Second-round effects after oil price shocks: Evidence for the euro area and Germany*

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Abstract

Strong and prolonged oil price declines in the recent past caused headline inflation rates in the euro area and Germany to decrease. This, in turn, raised concerns about potential second-round effects and a deflationary wage-price spiral, as negotiated wage growth slowed down over the same period of time. This paper investigates the presence of second-round effects induced by oil price shocks, identified following a commonly applied structural vector autoregression methodology. For this purpose, wage responses net of those movements that are induced through consumer price changes are calculated. The results show that there is no strong evidence for second-round effects in the euro area, and even less so in Germany in response to oil price shocks.

Keywords: Second-round effects, oil price shocks, VARs
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[...] we have observed even in the past disconnect between the behaviour of these [market-based] expectations and the behaviour of, for example, oil prices. So the conclusion of this reasoning is that we are monitoring these developments very closely, and we stand ready to act if we were to detect the signals that there could be second-round effects at play here.

Mario Draghi, Q&A after governing council meeting, September 8, 2016

1 Introduction

Strong oil price declines over a relatively long period of time in the recent past (from Q3 2014 to Q3 2016) led to low annual headline inflation rates in the euro area and its largest member, Germany. This situation raised concerns about potential second-round effects of oil-price changes on wages via their impact on consumer prices. Because these effects can trigger a deflationary wage-price spiral, they are potentially more detrimental for inflation developments than only the direct, one-time effect of oil-price changes on prices. As demonstrated by the above quote, policy makers are well aware of this possible transmission, observing the economic developments continuously. Negotiated wage growth in the euro area and Germany indeed slowed down over the above mentioned period (Figure 1). However, drawing the conclusion that this is due to low headline inflation rates in response to oil price declines and warning of second-round effects is premature without further analysis.

This paper analyses price and wage reactions in the euro area and Germany in response to oil price shocks within a structural vector autoregressive (SVAR) model and investigates the presence of second-round effects induced by oil price changes, i.e., indirect effects on wages via consumer price responses following oil price shocks. Previous papers have analyzed the effects of oil price shocks on the economies of the euro area (e.g., Riggi and Venditti 2015, Herwartz and Plödt 2016) and/or Germany (e.g., Jiménez-Rodríguez and Sánchez 2005, Carstensen et al. 2013), finding significant effects in both cases. Those paper, however, do not investigate the potential presence of second-round effects.

An exception is Peersman and van Robays (2009), who also analyze second-round effects. Our study differs from theirs in two important aspects. First, they infer from rising nominal wages and an increasing GDP deflator after a negative oil-supply shock that second-round effects must be present in the euro area. Our definition of second-round effects is narrower than theirs, as we concentrate on the effect of CPI increases on wages. To isolate this channel, it is not enough to consider the reaction of nominal wages, as they might be affected via alternative routes (e.g., a changing labor productivity due to a reduction in employment or a certain substitution between labor and capital on the aggregate level following the shock). We therefore employ an econometric procedure, described in the next section, which is suitable to address our specific question.

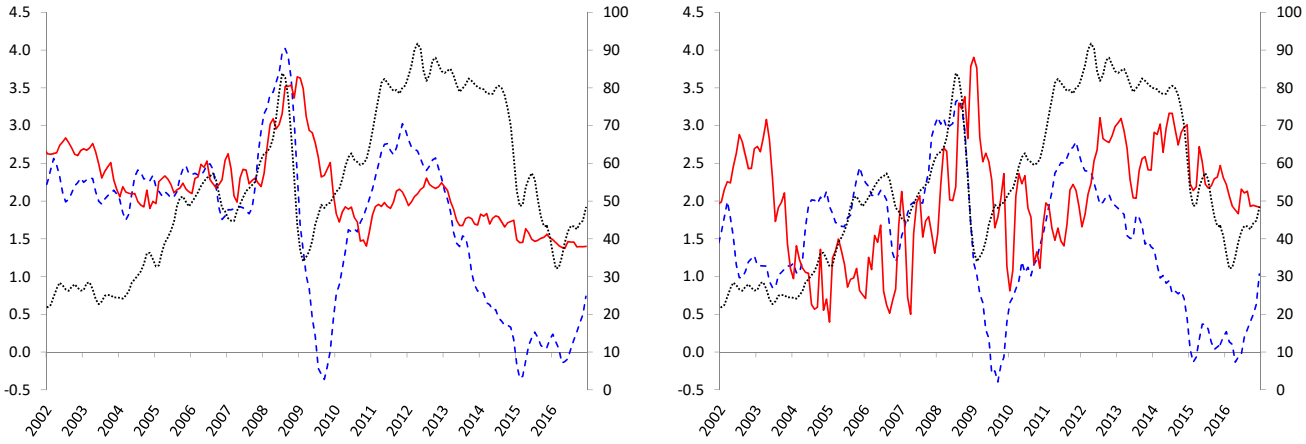

Figure 1: Developments in the euro area (left) and Germany (right) of wages (3-month average of y-o-y percentage changes, red solid line), HICP (3-month average of y-o-y percentage changes, blue dashed line), and oil price (3-month average of Brent, euro per barrel, right scale).

Second, we are in a position to use better-suited data for our study, relative to Peersman and van Robays (2009). They only had data on total labor cost per employee at their disposal, which might deviate from contracted wages. We employ data on negotiated wages instead. This measure corresponds closer to the channel under investigation, as they track increasing wage demands following changes in the price level more precisely. Lastly, we use monthly data, which is better suited for our identification approach. The paper is structured as follows. Section 2 describes the methodology and the data, Section 3 presents the empirical results, and Section 4 concludes.

2 Methodology and Data

The impact of oil price shocks on prices and wages is quantified using impulse-response functions from a SVAR model. This model allows us to decompose oil-price changes into shocks to global oil supply, global demand, and oil-specific demand or, in other words, precautionary demand for oil. The VAR includes three domestic variables (industrial production (IP), harmonized consumer price index (HICP) or harmonized consumer price index excluding energy prices (HICPexE), and nominal wages negotiated in total economy on a monthly basis and including all subsidiary agreements) and three global variables (world crude oil production, global IP, and the real price of oil). All variables are expressed in logarithms. We run separate regressions for the euro area and Germany. The model is estimated in levels using monthly data (seasonally and working day adjusted, except for oil-related variables) for the period 1997M1-2016M9 with 4 lags and a linear-quadratic trend.[1] The data sources are the U.S.

[1]The sample size is restricted by the start date of the availability of seasonally adjusted data for the HICP and by the end date of the availability of data on world crude oil production. Four lags were chosen according to the Akaike Information and Final Prediction Error Criteria. Including a linear-quadratic trend corresponds best to the development of the real oil price, which, over the sample period, has fallen for a relatively long time after an

Energy Information Administration (world crude oil production, the U.S. refiner acquisition cost of imported crude oil), U.S. Department of Commerce (U.S. consumer price index), Centraal Planbureau (global IP), European Central Bank (IP, HICP, HICPexE, negotiated wages for the euro area in fixed composition, 19 member countries), Federal Statistics Office of Germany (IP, HICP, HICPexE for Germany), and Deutsche Bundesbank (German negotiated wages).

Structural oil price shocks are identified by a Cholesky decomposition, i.e., by imposing restrictions on contemporaneous reactions as in Kilian (2009). Due to the fact that oil supply is inelastic in the very short term, global oil production is assumed to react contemporaneously, i.e., in the same month, only to unpredictable innovations to itself.[2] Innovations to global activity that are not explained by contemporaneous oil supply shocks are referred to as shocks to global demand. Finally, innovations to the oil price that cannot be explained by contemporaneous global oil supply or global demand shocks are referred to as oil-specific or precautionary oil demand shocks. We refer to oil supply and oil-specific demand shocks collectively as oil price shocks.

The extent of second-round effects, i.e., the degree to which effects of oil price shocks on wages are transmitted through the inflation channel, is identified by the following procedure. After having estimated the SVAR, we calculate impulse-response functions to the identified shocks in two different ways. The first leaves the responses unrestricted. When calculating the second version, we feed into the estimated SVAR consumer-price specific shocks that neutralize the original consumer-price responses following the identified shocks and therefore eliminate potential second-round effects of consumer prices on wages.[3] These innovations can be thought of as hypothetical price mark-up shocks, since consumer prices are ordered last in the domestic bloc of the SVAR, after IP and wages. This ordering corresponds to the assumption that domestic mark-up shocks do not impact IP, wages, or global variables in the same month. Given the standard assumption that nominal variables affect real variables only with a lag and that we employ negotiated wages, these assumptions seem reasonable.

Second-round effects can then be gauged by the difference between the responses of wages in the original estimation (with second-round effects from prices on wages) and in the simulation with a neutralized price reaction (without second-round effects from prices on wages).

ascending phase.

[2]The emergence of the shale oil sector (mainly in the U.S.) may put in question this contemporaneous restriction, as shale oil production certainly responds more quickly to oil price changes than conventional oil production. However, the still relative small share of shale oil in world oil production (by October 2016, the U.S. shale oil production increased to 6 % of world oil production, see Kilian 2017) and the monthly frequency of the analysis make this assumption tolerable. Furthermore, even for the U.S. economy, which in its production structure was affected most by the boom of the fracking industry, Baumeister and Kilian (2017) found "...no evidence that the emergence of the shale oil sector has fundamentally altered the propagation of oil price shocks..." The analysis of the propagation of oil price shocks into the euro area or German economy without an important domestic oil industry can hence be still conducted based on standard econometric models of the transmission of oil shocks.

[3]This approach is similar to Bachmann and Sims (2012), who create a hypothetical sequence of shocks that holds confidence fixed in response to a change in government spending.

3 Empirical Results

The resulting estimates provide plausible reactions to demand and supply shocks in the crude oil market. Figure 2 and Figure 3 (wages, top row) show impulse responses (percentage deviations from trend) of all variables to one-percent structural innovations along with 90-percent conditional heteroskedastic robust confidence intervals (see Goncalves and Kilian 2004) based on 1000 repetitions. We find that the SVAR for the euro area delivers responses which are quite similar to the German case. The following statistically significant results are worth highlighting:

- *Oil supply shock:* After a one-percent increase in world crude oil production, the real oil price declines by about 4 percent within the first three quarters. Global real activity measured by global IP increases by about 0.2 percent on impact, while German activity does not seem to react statistically significantly to positive oil supply shocks within the first two years. For the euro area, the lag is even larger, more than three year. In the euro area, prices fall significantly after one year and remain low. The same pattern is visible for wages (Figure 3) in the euro area and in Germany, albeit only marginally significant. Similarly, prices in Germany decline on impact but the reaction is insignificant.

- *Aggregate demand shock:* The response of the real oil price to an aggregate demand shock is much more pronounced. The real oil price increases by about 3 percent on impact and, subsequently, closely follows the course of global IP. Initially high global aggregate production provides an even stronger boost to real activity in the euro area and in Germany. Prices in Germany reach their highest, although still relatively small, response of around 0.15 percent almost one year after the shock. Note that the following decline towards zero denotes a return to trend inflation, and not necessarily a deflation. Wages in Germany show a statistically significant, minor positive response only within the third year after the shock. The corresponding reactions in the euro area, however, are stronger. Prices increase to around 0.3 percent and remain high. Similarly, wages increase significantly already after one year.

- *Oil-specific demand shock:* An oil-specific demand shock that results in a one-percent increase of the real oil price raises initially, although marginally, global, euro area, and German real activity. This effect, however, dissipates quickly and global as well as euro area and German IP reach their deepest decline (by about 0.04-0.05 percent for global and euro area IP and 0.08 percent in Germany) during the second year. Prices in the euro area and Germany increase on impact, while wages only show a (marginally and short-lived) statistically significant response for the euro area.

We don't find evidence for second-round effects after oil price shocks in the euro area, nor in Germany. That is, consumer-price reactions to oil price shocks do not statistically significantly transmit to the corresponding wage responses.[4]

[4]This finding also holds when using the HICP excluding energy (HICPexE) instead of the HICP. A difference worth mentioning is that HICPexE does not statistically significantly react to the identified oil price shocks for the first three years in both economies. See Figures A.1 and A.2 in the Appendix.

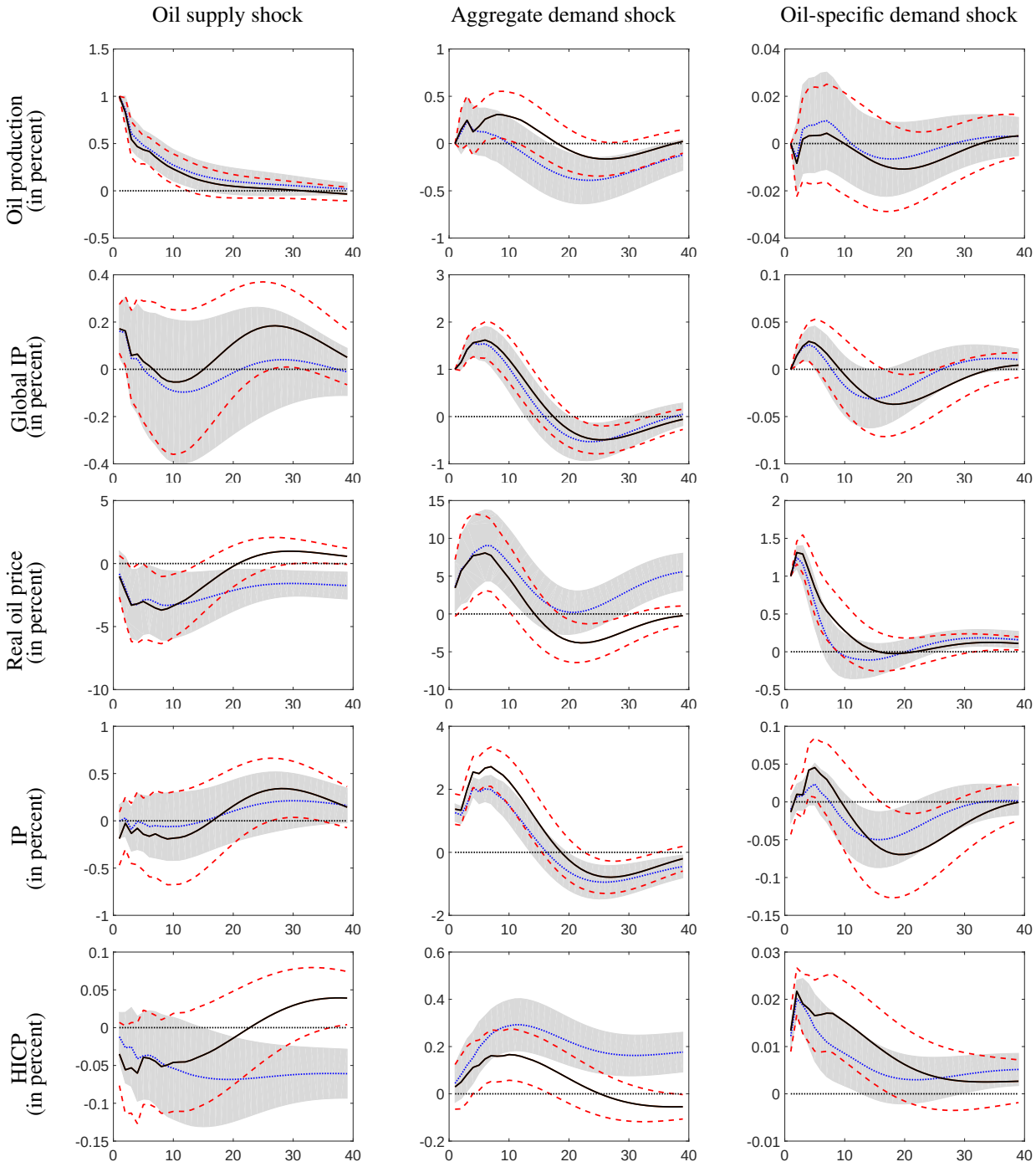

Figure 2: Impulse responses to demand and supply shocks. Point estimates for euro area (blue dashed line) and Germany (black solid line) with corresponding 90 percent confidence intervals (euro area: grey area, Germany: red dotted lines).

Figure 3 shows impulse responses of euro area and German wages to the identified shocks stemming from the original estimation that includes potential second-round effects from HICP to wages (first row of Figure 3).

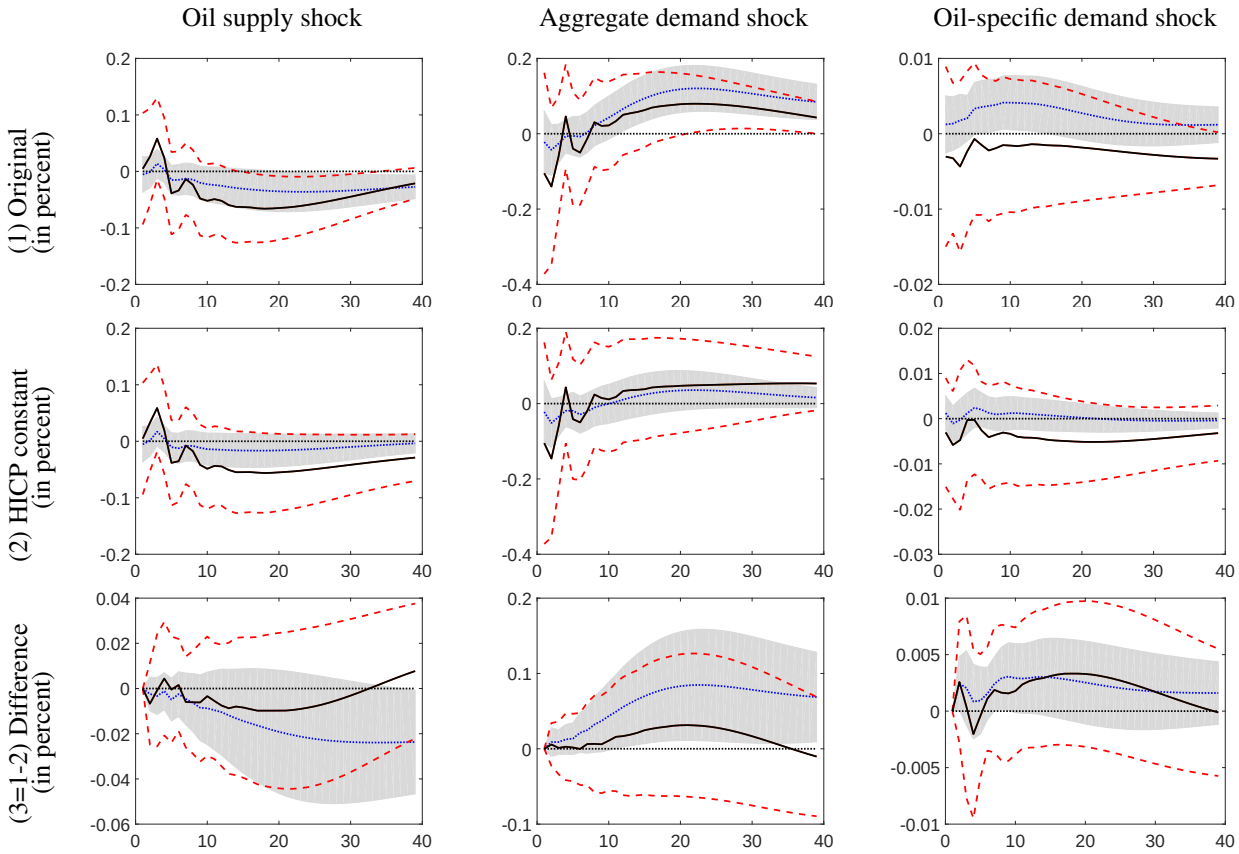

Figure 3: Wage responses to demand and supply shocks. Top row: unrestriced reaction. Middle row: reaction if HICP remains constant. Bottom row: difference between top and middle panel. For description of lines see Figure 2.

The second row shows results from the simulation in which consumer-price responses of the original estimation are held constant by feeding in appropriate price mark-up shocks. The difference between these two wage responses, displayed in the third row of Figure 3, isolates the price effects on wages. As visible, this difference is small and insignificant in all cases. There is one exception: in the euro area, the consumer-price reaction somewhat amplifies the wage response after the first year following an aggregate demand shock. An explanation could lie in the larger size of the euro area relative to Germany. A global demand shock is therefore more likely to be correlated with fundamentals in the euro area (instead of being mostly transmitted via export demand), such that its effects might be broader. Given that the aggregate demand shock does not originate in the crude-oil market, this reaction does not change our conclusions that oil price shocks do not trigger second-round effects in both considered economies. We also note, however, that reactions in the euro area are close to being significant after an oil supply shock (after 3 years) and an oil-specific demand shock (after 2 quarters). European policy makers are hence right to remain vigilant and to monitor the specific situations closely, without being too alert.

4 Concluding Remarks

After a long period of strong oil price declines in the recent past that caused headline inflation rates in the euro area and Germany to decrease, policy makers became increasingly worried about potential second-round effects. Because such developments can cause a deflationary wage-price spiral, inflation could be adversely affected for longer periods of time if second-round effects were present.

The present SVAR analysis identifies oil-supply and -demand innovations following a commonly applied methodology for the euro area and Germany. We find plausible reactions of macroeconomic variables in both cases. Our results suggest that there are no significant second-round effects in both economies in response to structural oil price shocks, with less clear-cut evidence for the euro area.

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Appendix: using HICP ex-energy instead of HICP

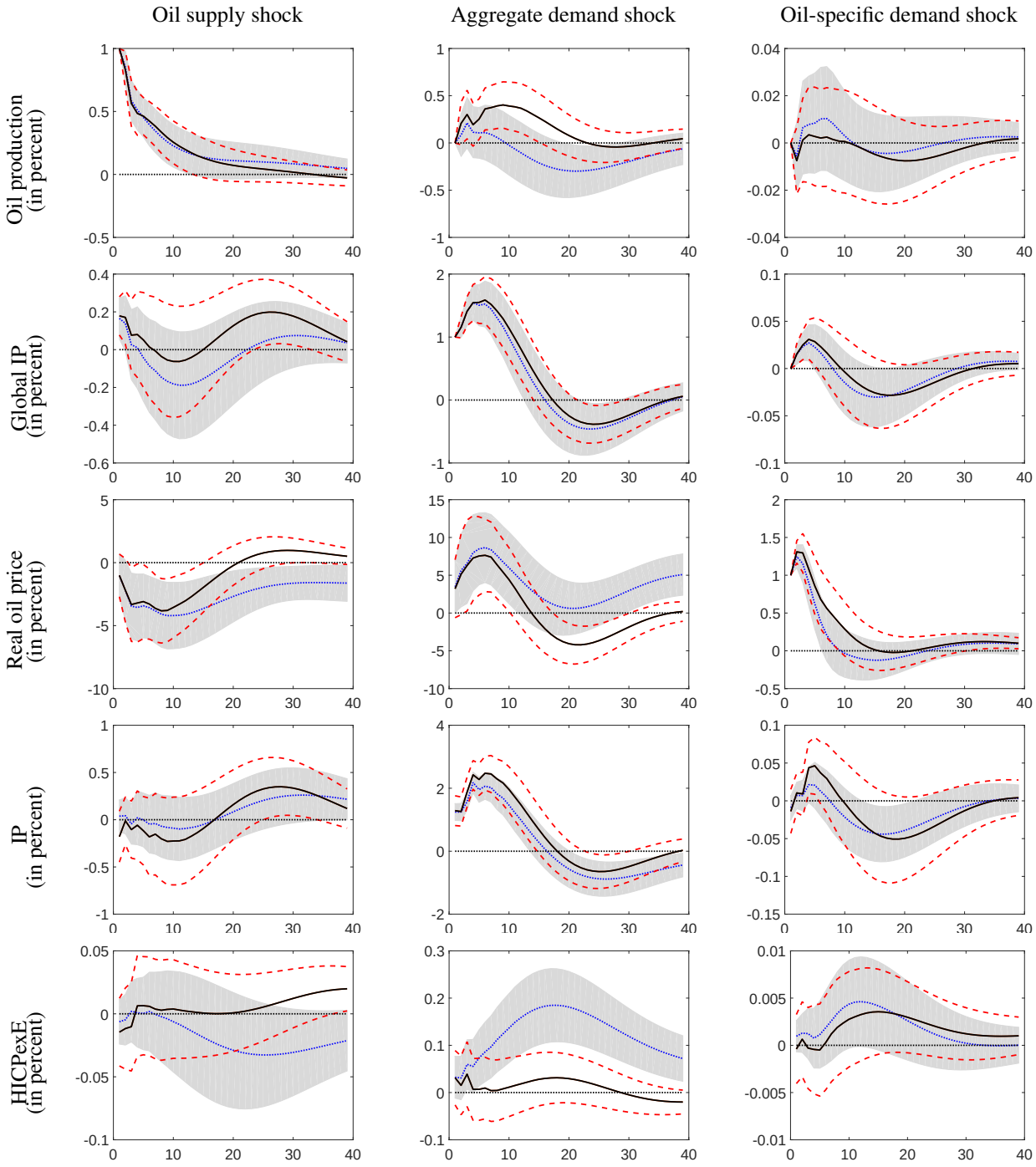

Figure A-1: Impulse responses to demand and supply shocks using HICP ex-energy instead of HICP. For description of lines see Figure 2.

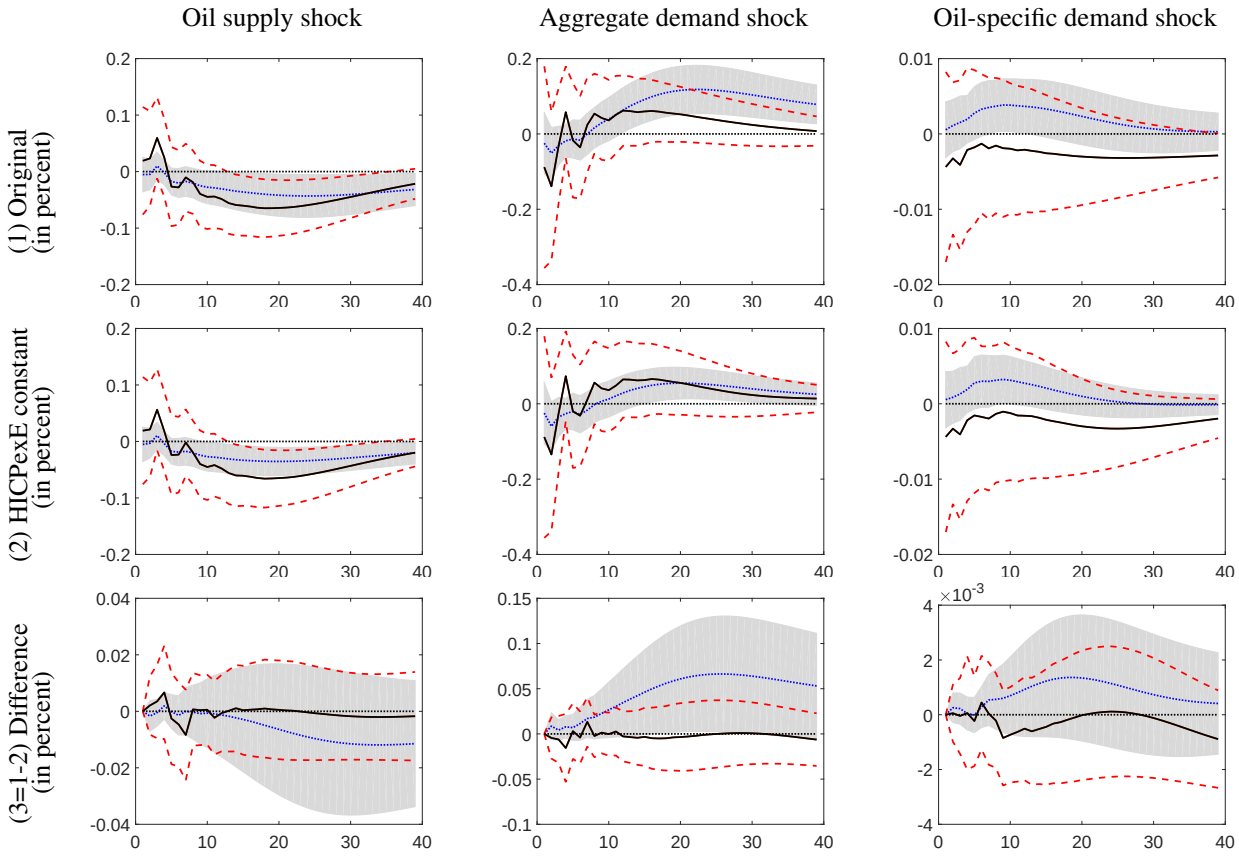

Figure A-2: Wage responses to demand and supply shocks using HICP ex-energy instead of HICP. Top panel: unrestriced reaction. Middle panel: reaction if HICP ex-energy remains constant. Bottom panel: difference between top and middle panel. For description of lines see Figure 2.