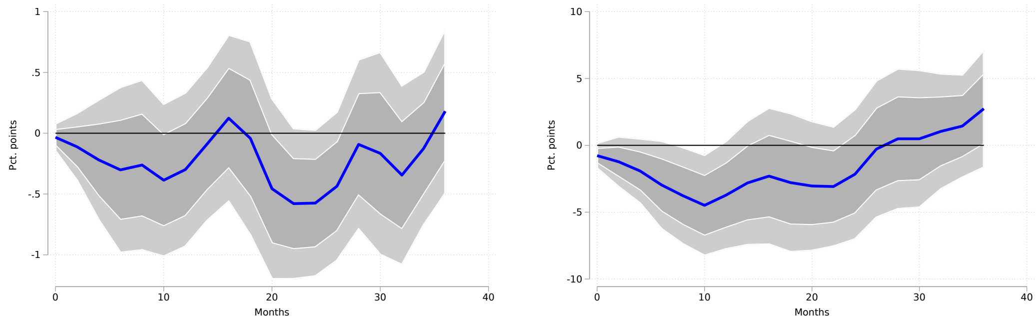
Similar to Section 3.2 for oil shocks, we use our administrative data to compute the effect of monetary policy shocks on the likelihood of different labor market transitions. The results are reported in Figure 7.

The Figure shows that a contractionary monetary policy shock reduces the employment probability for both the currently employed and unemployed, although the latter effect is concentrated in the first half of the response horizon. The point estimates are sizeable relative to the average probabilities of changing labor-market status in Table 1, but imprecisely estimated and, in the case of the employment probability of the currently employed, volatile.

The negative effect on employment probabilities caused by a tightening of Bundesbank monetary policy, shown in Figure 18 in the appendix, is similarly in magnitude, but more precisely estimated, less volatile for those employed in $t-1$ and more persistent for the unemployed.

[16]We report euro exchange rates as implied by the Euro-Deutschmark conversion rate for ease of comparison.

Figure 7: The labor market effects of ECB monetary policy



(a) Employment probability

(b) Job-finding probability

Note: The Figure shows estimates of coefficients β_h in Equation (1) for different dependent variables y. We instrument the monetary policy rate using the surprises from Altavilla et al. (2019). Standard errors are heteroskedasticity robust. The shaded areas represent 68% and 90% confidence intervals. Impulse responses are scaled to a 100 basis point monetary policy shock. The sample period is 1999-2018. The *Left Panel* shows the response of the average employment probability of the currently employed at horizon $t + h$. The *Right Panel* depicts the response of the average job-finding probability.

4.3 Incidence of monetary policy across the income distribution

To estimate the impact of monetary policy on earnings and employment across the income distribution, we run the following regression, mirroring Equation (2):

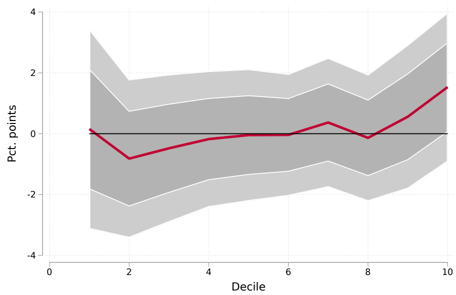
$$y_{t+h,i,d} - y_{t-1,i,d} = \alpha_{h,d} + \beta_{h,d} i_t + \sum_{l=1}^{L} \gamma_{h,l} X_{t-l} + \varepsilon_{t+h,i,d}. \tag{4}$$

where, as in Equation (3), we instrument the policy rate i_t using either the monetary shocks from Cloyne et al. (2022), for the Bundesbank, or the surprises from Altavilla et al. (2019), for the ECB. We employ the same control variables as before and use six lags. The coefficient $\beta_{h,d}$ measures the effect of monetary policy on y (employment status or individual log-earnings), for each horizon h and decile d.

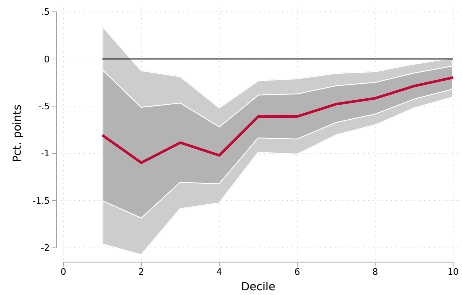
The top left panel of Figure 8 shows the impact of a 100 basis points ECB monetary policy shock on the earnings growth of the employed, two years after the shock. It shows that the impact of monetary policy on earnings is small and insignificant for the bottom 8 deciles. The increase in average earnings in Figure 6 thus seems entirely due to the rise at the very top of the distribution that is imprecisely estimated but dominates the average. The full impulse responses for deciles 2 and 9 in Figure 19 confirm this.

The top right panel of Figure 8 shows that the insignificant effect of ECB monetary policy on the average employment probability for the currently employed in Figure 7 masks significant but heterogeneous effects across the income distribution: Two years after a

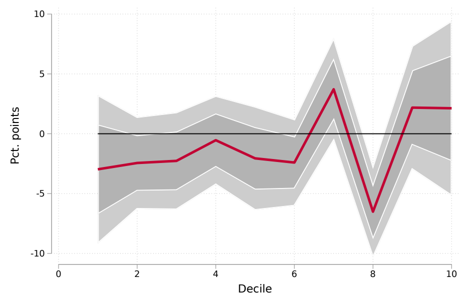
Figure 8: Responses to ECB monetary policy across the distribution – $h = 24$



(a) Earnings growth



(b) Employment probability



(c) Job-finding probability

Note: The Figure shows estimates of coefficients $\beta_{h,d}$ in Equation (4) for different dependent variables y, at horizon $h = 24$. Standard errors are heteroskedasticity robust. The shaded areas represent 68% and 90% confidence intervals. Impulse responses are scaled to a 100 basis point monetary policy shock. The policy rate is instrumented using monetary policy surprises from Altavilla et al. (2019). The sample period is 1999-2018. The *Top Left* panel shows the change in earnings growth across deciles, conditional on employment. The *Top Right* panel shows the change in the probability of a worker employed at $t - 1$ to be employed at $t = 24$. The *Bottom* panel shows the change in the probability of an unemployed individual in period $t - 1$ to be employed in period $t = 24$.

monetary policy shock, the probability of being employed (for individuals who were employed before the shock) has fallen by a percentage point for workers below the median. Moving further up the distribution, the effect diminishes strongly. The results are in line with those reported in Broer et al. (2022), who, despite different sample selection, sample period and monetary policy surprises, find that ECB monetary policy significantly reduces separation probabilities (the complement of our estimate) especially at the bottom of the income distribution.

The point estimates of the effect of monetary policy on the job-finding probability (of an initially unemployed individual being employed at horizon h) are also negative below the median (and even rise above zero at the top of the distribution). At the 24-months-horizon shown in Figure 8, the effects are mostly insignificant, but there are significant reductions below the median at shorter horizons, with mostly insignificant effects above.

We relegate the estimation results of Equation (4) for the Bundesbank sample to the appendix. They are summarized in Figures 20 and 21, which show less heterogeneity around the effects on average employment probabilities shown in Figure 18. The effect on earnings growth is indeed positive and significant for the first seven deciles at the 24 months horizon, a result of the volatile average response in Figure 15.

Overall, we find stronger incidence of monetary policy and oil shocks at the bottom of the income distribution. For monetary policy, however, this heterogeneity materialises through its effect on labor market transitions, mainly during the ECB period. The incidence on earnings of the employed, and during the Bundesbank period, is substantially less heterogeneous. This contrasts with the incidence of oil shocks that is strongly heterogeneous in particular on earnings.

4.4 Aggregate responses without monetary contraction

In this section we identify the effects of oil shocks on the German economy when monetary policy does not react. When applying the method of Sims and Zha (2006), we solve for the monetary policy shock series, separately for each of our two monetary policy regimes, that sets the policy rate exactly to zero for all $t \in \{0, 36\}$. When following McKay and Wolf (2023) we proceed as follows: to the oil shock responses in Figure 1, we add a weighted sum of the responses to monetary policy shocks in Figures 6 and 15 (ECB and Bundesbank). The weights are chosen to attain a monetary policy rate as close to zero as possible over the first 36 months in response to the oil shocks.

The monetary shocks implied by these different procedures are displayed in Figure 22 in the Appendix. The counterfactual responses computed according to Sims and Zha (2006) using ECB-period shocks require rather large and volatile monetary policy interventions to implement non-reaction to oil shocks. This is because the ECB-period shock, in response to which the policy rate rises upon impact and remains high for 6 months before declining rapidly, struggles to offset the hump-shaped response of monetary policy to oil shocks. Using in the Sims and Zha (2006)-method the Bundesbank-period shocks, which decline smoothly throughout the first 2.5 years, implies smaller and less volatile shocks.

As a consequence, when following McKay and Wolf (2023), to undo the contractionary response to the oil price shock using $t = 0$ shocks, the weight given to Bundesbank shocks (equal to -17 basis points, or close to one standard deviation) strongly exceeds that of ECB shocks (-3.3 basis points, or 2/3 of a standard deviation).

Figure 9 displays the original responses to the oil supply shock jointly with the counterfactual responses. Under the approach of Sims and Zha (2006), the policy rate is exactly zero by construction, for the entire response horizon. The McKay and Wolf (2023)-approach yields a substantially dampened policy path. During the year following the oil shock, both approaches imply a mildly more expansionary monetary policy, with an average reduction of the policy rate of 10 basis points. Figure 23 depicts the difference between the estimated responses of policy and other variables to the oil-price shock and those under the counterfactual scenarios. As the top right panel of Figure 9 shows, the counterfactual, more expansionary monetary policies would have raised inflation during the second and third year after the oil-price shock, by around 0.2 percentage points after two years. The approach by Sims and Zha (2006) using the ECB shocks implies a substantially larger increase thereafter, by up to 0.6 percentage points.

Aggregate activity is affected somewhat less than inflation by the more expansionary policy paths based on Sims and Zha (2006) using Bundesbank-period shocks, and on McKay and Wolf (2023) (where the Bundesbank shocks receive a substantially higher weight). For example, the unemployment rate is lower by about 10 basis points during year 2 of the response. This is because Bundesbank-period shocks have a smaller impact on activity than shocks during the ECB period. When fed through the Sims and Zha (2006)-method, the ECB shocks, in fact, imply a substantially stronger boost to employment (of about 35 basis points during year 2) and to industrial production (which rises by a percentage point on average during in year 2).

4.5 The labor market effects of counterfactual monetary policy

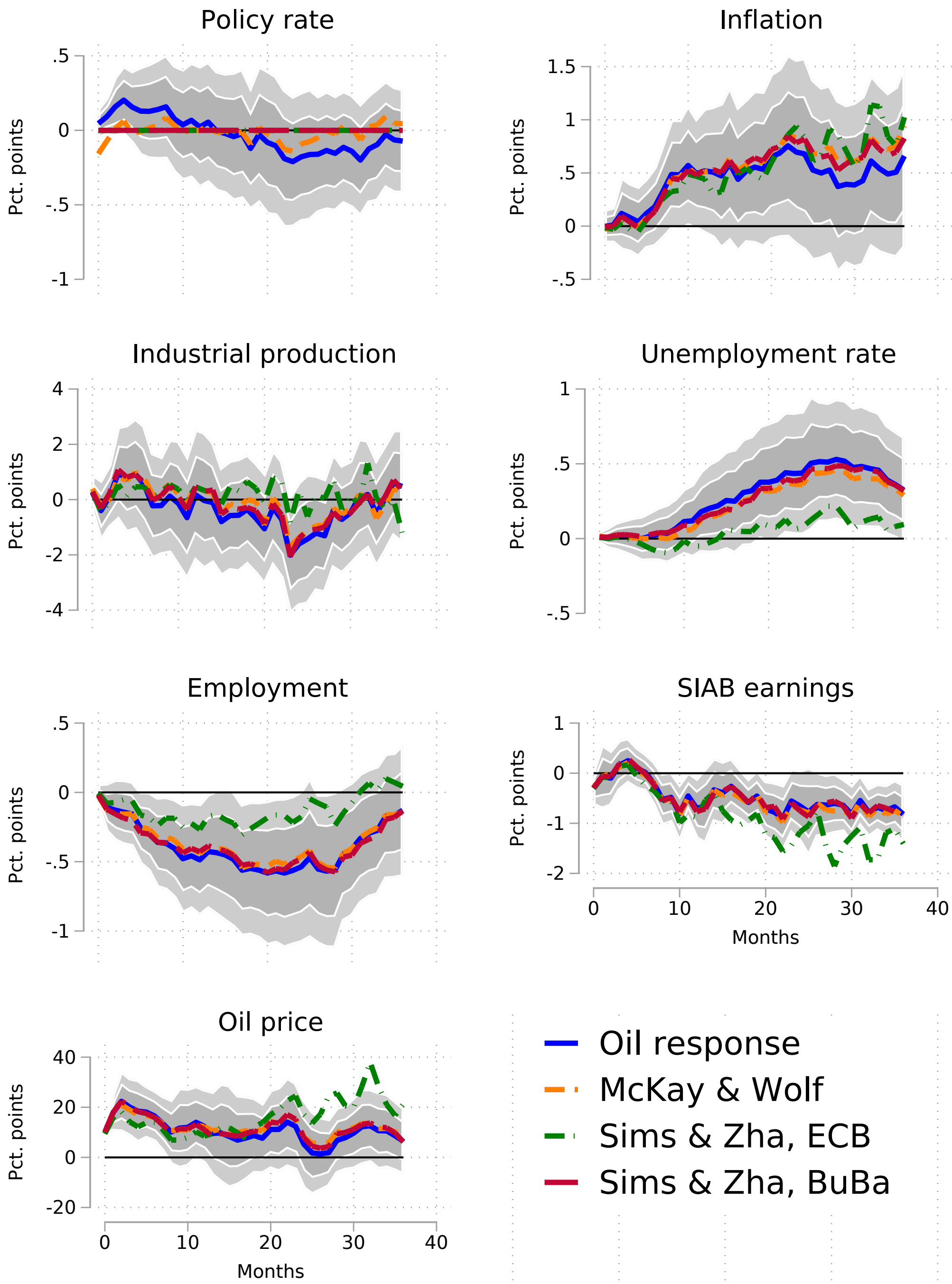
Figure 10 shows the response of average employment probabilities to oil shocks when monetary policy follows the counterfactual policy paths discussed in the previous section. The employment probability for the currently employed is higher in the counterfactuals. The effect is largest for the counterfactual that loads heavily on the ECB response, with 20 basis points in year 2 of the response. The counterfactuals that load heavily on the Bundesbank increase the probability by only half as much. The effects of muted monetary policy on the job-finding probability are slightly larger and materialize earlier. In the case of the McKay and Wolf (2023) and Sims and Zha (2006)-methods with Bundesbank shocks, however, they are less persistent, making them very close to the original response to oil-shocks after two years.

4.6 Distributional effects without monetary contraction

In this section we present counterfactual responses of earnings and employment probabilities to oil shocks across the income distribution when monetary policy follows the counterfactual policy paths discussed in the previous section.

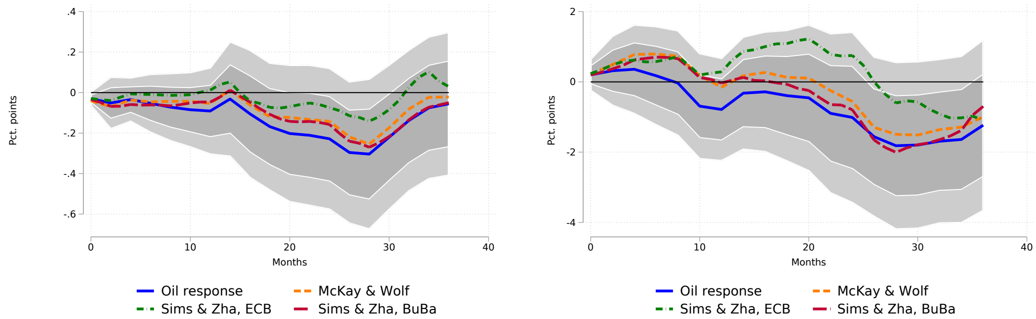
Figure 11 presents the results, across deciles, at horizon $h = 24$. Starting with the bottom panel, because the Bundesbank monetary policy shocks have a small effect on job-finding probabilities, the counterfactual policies that rely heavily on them (including those following

Figure 9: The aggregate effects of counterfactual monetary policy



Note: The Figure shows estimates of coefficients β_h in Equation (1) for different dependent variables y as blue solid lines. Standard errors are heteroskedasticity robust. The shaded areas represent 68% and 90% confidence intervals. Impulse responses are scaled to a 10 percent increase in the oil price upon impact. The orange lines represent the counterfactual responses of the variables estimated according to McKay and Wolf (2023). The green dash-dotted line represents counterfactual responses estimated according to Sims and Zha (2006), using ECB monetary policy. The red long-dashed lines represent counterfactual responses estimated according to Sims and Zha (2006), using Bundesbank monetary policy.

Figure 10: The labor market effects of counterfactual monetary policy



(a) Employment probability

(b) Job-finding probability

Note: The Figure shows estimates of coefficients β_h in Equation (1) for different dependent variables y. We instrument the price of oil using the oil price surprises from Känzig (2021). Standard errors are heteroskedasticity robust. The shaded areas represent 68% and 90% confidence intervals. Impulse responses are scaled to a 10% increase in the monthly price of oil. The orange lines represent the counterfactual responses of the variables estimated according to McKay and Wolf (2023). The green dash-dotted lines represent counterfactual responses estimated according to Sims and Zha (2006), using ECB monetary policy. The red long-dashed lines represent counterfactual responses estimated according to Sims and Zha (2006), using Bundesbank monetary policy.

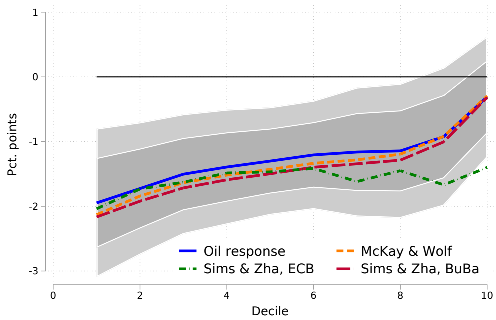
McKay and Wolf (2023)) leave their baseline response essentially unchanged. Using the ECB-shocks to implement the Sims and Zha (2006)-method, in contrast, implies a substantial boost to job-finding, by between 1.5 and 2 percentage points, below the median of the income distribution. This is because job-finding responds strongly and quickly to ECB shocks (see the impulse responses in Figure 19). This increases the cumulative effect of the shocks depicted in Figure 22, whose strong volatility, however, calls for caution when using this case as a base for counterfactual policy.

The effect of more expansionary monetary policy on separation rates is more similar across the three methods: a mild reduction that falls in magnitude along the income distribution. This contrasts with the effect on earnings growth of the employed, which is predicted to fall by *more* below the median of the income distribution (for counterfactuals relying heavily on Bundesbank shocks) or above (for the Sims and Zha (2006)-method using ECB shocks). This is because of the estimated positive effect of monetary contractions on earnings of the employed in those parts of the distribution (which, again, may be interpreted as a selection effect of lower-paid workers being laid off).

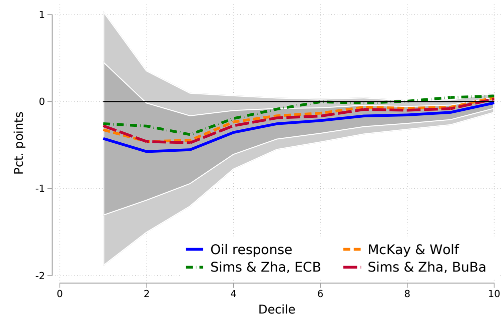
5 Conclusion

Our study sheds light on the impact of oil price shocks, and the monetary responses they cause, on the German economy. We find that oil price increases trigger significant economic

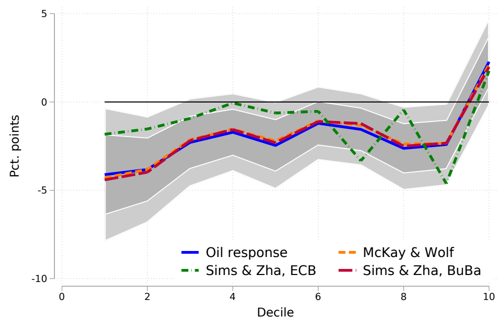
Figure 11: Responses to counterfactual monetary policy across the distribution – h=24



(a) Earnings growth of the employed



(b) Employment probability of the employed



(c) Job-finding probability of the unemployed

Note: The Figure shows estimates of coefficients $\beta_{h,d}$ in Equation (2) for different dependent variables y as blue solid lines, across deciles, for $h = 24$ months after the initial shock. Standard errors are heteroskedasticity robust. The shaded areas represent 68% and 90% confidence intervals. Impulse responses are scaled to a 10 percent increase in oil prices upon impact. The orange lines represent the counterfactual responses of the variables estimated according to McKay and Wolf (2023). The green dash-dotted line represents counterfactual responses estimated according to Sims and Zha (2006), using ECB monetary policy. The red long-dashed lines represent counterfactual responses estimated according to Sims and Zha (2006), using Bundesbank monetary policy. The *Top Left Panel* shows the responses of the earnings growth of the employed, the *Top Right Panel* shows the response of the probability of an individual employed at $t-1$ to be employed at $t+24$, the *Bottom Panel* shows the response of the probability that an individual who was unemployed at $t-1$ is employed at $t+24$.

contractions, with heterogeneous impact along the income distribution. Notably, income-poor workers bear the brunt of these shocks, experiencing lower employment probabilities and persistently lower earnings growth.

We compare these effect to those of monetary policy shocks. Their incidence is similarly stronger on the income-poor, but only through labor-market transitions and not earnings growth.

Constructing counterfactual monetary policy non-responses to oil price shocks, we show that, at the aggregate level, inflationary pressures are greater without monetary intervention. Employment and output are affected only little (although the details of how to implement monetary non-response matter more in this case). Because the distributional effects of monetary shocks during the Bundesbank period (that feature importantly in our counterfactuals) are limited, we conclude that the distributional effects of oil shocks are affected only mildly by the monetary policy response to oil shocks.

Future research should further explore the interplay between supply shocks and monetary policy. In particular, the different magnitudes of monetary-policy effects across different periods of our data sample deserve further investigation. Different types of supply shocks do, too.

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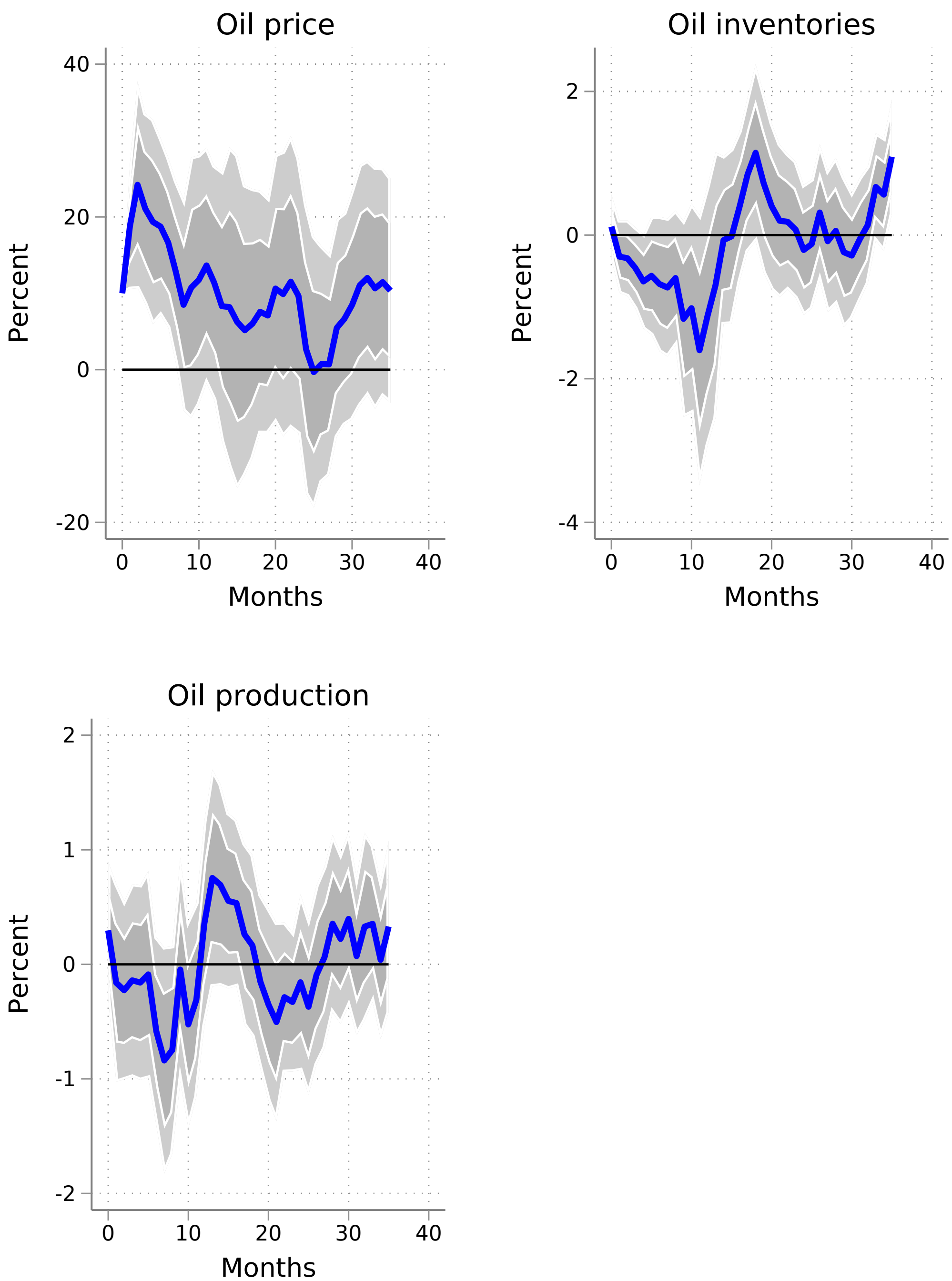
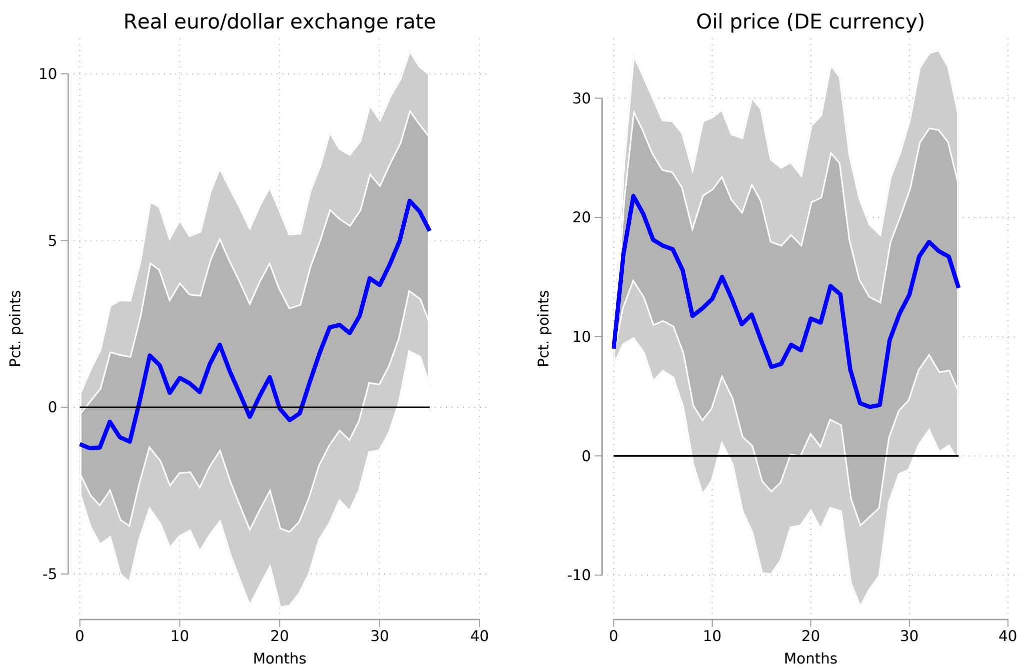
A Additional Figures

Figure 12: The aggregate effects of Oil price shocks – oil variables



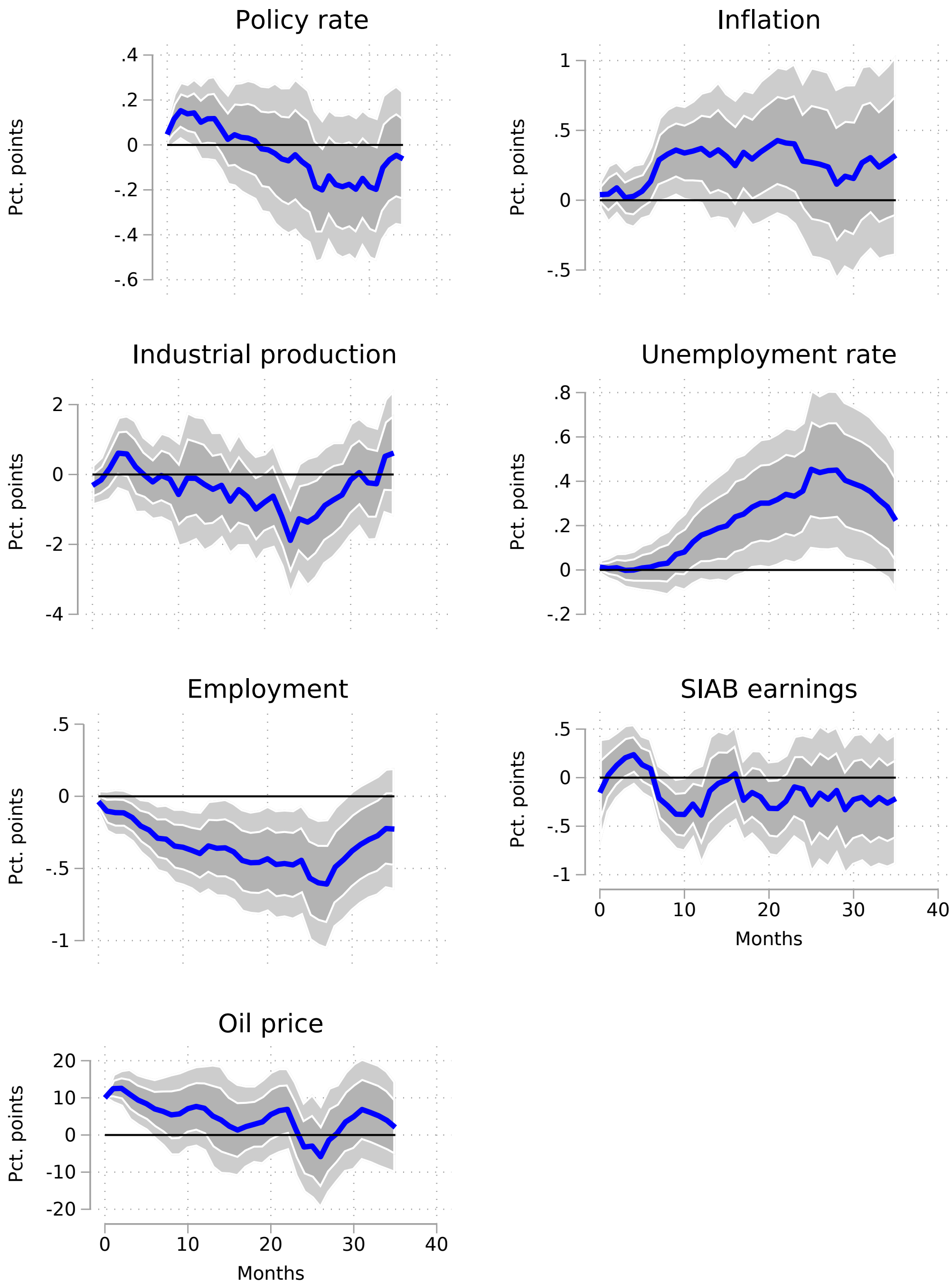
Note: The Figure shows estimates of coefficients β_h in Equation (1) for different dependent variables y. We instrument the price of oil using the oil price surprises from Känzig (2021). Standard errors are heteroskedasticity robust. The shaded areas represent 68% and 90% confidence intervals. Impulse responses are scaled to a 10% increase in the monthly price of oil. The sample period is 1975-2018.

Figure 13: The aggregate effects of Oil price shocks – exchange rates



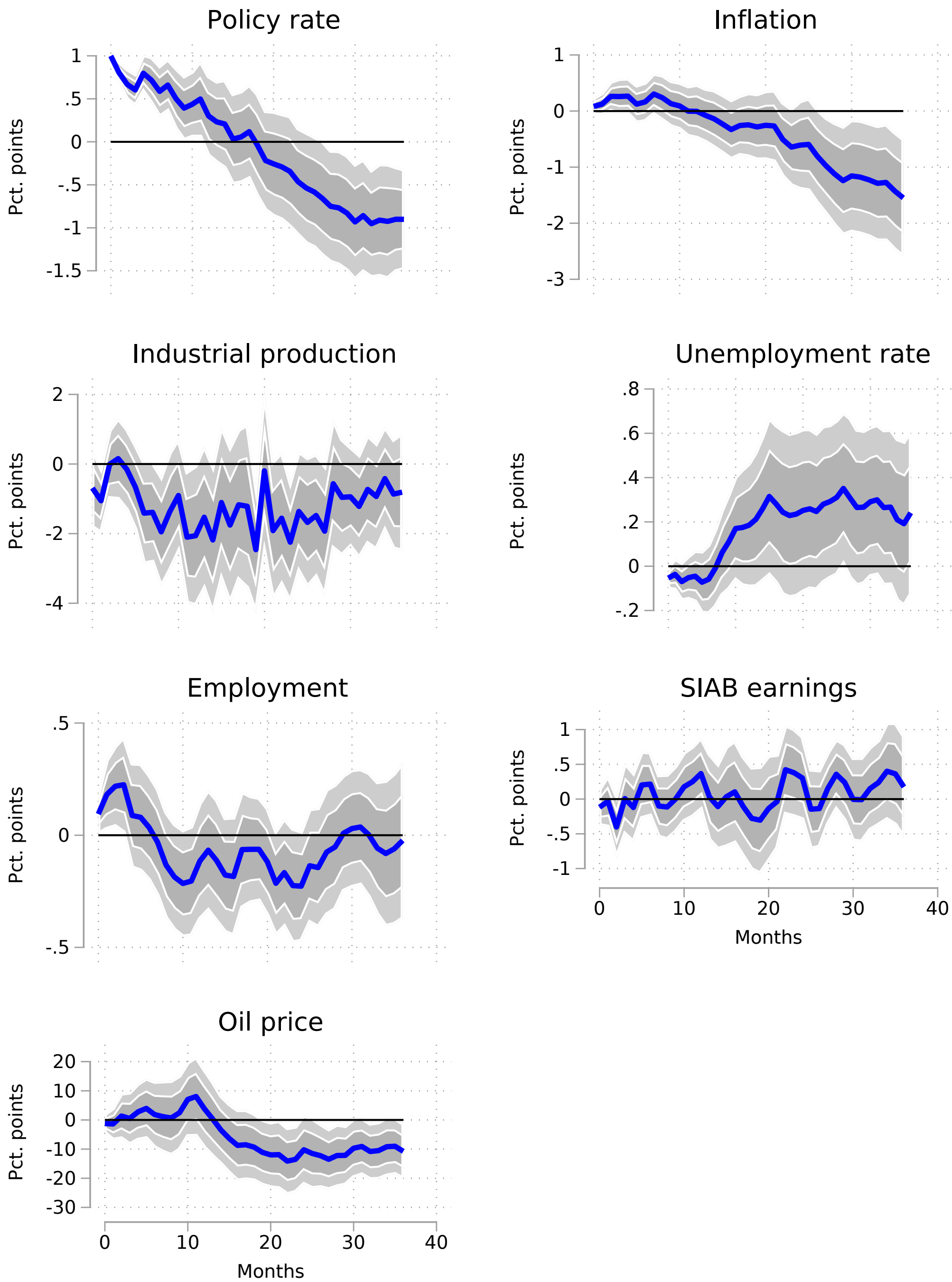
Note: The Figure shows estimates of coefficients β_h in Equation (1) for different dependent variables y. We instrument the price of oil using the oil price surprises from Känzig (2021). Standard errors are heteroskedasticity robust. The shaded areas represent 68% and 90% confidence intervals. Impulse responses are scaled to a 10% increase in the monthly price of oil. The sample period is 1975-2018.

Figure 14: The aggregate effects of Oil price shocks – Kilian (2024) instrument



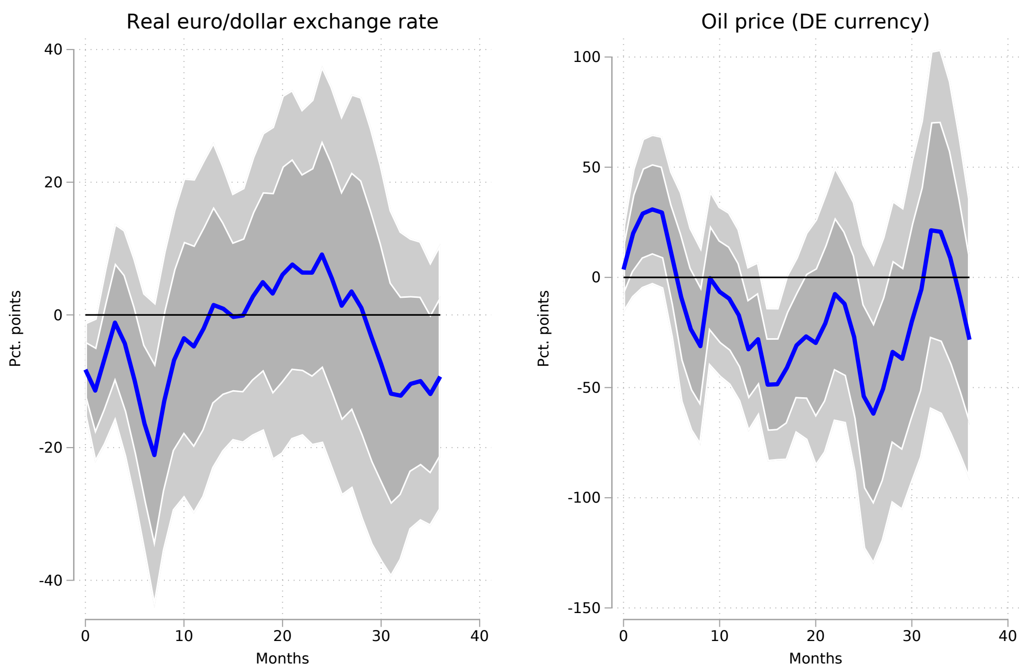
Note: The Figure shows estimates of coefficients β_h in Equation (1) for different dependent variables y. We instrument the price of oil using the oil price surprises constructed as in Kilian (2024). Standard errors are heteroskedasticity robust. The shaded areas represent 68% and 90% confidence intervals. Impulse responses are scaled to a 10% increase in the monthly price of oil. Employment and average real earnings are constructed using German administrative data. The sample period is 1975-2018.

Figure 15: The aggregate effects of Bundesbank monetary policy



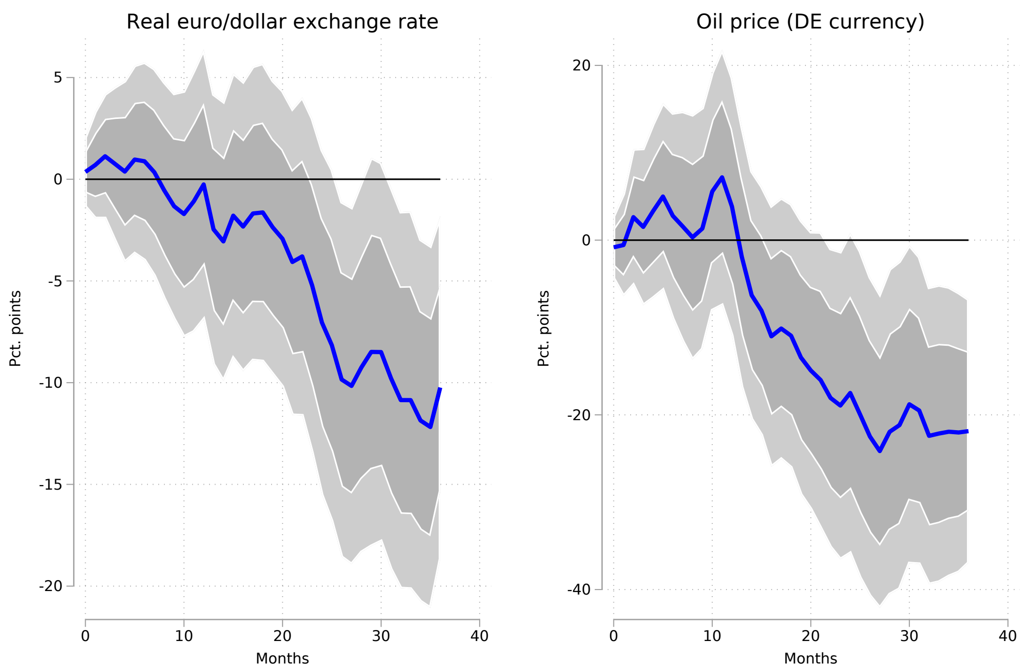
Note: The Figure shows estimates of coefficients β_h in Equation (3) for different dependent variables y. We instrument the monetary policy rate using the monetary policy surprises from Cloyne et al. (2022). Standard errors are heteroskedasticity robust. The shaded areas represent 68% and 90% confidence intervals. Impulse responses are scaled to a 100 basis point monetary policy shock. Employment and average real earnings are constructed using German administrative data. The sample period is 1975-1998.

Figure 16: The aggregate effects of ECB monetary policy – exchange rates



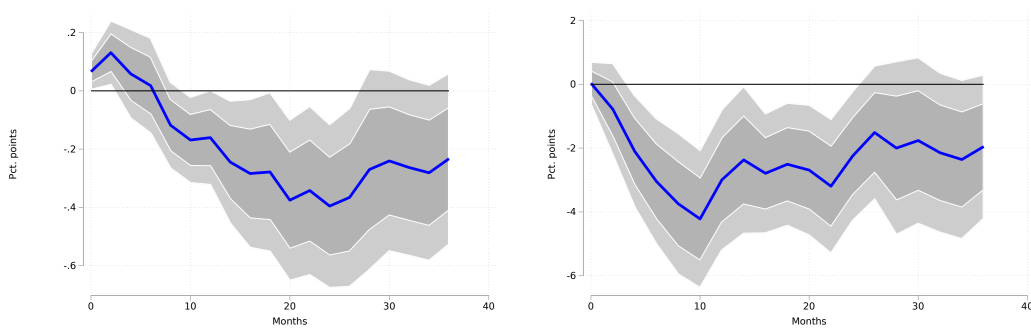
Note: The Figure shows estimates of coefficients β_h in Equation (3) for different dependent variables y. We instrument the monetary policy rate using the monetary policy surprises from Altavilla et al. (2019). Standard errors are heteroskedasticity robust. The shaded areas represent 68% and 90% confidence intervals. Impulse responses are scaled to a 100 basis point monetary policy shock. The sample period is 1999-2018.

Figure 17: The aggregate effects of Bundesbank monetary policy – exchange rates



Note: The Figure shows estimates of coefficients β_h in Equation (3) for different dependent variables y. We instrument the monetary policy rate using the monetary policy surprises from Cloyne et al. (2022). Standard errors are heteroskedasticity robust. The shaded areas represent 68% and 90% confidence intervals. Impulse responses are scaled to a 100 basis point monetary policy shock. The sample period is 1975-1998.

Figure 18: The labor market effects of Bundesbank monetary policy

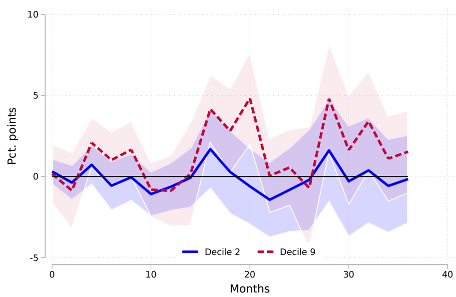


(a) Employment probability

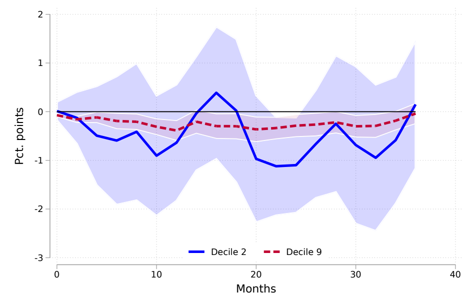
(b) Job-finding probability

Note: The Figure shows estimates of coefficients β_h in Equation (1) for different dependent variables y. We instrument the monetary policy rate using the surprises from Cloyne et al. (2022). Standard errors are heteroskedasticity robust. The shaded areas represent 68% and 90% confidence intervals. Impulse responses are scaled to a 100 basis point monetary policy shock. The sample period is 1975-1998. The *Left Panel* shows the aggregate response of the probability of observing an individuals as employed in periods $t-1$ and $t+h$. The *Right Panel* depicts the response of the probability of an unemployed individual in $t-1$ having a job in period $t+h$.

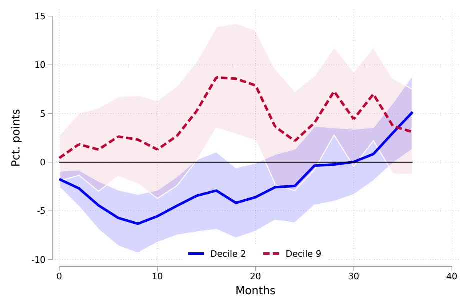
Figure 19: Responses to ECB monetary policy across the distribution – Deciles 2 & 9



(a) Earnings growth



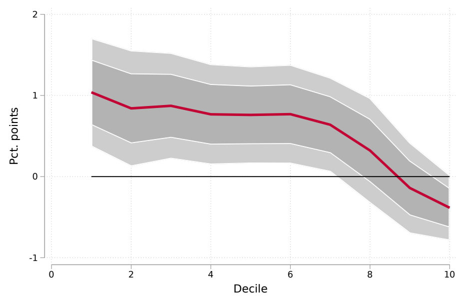
(b) Employment probability



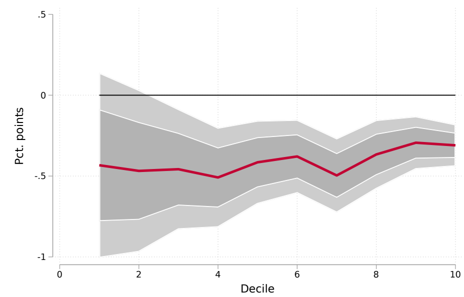
(c) Job-finding probability

Note: The Figure shows estimates of coefficients $\beta_{h,d}$ in Equation (4) for different dependent variables y, for deciles $d = \{2, 9\}$. Standard errors are heteroskedasticity robust. The shaded areas represent 68% and 90% confidence intervals. Impulse responses are scaled to a 100 basis point monetary policy shock. The policy rate is instrumented using monetary policy surprises from Altavilla et al. (2019). The sample period is 1999-2018. The *Top Left* panel shows the change in earnings growth over time, conditional on employment. The *Top Right* panel shows the change in the probability of a worker employed at $t-1$ to be employed in period $t+h$. The *Bottom* panel shows the change in the probability of an unemployed individual in period $t-1$ to be employed in period $t+h$.

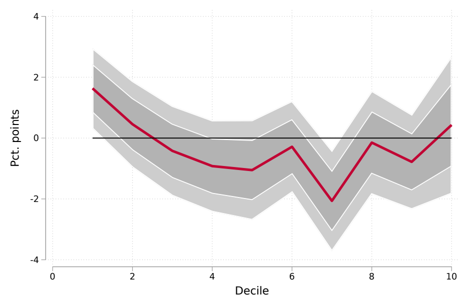
Figure 20: Responses to Bundesbank monetary policy across the distribution – $h = 24$



(a) Earnings growth



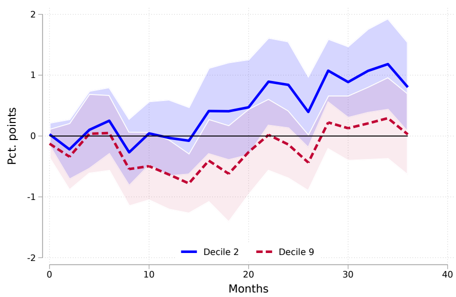
(b) Employment probability



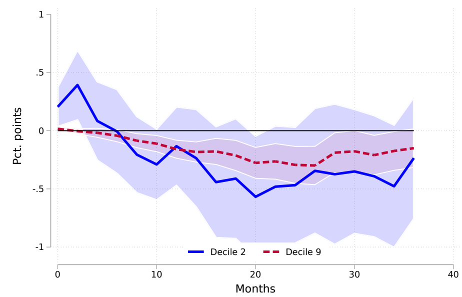
(c) Job-finding probability

Note: The Figure shows estimates of coefficients $\beta_{h,d}$ in Equation (4) for different dependent variables y, at horizon $h = 24$. Standard errors are heteroskedasticity robust. The shaded areas represent 68% and 90% confidence intervals. Impulse responses are scaled to a 100 basis point monetary policy shock. The policy rate is instrumented using monetary policy surprises from Cloyne et al. (2022). The sample period is 1975-1998. The *Top Left* panel shows the change in earnings growth across deciles, conditional on employment. The *Top Right* panel shows the change in the probability of a worker employed at $t - 1$ to be employed at $t + h = 24$. The *Bottom* panel shows the change in the probability of an unemployed individual in period $t - 1$ to be employed in period $t + h = 24$.

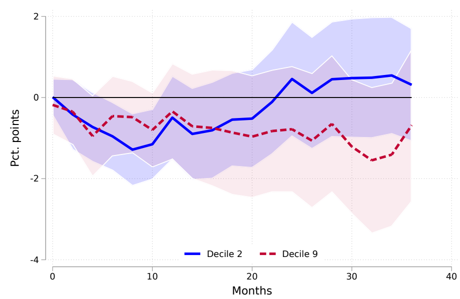
Figure 21: Responses to Bundesbank monetary policy across the distribution – Deciles 2 & 9



(a) Earnings growth



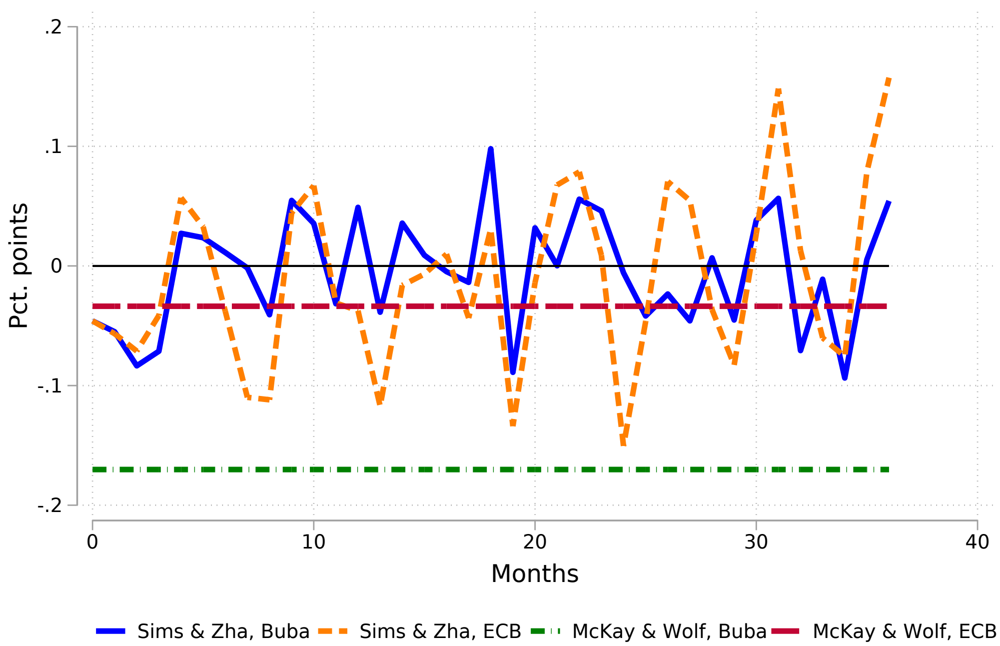
(b) Employment probability



(c) Job-finding probability

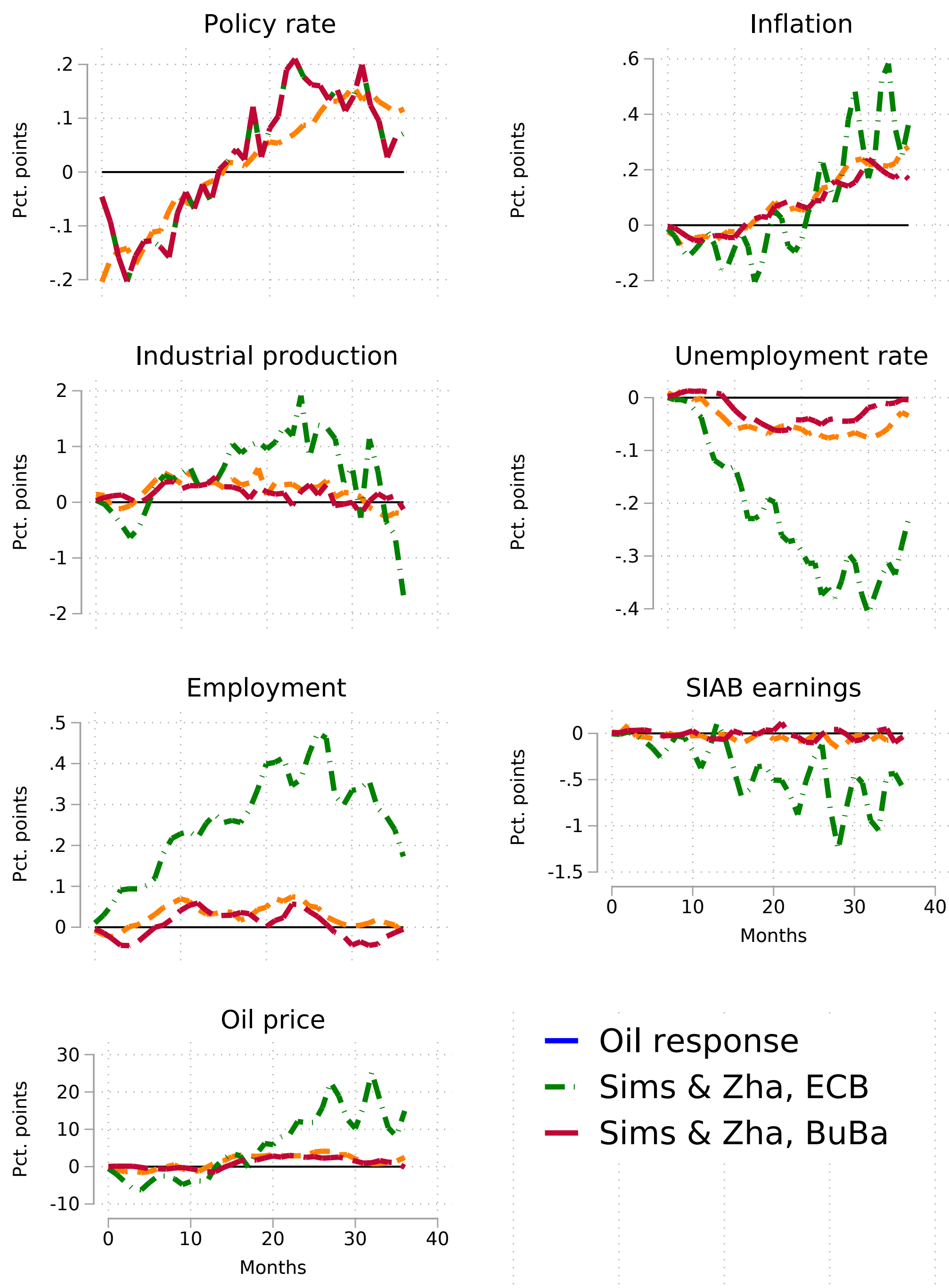
Note: The Figure shows estimates of coefficients $\beta_{h,d}$ in Equation (4) for different dependent variables y, for deciles $d = \{2, 9\}$. Standard errors are heteroskedasticity robust. The shaded areas represent 68% and 90% confidence intervals. Impulse responses are scaled to a 100 basis point monetary policy shock. The policy rate is instrumented using monetary policy surprises from Cloyne et al. (2022). The sample period is 1975-1998. The *Top Left* panel shows the change in earnings growth over time, conditional on employment. The *Top Right* panel shows the change in the probability of a worker employed at $t-1$ to be employed in period $t+h$. The *Bottom* panel shows the change in the probability of an unemployed individual in period $t-1$ to be employed in period $t+h$.

Figure 22: Implied shock series



Note: The Figure shows the implied monetary policy shock series necessary for a zero response of the policy rate after an oil supply news shock (Sims and Zha, 2006), for both the Bundesbank and the ECB. In addition, it shows the period-0 shocks necessary to keep the policy rate response as small as possible, following McKay and Wolf (2023).

Figure 23: The aggregate effects of counterfactual monetary policy – relative

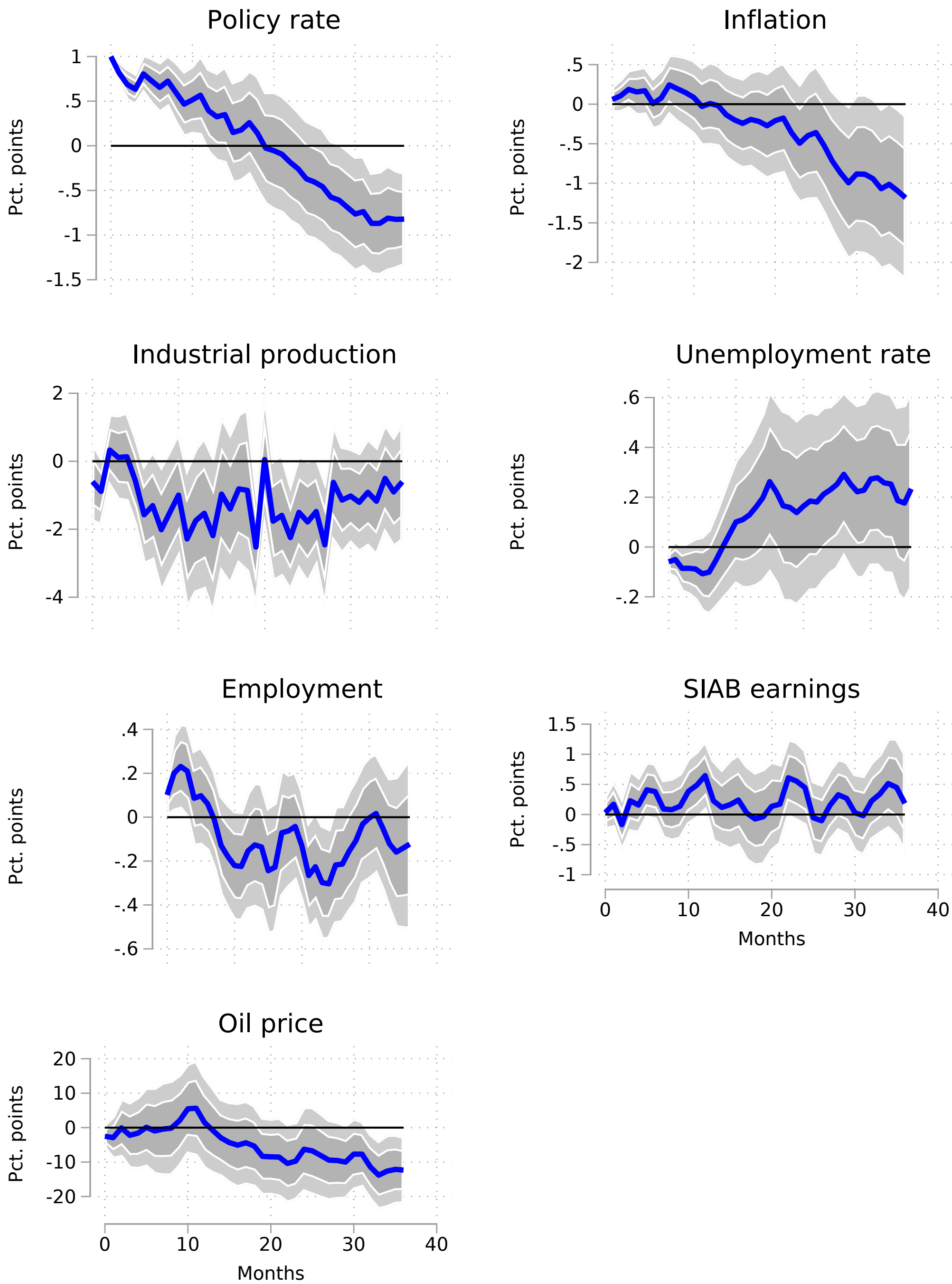


Note: The Figure shows **the difference** between estimates of coefficients β_h in Equation (1) and the counterfactual impulse responses, for different dependent variables y. Impulse responses are scaled to a shock that raises the oil price by 10 percent. The orange lines represent the counterfactual responses of the variables estimated according to McKay and Wolf (2023). The green dash-dotted line represents counterfactual responses estimated according to Sims and Zha (2006), using ECB monetary policy. The red long-dashed lines represent counterfactual responses estimated according to Sims and Zha (2006), using Bundesbank monetary policy.

Figure 24: The aggregate effects of ECB monetary policy – 5 lags

Note: The Figure shows estimates of coefficients β_h in Equation (3) for different dependent variables y. We instrument the monetary policy rate using the changes in 3-month OIS rates in a narrow window around monetary policy announcements from Altavilla et al. (2019). Standard errors are heteroskedasticity robust. The shaded areas represent 68% and 90% confidence intervals. Impulse responses are scaled to a 100 basis point monetary policy shock. Employment and average real earnings are constructed using German administrative data. The sample period is 1999-2018.

Figure 25: The aggregate effects of Bundesbank monetary policy – 8 lags



Note: The Figure shows estimates of coefficients β_h in Equation (3) for different dependent variables y. We instrument the monetary policy rate using the monetary policy surprises from Cloyne et al. (2022). Standard errors are heteroskedasticity robust. The shaded areas represent 68% and 90% confidence intervals. Impulse responses are scaled to a 100 basis point monetary policy shock. Employment and average real earnings are constructed using German administrative data. The sample period is 1975-1998.