ECB FORUM ON CENTRAL BANKING

27–29 June 2022

Challenges for monetary policy in a rapidly changing world

The effect of rising energy prices amid geopolitical developments and supply disruptions

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EUROPEAN CENTRAL BANK

EUROSYSTEM

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By Hilde C. Bjørnland[1]

Abstract

Much research has documented how changes in supply and demand for commodities cause price fluctuations, with subsequent effects on the global economy. This paper puts the recent energy price surge in perspective amid geopolitical developments and supply disruptions, and analyses the effects for global activity and inflation, focusing in particular on Europe. It highlights the importance of inflation expectations for transmitting energy shocks to inflation, analyses to what extent such energy shocks can have a significant long lasting effect on actual inflation, and discusses the new monetary policy challenges in the wake of the current situation.

1 Introduction

During a few months in 2020, oil prices (i.e., Brent blend) fell by more than 85 percent, from 68 USD dollars per barrel (January 2020) to 10 USD per barrel (April 2020), as demand for energy collapsed during the severe economic downturn in the pandemic. Since then, oil prices have gradually increased, at first following the economic recovery in 2020/2021 when the world opened up after the lockdowns, and then with rising geopolitical tensions and subsequent war in Ukraine due to Russia's invasion in February 2022. The higher oil prices have, together with the rise in other commodity prices, contributed to rising inflation expectations and inflation across many countries. However, it is not only the level of oil prices that has increased. Volatility has also increased drastically in the recent months, giving concerns that the world will face a new global economic recession, see Chart 1.

This paper looks at the recent energy price changes, and analyses effects on economic activity and inflation, focusing on Europe in particular. Since the seminal contribution of Hamilton (1983), a growing oil-macroeconomic literature has predicted an inverse relationship between oil price changes and economic activity in oil importing countries across the world. However, although the existence of this negative relationship is well established by now, there has been substantial disagreement in the literature as to the magnitude of the relationship, which has

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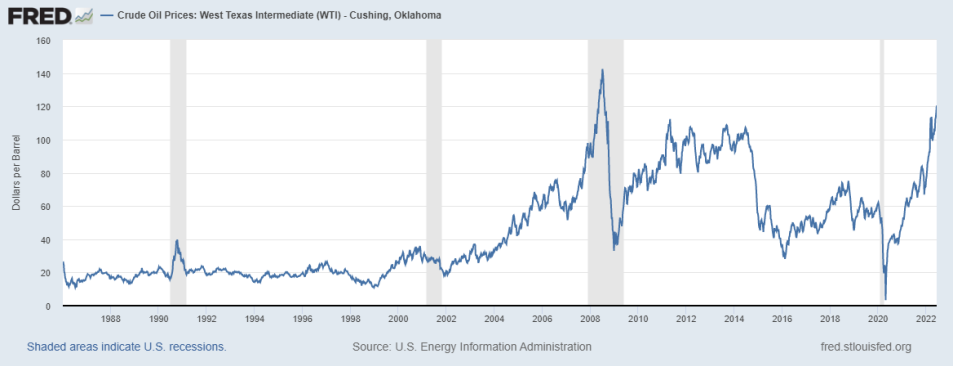
been shown to be dependent on the causes of the oil price increase, volatility of oil prices, country differences, such as the share of energy in consumption, industry structure in the countries/regions affected and the role of economic policy to counteract the inflationary effect of the higher oil prices.

Chart 1: Crude oil price changes and recession fears



Source: Fred database, St. Louis Fed.

In this paper, I analyse these issues by providing a thorough review of the literature, before zooming in on the recent events that have driven up oil and gas prices and volatility. As oil and gas are commodities traded in the global market, I will analyse and discuss global affects, before turning to discuss effects for European countries and the implication for monetary policy in the euro area.

I have six key takeaways:

First, the effect of higher oil prices depends on sources of shocks and geography. Historically, European countries have been among the most negatively affected by rising oil prices, most likely due to the high dependence on oil and gas in production and consumption. On average, a 10 percent increase in oil prices due to geopolitical tensions or supply constraints will reduce GDP in the euro area by 0.5 percent after two years. Hence, a 30 percent increase in oil prices, can reduce GDP in the euro area with 1.5 percent, all else equal. The negative effect will potentially be even larger when oil price volatility is also high, as it is now.

Second, the transmission of oil price shocks on parts of the U.S. activity has changed with the shale oil boom, and activity and wages in many manufacturing-intensive states now increase following oil price increases, potentially also fuelling inflation further. So far there is little to suggest the real effects will spill over to European countries, as the direct trade linkages are likely to have a modest impact on activity in Europe. Nevertheless, the shale oil revolution might be beneficial to net oil importers by supporting non-OPEC supply growth and thus, mitigating oil price volatility.

Third, inflation expectations and associated pass-through of oil price shocks depend on demand and supply conditions in the global oil market. Demand for oil associated with unexpected large global economic activity shocks, such as the early millennium

oil price surge of 2003-08, elicits a persistent response in both expected and actual inflation. In contrast, when the economy is hit by brief shocks to oil prices due to supply etc., both expected and actual inflation initially increase but then gradually revert back to zero. Recent findings suggest oil price shocks have been more persistent, and that has increased inflation expectations.

Fourth, the negative contribution of the oil price shocks to economic activity and inflation is substantial when oil price volatility is high, and there is an independent role for oil price shocks in the past and present recessions. Furthermore, the effects of oil price shocks on inflation are smaller when policymakers respond strongly to inflation (i.e., they are 'hawkish'), yet, when volatility is high, there is still a substantial share of inflation being explained by the oil price shocks. This suggests that during periods of high oil price volatility, stabilizing inflation is difficult, although important.

Fifth, the recent energy price increase is due to a combination of increased demand and disruptions of supply. The persistence of shocks combined with the elevated volatility will erode growth in Europe and increase inflation further. With a multiple of commodity prices on a persistent rise, food prices in particular, the probability of a recession scenario for Europe has increased substantially. Will we also see a repetition of the stagflation of the 1970s? The energy shocks are smaller than the 1970s oil shocks, but involve more commodities and are more persistent. So the risk is there. Yet, more credible policy frameworks and nominal anchors, makes stagflation like the 1970s less likely. But the success hinges on swift response from monetary policymakers now to prevent inflation expectations from building up further, leading to a wage-inflation spiral. This should be the number one priority now.

Sixth, while central banks should respond swiftly to prevent inflation expectations from building up, elevated oil prices and contractionary policy will reduce economic growth and asset prices further out. This suggests more troubling and challenging times ahead for European economies and policymakers. During periods of high oil price volatility, stabilizing inflation is in particular difficult, and the cost on growth and employment may be severe. Going forward central banks need to balance growth and inflation.

The paper is organized as follows. I start by providing a review of the growing body of literature on the oil-macro relationship in Section 2, taking into account sources of shocks, global demand, short run price elasticity, and the role of oil exporters versus importers. Section 3 reviews the effect of inflation expectation in transmitting oil price shocks to inflation and looks at recent evidence. In Section 4 I discuss how high oil price volatility exacerbates the adverse effects of oil price shocks. Section 5 analyses the recent oil price increase in more detail and its effect on economic activity and inflation in Europe in particular. In Section 6 I discuss implications for monetary policy, while Section 7 concludes.

2 The oil price - macroeconomic relationship

Since the seminal contribution of Hamilton (1983), a growing body of literature has predicted an inverse relationship between oil price changes and aggregate activity in a number of countries, see for instance Burbidge and Harrison (1984), Gisser and Goodwin (1986), Shapiro and Watson (1988) and Bernanke, Gertler, and Watson (1997) for some early studies. Higher energy prices typically lead to an increase in production costs and inflation, thereby reducing overall demand, as both consumers and producers have to pay more for the imported energy products and the complementary products to energy.

Although the existence of this negative relationship is well established by now, there is substantial disagreement as to the magnitude of the relationship, and what it actually implies for policymakers. For instance, while Hamilton (1983) found that all but one U.S. recession since World War II had been preceded by a dramatic increase in the price of crude oil, Bernanke, Gertler, and Watson (1997) argued that the recessions that followed the big oil shocks were not entirely caused by the oil shocks themselves, but rather by the Federal Reserve contractionary response to inflationary concerns attributable in part to the oil shocks. Hamilton and Herrera (2004), however, later challenged the conclusion in Bernanke, Gertler, and Watson (1997), showing that both the nature and the magnitude of the actions suggested for the Fed to have the required negative effect on economic activity, were not consistent with historical evidence. Hence, the finding of the negative effects prevailed according to Hamilton and Herrera (2004), but as we will see in this paper, the discussion is still very relevant today.

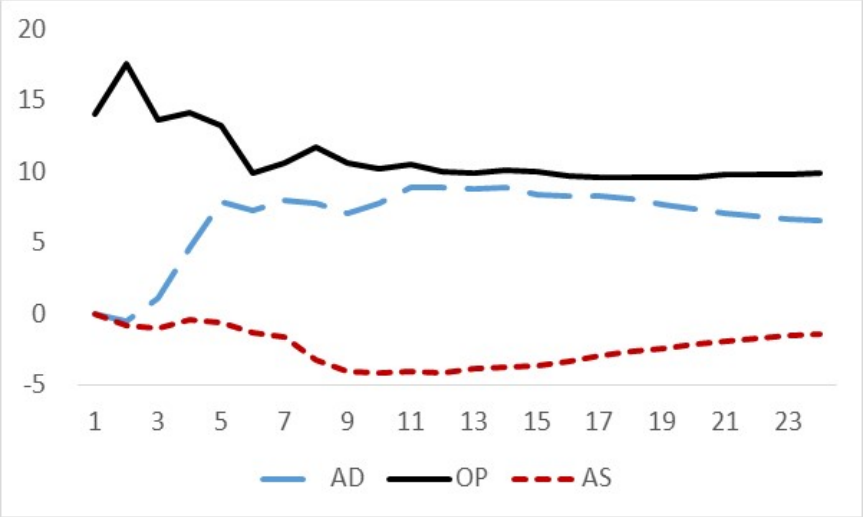
2.1 Demand and supply shocks as a driver of oil prices

Common to the papers cited above is that they typically focus on the response of macroeconomic aggregates to exogenous changes in the price of oil. More recent papers have emphasized the importance of allowing oil prices to be modelled as an endogenous process, see for instance the early papers by Ahmed, Rosser and Sheehan, R. (1988) that analyse endogeneity of oil prices by changing the order of variables in a four variable vector autoregressive (VAR) model, and Hooker (1996) for an early study that test whether oil prices are endogenous using granger causality tests.

Bjørnland (2000) is a first study that addresses the endogeneity issue explicitly using a structural model that allows oil prices and macroeconomic variables to be jointly determined by demand and supply shocks. In particular, Bjørnland (2000) estimates a structural vector autoregressive (SVAR) model for the U.S., Germany, UK and Norway over the period 1960/1966 - 1994, where oil prices, GDP and unemployment are driven by demand, supply and oil (specific) price shocks. The model is identified using a mix of short run and long run identifying restrictions. In so doing, the model

extends Blanchard and Quah (1989) to the oil market.[2] Doing so, the paper finds that oil price shocks have a persistent negative effect on GDP in all countries but Norway, which is explained by the fact that Norway is a major oil exporter. On the other hand, demand shocks increase both real oil prices and real activity in all the different countries, while supply shocks had trivial effects.

Chart 2 The effects of oil market shocks on real oil prices



Source: Bjørnland (2000)

Note: The effect of aggregate demand (AD), aggregate supply (AS) and oil price (OP) shocks on the level of the real oil price. The horizontal axis measures quarters.

Charts 2-3 provide more details. In particular, Chart 2 displays the responses in the real oil price to aggregate demand, supply and oil price shocks, based on the aggregate response in the above mentioned countries. As discussed above, all shocks can potentially affect oil prices, and in Chart 2, we see that all shocks actually do, but to a varying degree: Oil price shocks have a persistent positive effect on real oil prices, demand shocks push up oil prices for a prolonged period before the effect fades out, while supply shocks (that can increase output in each country permanently), have negative, but marginal effects on oil prices.

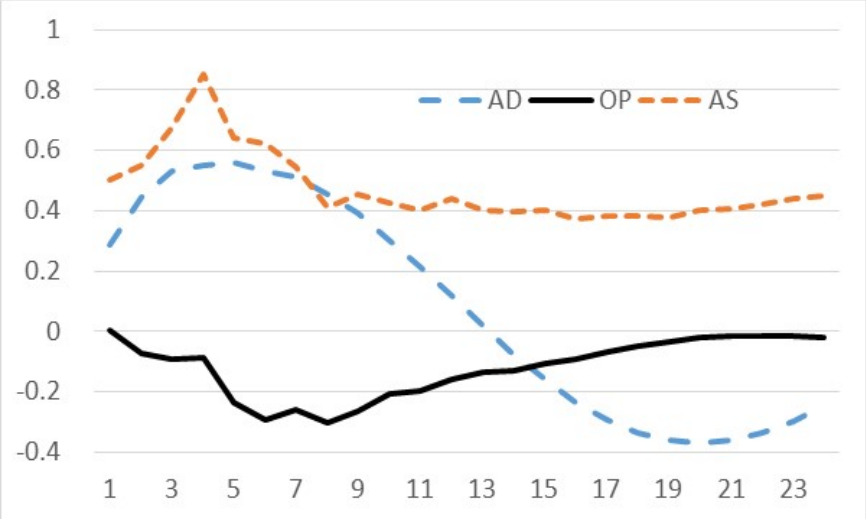
Chart 3a illustrates the effect of demand, supply and oil price shocks on GDP in Germany, while Chart 3b compares the effect of the oil price shock on GDP in Germany, the UK and the US.[3] In the figure, we are examining a one standard deviation shock, i.e., an impact increase in oil prices by approximately 14 percent, see Chart 2.

[2] The SVAR model is identified using a mixture of short run and long run restrictions (for each country), assuming demand shocks cannot have a long run effect on real GDP as in Blanchard and Quah (1989). Oil prices can respond to all shocks, but with a delay. Note that no restrictions are imposed on the long run effect of shocks on real oil prices. However, one would expect demand shocks to also have zero influence on the real oil price in the long term, as the domestic price level will adjust to the new situation. By inspection, this is supported.

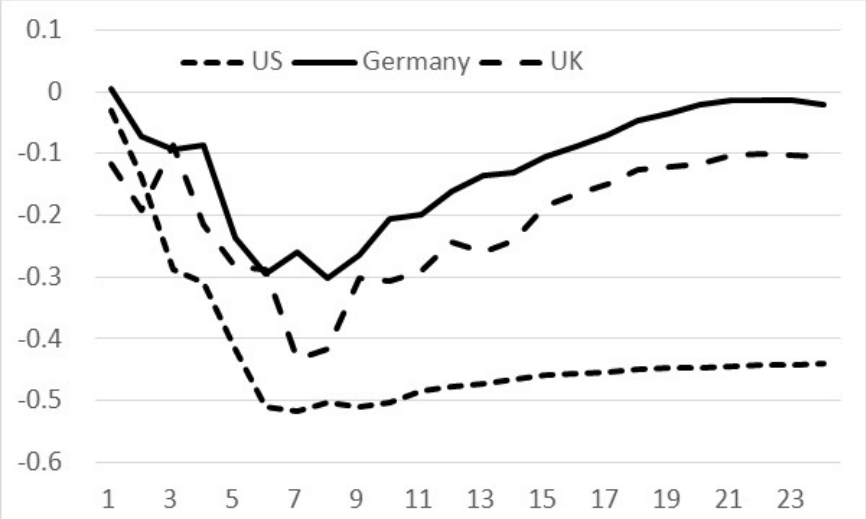
[3] Results for Norway are not displayed here, see Bjørnland (2000) for details.

Chart 3 The effect of oil market shocks on GDP

a) The effect of demand, supply and oil price shocks on GDP in Germany



b) Comparing effect of oil price shocks on GDP in Germany, UK, US



Source: Bjørnland (2000).

Note: The top graph shows effect of aggregate demand (AD), aggregate supply (AS) and oil price (OP) shocks on GDP in Germany price. The bottom graph compares the effect of the oil price (OP) shock on GDP in the US, Germany and the UK. The shock is normalized to increase oil prices on impact by a standard deviation (approximately 14 percent, c.f. Chart 2). The horizontal axis measures quarters.

Starting with Chart 3a, we see that demand and supply shocks have the expected effects on GDP in Germany[4]; demand shocks increase activity temporarily, while the effect of a supply shock is to increase GDP permanently. An oil price shock, however, reduce output temporarily and the responses are significant (see Bjørnland 2000). These results suggest the importance of separating aggregate supply shocks

[4] Similar graphs can be provided for all countries.

(as identified in Blanchard and Quah, 1989) from (adverse) oil price shocks, as they have very different effects on economic activity.

Turning to Chart 3b where we compare the effect of the oil price shock on GDP across countries. We see that in all three countries, GDP falls following the oil price shock. U.S. responds the most strongly, with GDP falling by 0.6 percent after two years, and this effect is more severe than what is found in studies where oil prices are exogenous, i.e., Shapiro and Watson (1988). GDP in Germany falls by approximately 0.3 percent after two years, before the effect gradually dies out.

2.2 Global shocks in the oil market

The abovementioned study captured the reverse causality of the macroeconomy (via demand and supply shocks) to the oil market. Still, the model is limited in the sense that it identifies these demand and supply shocks within each country (although these shocks may of course be correlated across countries, making the business cycles synchronized).

Subsequently, Barsky and Kilian (2002) and Kilian (2009) have pointed out the importance of allowing for a reverse causality from the global economy to the oil price. In an influential paper, Kilian (2009) has emphasized the role of the global economy as a main driver of oil prices that needs to be modelled explicitly. Doing so, the paper shows that the price of oil is driven by distinct global demand and supply shocks which can have very different effects on the real price of oil and hence on the macroeconomy. The paper shows the important role for global demand as a driver of oil prices over the recent decades.

In the years following the influential paper by Kilian (2009), much of the literature evolved around identifying the causes of an oil price increase, and the effects of various structural oil market shocks on the aggregate macroeconomy across countries, see e.g. Hamilton (2009), Lippi and Nobili (2012), Kilian and Murphy (2012, 2014), Cashin, Mohaddes, Raissi, and Raissi (2014), Aastveit (2014), Aastveit, Bjørnland and Thorsrud (2015) and Stock and Watson (2016) among many others.

In Kilian (2009), global real economic activity is a key determinant behind movements in macroeconomic variables and commodity prices. To approximate global activity, Kilian (2009) constructed an indicator based on the cost of shipping. The idea was that the market for shipping would be driven by demand and supply shocks. Since then, the indicator has been used in a multiple of studies, although more recently the indicator has come under critique, see Hamilton (2021), and see Aastveit, Bjørnland and Thorsrud (2015), Baumeister and Hamilton (2019), Ravazzolo and Vespignani (2020) and Delle Chiaie, Ferrara and Giannone (2022) for alternative global indicators. In the following I will base my discussion on Aastveit, Bjørnland and Thorsrud (2015), focusing in particular on results for countries in Europe.

During the last decades, the global economic landscape has shifted dramatically. Emerging market economies have experienced rapid growth in economic activity and international trade, outperforming most developed countries across the world. Building on the main structure in Kilian (2009), Aastveit, Bjørnland and Thorsrud (2015) examine explicitly the importance of emerging versus developed economies as drivers of the real price of oil, by replacing the global indicator with separate factors for emerging and developed economies using a factor-augmented vector autoregressive (FAVAR) model for this purpose. The model is identified with a mixture of sign and zero restrictions, see Aastveit, Bjørnland and Thorsrud (2015) for details.

In particular, the paper identifies four structural shocks that has the potential to change oil prices and macroeconomic variables; Demand in developed economies, demand in emerging economies, shocks to oil supply (that captures unexpected shocks in the global supply of oil), and oil specific (demand) shocks. The oil-specific (demand) shocks pick up innovations to the real price of oil that cannot be explained by the three aforementioned shocks. Kilian (2009) argues that such shocks primarily capture precautionary demand for oil driven by the uncertain availability (scarcity) of future oil supply. This is also the interpretation we take here.

Identified in this way, the paper has two goals. First, create two distinct ‘global’ activity indicators that separate between shock to demand in emerging and developed economies. This allows one to determine whether the increased demand for oil originates from emerging economies, which have been growing at a pace twice that of the developed economies, or from the developed world, which historically has been the main consumer of oil. Second, having established where demand originates from, the paper analyses how different geographical regions respond to the various oil market shocks that drive up oil prices.

Chart 4a-b illustrates the results. In particular, Chart 4a graphs the effects of demand shocks in emerging and developed economies (that increases oil prices) on GDP across regions. The shocks are normalized to increase activity in either developed or emerging countries by 1% initially, see Aastveit, Bjørnland and Thorsrud (2015) for details. Chart 4b shows the responses in GDP to the two other shocks (that also increase oil prices); oil supply and oil specific shocks.

There are three main findings:

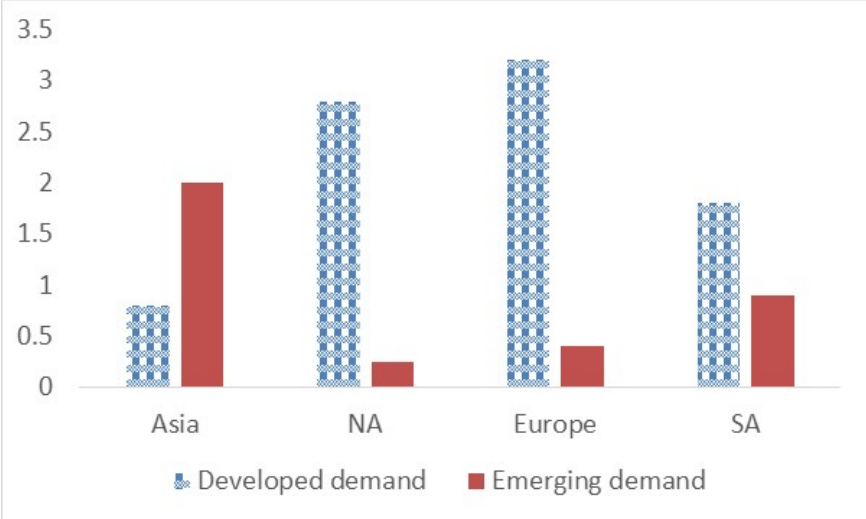
First, we show in the paper that demand shocks in emerging and developed economies together account for 50-60 percent of the fluctuations in the real price of oil over the last two decades. Furthermore, demand shocks in emerging markets, particularly in Asia, are more than twice as important as demand shocks in developed economies in explaining fluctuations in the real price of oil and global oil production. For details, see Aastveit, Bjørnland and Thorsrud (2015).

Second, and as seen below in Chart 4a., all countries respond positively to either of the demand shocks that drive up oil prices, although the response varies across countries and regions. This emphasises the importance of understanding better where demand is coming from when analysing the effect of an oil price increase.

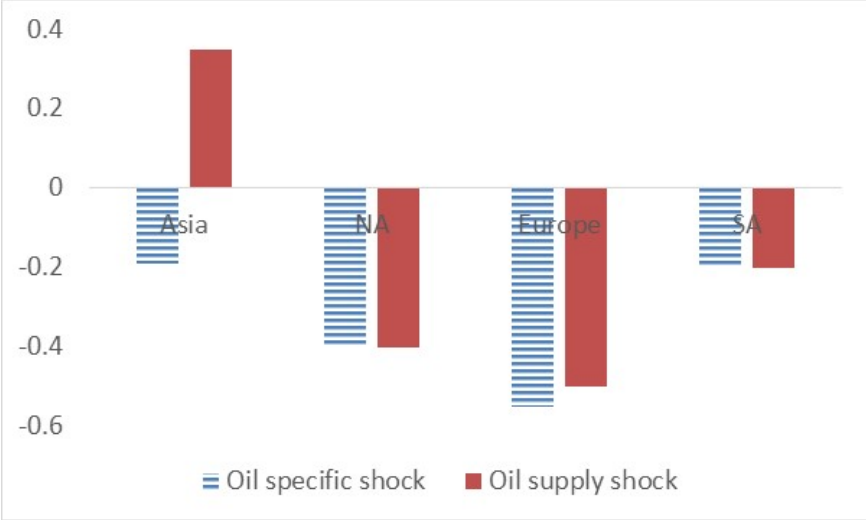
Third, countries respond differently to the two adverse oil market shocks. Note that both shocks increase oil prices, although supply shocks have a more delayed effect (peak effect is after two years). We see that while economic activity in Europe and the US decline substantially following the two oil market shocks, economic activity in emerging markets in Asia and South America declines by a substantially smaller amount, and in some cases, GDP actually temporarily increase with the higher oil price, c.f. Chart 4b.

Chart 4: Effect of oil market shocks on GDP; all shocks increase oil prices

a) Effects of shocks to developed and emerging demand on GDP



b) Effect of oil supply and oil specific shocks on GDP

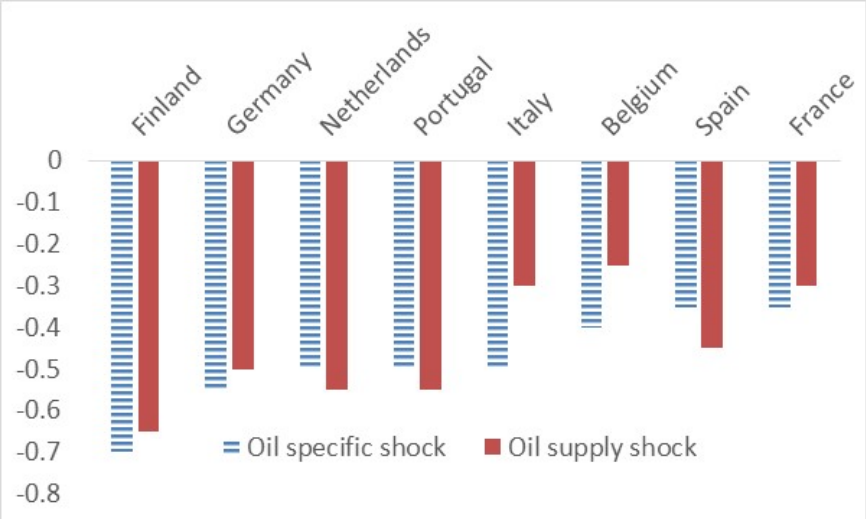


Source: Aastveit, Bjørnland and Thorsrud (2015).

Note: Effect of shocks on the level of GDP in Asia, Europe, North America (NA) and South America (SA). All shocks increase oil prices. The developed and emerging demand shocks are normalized to increase activity in developed and emerging countries by 1% on impact, respectively. The oil supply shock is normalized to decrease oil production by 1% (which eventually increases oil prices with 10 percent), while the oil-specific demand shock is normalized to increase the real oil price by 10% on impact. The y-axis reports the median response at the 2-year horizon

Some of these differences relate to country characteristics. Typically, countries with a high investment share of GDP and a high degree of openness, are less negatively affected of the adverse oil market shocks than countries with a high consumption share of GDP (i.e., Asia versus Europe). This emphasises the importance of separating demand and supply shocks when understanding the effect of an oil price increase, but also to separate these effects across countries and regions.

Chart 5: Effect of oil supply and oil specific shocks on GDP in the Euro area



Source: Aastveit, Bjørnland and Thorsrud (2015).

Note: Effect of oil supply shocks (blue) and oil specific shocks (red) on the level of GDP in various countries in the euro era. The oil supply shock is normalized to decrease oil production by 1% (which eventually increases oil prices with 10 percent), while the oil-specific demand shock is normalized to increase the real oil price by 10% on impact. The y-axis reports the median response at the 2-year horizon

Chart 5 zooms in on the responses to the adverse oil specific and supply shocks in some selected countries in the euro area. The graph shows that responses are consistently negative, although somewhat dispersed. In particular, countries such as Finland and Germany respond more negatively than France to the adverse oil market shocks.

To conclude, these results highlight heterogeneity in terms of the effects of oil market shocks on the macro economy, with emerging countries in Asia and South America being more important drivers of the real oil price, but less affected by the adverse oil markets shocks. In contrast, most European countries respond negatively to adverse oil market shocks, and more so on average than the US for equally sized shocks. It also emphasizes that once one has accounted for the difference in demand, both supply and oil specific shocks have an important negative effect on real activity in most developed countries, and the effects are somewhat stronger than what was found for the U.S. in Kilian (2009) and also in Bjørnland (2000).

Although one should be careful by interpreting too much into the difference in responses, there are some possible explanations for the overall results. A key parameter in determining the consequences of an oil price increase is the share of energy purchases in total expenditures. In particular, a low expenditure share

combined with a low price elasticity of demand will imply very small negative effects of an oil price increase, see Hamilton (2009). While the oil consumption share in most industrial economies has generally been flat or declined slightly since the 1980s, it has risen sharply in emerging countries such as China. However, as China began from a much lower level, per capita oil consumption in developed countries are still much larger than in China. This may suggest why emerging countries respond less negatively to the adverse oil supply or oil specific shocks than i.e., countries in Europe or the US.

Also, as pointed out by Edelstein and Kilian (2009) and Hamilton (2009), a key factor transmitting energy price shocks to the domestic economy has been the automobile sector. In particular, higher energy prices have typically implied an increase in the demand for energy-efficient small cars at the expense of energy-inefficient large cars (SUVs). This has benefitted producers in emerging countries in Asia, in particular. Going forward, more and more manufacturers in advanced countries are developing energy-efficient cars and equipment, thereby also making car manufacturing producers and consumers in the developed world less vulnerable to oil price fluctuations, all else equal.

For the European countries, the difference between countries could also relate to the share of energy in consumption, with countries such as Finland, Germany and Belgium having a larger share of oil in consumption (per capita) than France. However, the differences are not large, and not always statistically significantly, see Aastveit, Bjørnland and Thorsrud (2015) for details.

Above we have focused on the aggregate macroeconomic effects. In section 3 we will look into detail on inflation, while in Section 4 we will examine effects across a series of other macroeconomic variables, allowing also volatility to change over time.

2.3 The short run price elasticity

Until recently, many oil price-macro papers have often assumed the short run price elasticity of aggregate oil production to be zero, or at least, small, when identifying oil market shocks, see for instance Kilian (2009) and Kilian and Murphy (2012, 2014), and a series of other papers building on the seminal paper of Kilian (2009), including those cited above. Recent turbulences in the oil market have again sparked renewed interest in the question of how oil prices affect the macroeconomy, and vice versa. As a consequence, the role of supply and demand in generating fluctuations in the price of oil (and the macroeconomy) has been scrutinized, see Baumeister and Hamilton (2019), Caldara, Cavallo and Iacoviello (2019) and Kanzig (2021) for some influential papers. I will briefly discuss these below.

Baumeister and Hamilton (2019) criticise the use of restrictive identifying assumptions to identify the oil market shocks, and use instead Bayesian inference with prior information about both elasticities and the equilibrium when identifying the models. The Bayesian inference and identification has the benefit of being based on sign restrictions that are less restrictive than commonly used alternatives in the literature, such as e.g. Kilian (2009) and Kilian and Murphy (2012, 2014) that

respectively assumes a zero or low short run oil supply elasticity, and further has the advantage of accounting for uncertainty about the identifying assumptions themselves. As highlighted by Baumeister and Hamilton (2019), this is crucial for identifying demand and supply shocks to the oil market (see also Baumeister and Hamilton (2015) for general theory). Doing so, they find that supply shocks appear to be more important than found in earlier studies, although many of the previous findings from the literature prevail.

The conclusion in Baumeister and Hamilton (2019) can be supported by recent evidence from micro studies. While assuming a zero oil supply elasticity may be consistent with the behaviour of conventional oil producers, c.f. Anderson, Kellogg, and Salant (2018), new results for shale producers documented in Bjørnland, Nordvik and Rohrer (2021), Bornstein, Krusell and Rebelo (2021) and Aastveit, Bjørnland and Gundersen (2022) suggest shale oil producers are forward looking and respond quickly to news about future price signals. This support exploring alternative identification schemes that relax the assumption of a zero short-run oil supply elasticity, such as the approach recently developed in Baumeister and Hamilton (2019).

In a complementary study, Caldara, Cavallo and Iacoviello (2019) use external information from a large panel of countries to impose restrictions on the short-run price elasticities of oil supply and oil demand in order to identify a structural VAR model of the global oil market. Doing so, they also find an increased role for oil supply shocks relatively to earlier studies. As it turns out, shocks to oil supply and shock to global demand each account for about one-third of the fluctuations in oil prices at business cycle frequencies. Further, an increase in oil prices driven by oil supply shocks reduces industrial production in developed countries, while it boosts industrial production in emerging economies, thus helping explain the muted effects of changes in oil prices on global economic activity recently. Interestingly, this is consistent with the findings in Aastveit, Bjørnland and Thorsrud (2015), see Chart 4 above.

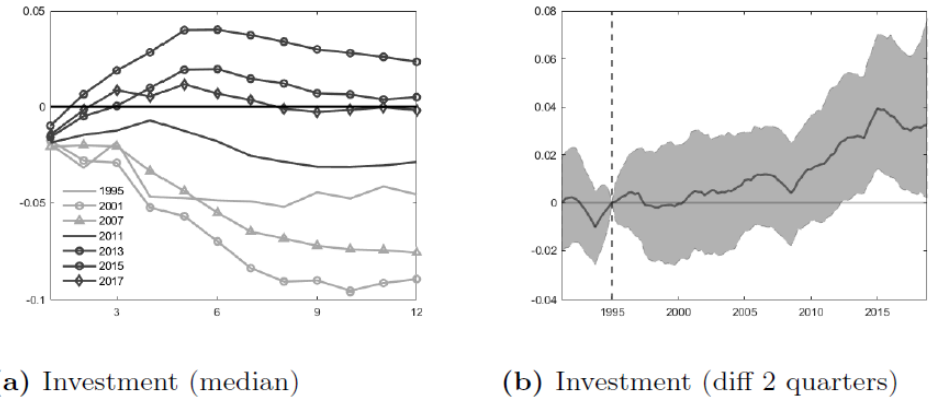
Finally, Kanzig (2021) proposes a novel identification strategy to shed light on the role of oil supply expectations. Using variation in futures prices around OPEC announcements, the paper identifies oil supply news shocks. Doing so, it finds oil supply news shocks can have significant effects on economic activity and prices, pointing to a strong channel operating through supply expectations.

2.4 Energy exporters and importers

Many papers have pointed out that oil exporters may benefit from higher oil prices through higher income, increased activity and spillovers to other industries, see e.g., Peersman and Van Robays (2012), Bjørnland and Thorsrud (2016), Bjørnland, Thorsrud and Torvik (2019) and Arezki, Ramey and Sheng (2016) for some recent studies. This may explain why resource rich countries such as Canada and Norway responded less negatively (or even positive) in the analysis above, a finding also seen in Bjørnland (2000) and Aastveit, Bjørnland and Thorsrud (2015).

More recently, the US has gained momentum as an oil and gas producer due to the massive surge in the production of oil and gas from shale rock deep underground. This has in a few years made the United States the world's largest oil and gas producer. Such a transition has not happened by itself. To build up productive capacity requires capital, technology, labor, skills and Learning By Doing (LBD) over a prolonged period of time, and with potential spillovers to other industries, see e.g. Allcott and Keniston (2018). To the extent that these spillovers affect production and employment across the U.S. states, the relationship between oil prices and aggregate U.S. activity could also have changed.

Chart 6: Effect of oil price shock on Non-residential (non-oil) investment in the U.S.



(a) Investment (median) (b) Investment (diff 2 quarters)

Source: Bjørnland and Skretting (2022)

Note: Left frame: posterior median of impulse responses at different points in time. Right frame: difference between impulse responses after 2 quarters, in period 1991:Q1-2018:Q4 relative to the responses in 1995:Q1, with 16-th and 84-th percentiles. All responses are reported in percent.

This question is addressed by Bjørnland and Skretting (2022). In order to consistently analyze the effect across industries, geographical areas and across time, they identify various shocks to the oil market, while also accounting for heterogeneity in several dimensions. Previous times series studies addressing this issue for the U.S. have typically been aggregate and focus on only a few macroeconomic variables.

Doing so, they find substantial changes in the way an oil specific price shock is transmitted to the U.S. economy. In particular, they find that that higher oil prices have positive spillovers to many industries in the U.S., effects that were not present before the shale oil boom. In particular, they find non-oil nonresidential business investment, manufacturing production, and non-oil employment in both oil-producing and many manufacturing-intensive states to increase following an oil price rise, see Chart 6 for impulse response for investment at different point in time (left), and test of significance of changes in responses (right). The reason is simply that the U.S. has increased its reliance of oil, not as a consumer, but by becoming the world's largest oil producer.

Going forward, policymakers need to take into account that the transmission of an oil price shock on in the US has changed with the shale oil boom, so that in the oil producing and manufacturing intensive U.S. states, an oil price increase can

stimulate activity, demand and income, and therefore also potentially push up domestic inflation.

However, so far there is little to suggest the real effects will spill over to European countries, as the direct trade linkages are likely to have a modest impact on activity in Europe. Nevertheless, the shale oil revolution might be beneficial to net oil importers by supporting non-OPEC supply growth and thus, mitigating oil price volatility (again see Bornstein, Krusell, Rebelo, 2021).

To sum up the discussions in Section 2, we have documented strong negative effects on the real economy from oil supply/oil specific shocks, while demand shocks increase both oil prices and activity. We have also shown that the negative effects from oil supply shocks seems to prevail across most studies, in particular when one use identifying restrictions that allow short run supply elasticity to divert from zero. Doing so, many recent studies have found an increased role for adverse supply shocks in generating fluctuations in the price of oil (and the macroeconomy).

We have further shown that there is evidence of heterogenous effects across regions following oil supply shocks, with Asia being the least negatively effected (in some instances also positively affected), followed by the US and Europe.

Finally, we have shown that as the US has now become a major oil producer, there is evidence of positive spillovers to several industries within the U.S. However, so far there is little to suggest the real effects will spill over to European countries, as the direct trade linkages are likely to have a modest impact on activity in Europe. Nevertheless, the shale oil revolution might be beneficial to net oil importers by supporting non-OPEC supply growth and thus, mitigating oil price volatility.

3 The role of inflation expectations as a transmitter of oil price shocks to inflation

An important element of monetary policy is that the anchoring of inflation expectations is necessary for achieving stable prices. Since such expectations are sensitive to increases in the price of oil, understanding the degree to which expectations facilitate the inflation pass-through of oil price shocks is an important policy question that has achieved much academic attention (see, e.g. Hooker (2002), Harris, Kasman, Shapiro and West (2009), Coibion and Gorodnichenko (2015) and Wong (2015)).

Despite this, there is currently no consensus on the empirical strength of this mechanism. For instance, while Coibion and Gorodnichenko (2015) argue that the high sensitivity of household's inflation expectations to oil price shocks in the US can help explain the missing deflation puzzle of the Great Recession, other studies such as Blanchard and Gali (2007) and Wong (2015) suggest that this mechanism is weak at best, and may have altogether disappeared since the 1990s.

In a recent study, Aastveit, Bjørnland and Cross (2022) question whether inflation expectations and any associated oil price pass-through depends on demand and

supply conditions underlying the global market for crude oil. The question is motivated by the idea that households may form their expectations of inflation differently when faced with long sustained increases in the oil price, such as the early millennium oil price surge of 2003-2008, as compared to short and sharp price increases that characterized much of the twentieth century. If this hypothesis is true, then it not only may help explain how oil price shocks propagate throughout the economy, but may also provide a resolution of the aforementioned debate about the empirical strength of the inflation expectations mechanism of oil price pass through.

To model the relationship between oil prices, inflation expectations and actual inflation, Aastveit, Bjørnland and Cross (2022) extend the SVAR model of the global market for crude oil developed in Baumeister and Hamilton (2019) to include monthly measures of expected and actual inflation in the US.[5] The Bayesian inference and identification has the benefit of being based on sign restrictions that are less restrictive than commonly used alternatives in the literature, c.f. the discussion above in Section 2.2.

Doing so, Aastveit, Bjørnland and Cross (2022) confirm previous findings that inflation expectations are sensitive to oil price shocks. In addition, they also provide novel insight that the degree of sensitivity depends on the underlying source of oil market shock. In particular, they show that demand for oil associated with unexpected large global economic activity shocks, such as the early millennium oil price surge of 2003-08, elicits a persistent response in both expected and actual inflation. In contrast, when the economy is hit by shocks to oil supply, consumption demand, or inventory demand, the paper shows that both expected and actual inflation initially increase but then gradually revert back to zero.

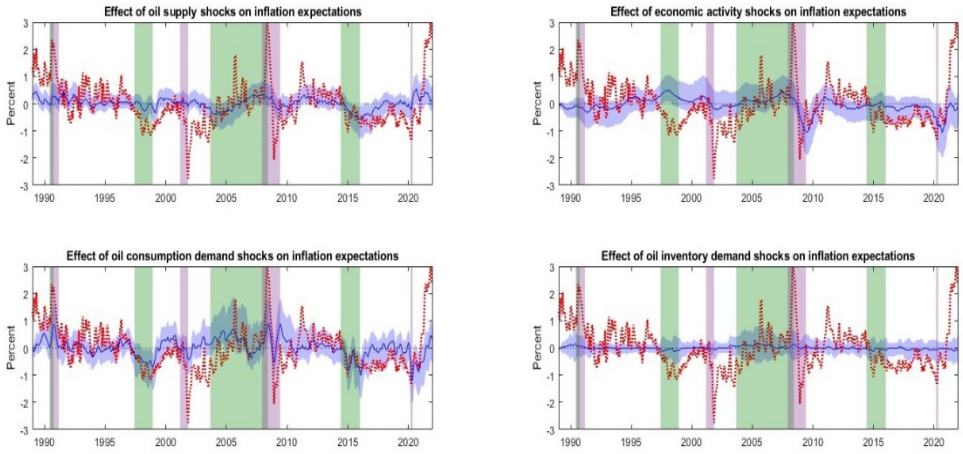
The results suggests that the way in which households form their expectations differs depending on the type of oil price shock underlying the global market for crude oil, or more precisely, the persistent effect of the shock on inflation expectations and inflation.

Having shown that both expected and realized inflation are sensitive to oil price shocks, Aastveit, Bjørnland and Cross (2022) investigate their relative effects during some commonly studied periods of economic significance. They find that much of the fluctuations in expected inflation is accounted for by unanticipated fluctuations in demand for crude oil. For instance, there is a close mapping between consumption demand and inflation expectations during the 1997/98 Asian Financial Crisis, while demand from economic activity played a key role in driving the persistent increases in expectations throughout the oil price surge of 2003-08 and the subsequent collapse in expectations in 2009. Finally, consumption and economic activity shocks jointly explain the persistent reduction in inflation expectations since the oil price drop of 2014/2015.

[5] The variables in the inflation block are measured as in Coibion and Gorodnichenko (2015) and Wong (2015): Inflation expectations are measured by the median one year-ahead inflation expectations Michigan Survey of Consumer Inflation Expectations. Inflation is the annualized month-on-month rate of change in the US consumer price index (all items).

Chart 7 below shows the historical decomposition for expected inflation, where we have updated and re-estimated the model to include 2021. Adding a few additional years, we confirm previous results, but now also clearly show that oil price shocks have had an important effect on the elevated inflation expectations in the recent two years. In particular, it is oil supply and oil consumption demand that are fuelling inflation expectations, and subsequently inflation the last two years.

Chart 7: Historical Decompositions: Expected inflation



Source: Aastveit, Bjørnland and Cross (2022) and own calculations

Notes: Observed demeaned time series (red dotted lines) and median estimate of historical contribution of separate structural shocks (blue lines). Blue shaded regions indicate 95 percent posterior credibility regions from the posterior distribution of 100,000 structural models. Green shaded bars represent periods of significance in the oil market discussed throughout the text. Purple shaded bars represent NBER recession dates.

Hence, these results support existing evidence that inflation expectations are sensitive to oil price shocks. Furthermore, the degree of sensitivity depends on the underlying source of oil market shock. In particular, demand for oil associated with unexpected large global economic activity shocks, such as the early millennium oil price surge of 2003-08 elicits a persistent response in both expected and actual inflation. In contrast, when the economy is hit by shocks to oil supply, consumption demand, or inventory demand, the effect on expected and actual inflation initially increase but then gradually revert back to zero. Despite this, there is clear evidence that the recent oil market shocks (oil supply and consumption demand) have increased inflation expectations, c.f. Chart 7. Based on historical experience, and the persistence of the recent response, this suggests that the oil market shocks may feed into inflation, through the elevated inflation expectations.

On a final note. We have shown that the way in which households form their expectations differs depending on the effect the of the oil price shock underlying the global market for crude oil. Still, although households may not be aware of the source of the shock, they care about its persistence. For instance, because gasoline prices are among the most visible prices to consumers, households pay particular attention to them when formulating their expectations (Coibion and Gorodnichenko, 2015).

Furthermore the persistent response of inflation expectations could depend on the fact that global demand shocks itself have been very persistent in the last twenty years. This is an important question, as oil supply shocks bring the risk of a persistent impact on inflation (and inflation expectations). We will come back to this when discussion implications for monetary policy in Section 6.

4 Oil prices and non-linear effects

So far, the discussions have been based on linear models, assuming stable effects over time. There is a growing literature also focusing on non-linear time-varying response to oil price changes, see Mork (1989), Hooker (1996), Hamilton (1996, 2003, 2011), Clark and Terry (2010), Baumeister and Peersman (2013a,b), Bjørnland, Larsen and Maih (2018) and Delle Chiaie, Ferrara and Giannone (2022) among many others.

The early literature mostly focused on the asymmetric response to oil price increases and decreases, c.f. Mork (1989). The idea was that an increase in oil price would have a larger negative effect on real activity, than the positive effects for a similar sized fall in oil prices. Hooker (1996) argued in addition that the negative effects had vanished over time, and in particular since the oil price collapse in 1985/86. However, as pointed out by Hamilton (1996), many of the oil price increases observed since 1985 were corrections to even bigger oil price decreases the previous quarter. When one looks at the net increase in oil prices over the year, data were consistent with the historical correlation between oil shocks and recessions.

More recent papers have analysed if the relationship between oil prices and the macroeconomy has changed due to structural changes in the economy. In particular, using non-linear models that allows for time varying changes, Baumeister and Peersman (2013a,b) have shown that there has been a decline in the price elasticity of demand for oil over time, which has dampened the effect of a supply disruptions on the macroeconomy. Furthermore, they have shown that the contribution of oil price shocks to the variability of oil prices has declined over time, and supply shocks explain a smaller part of the recession and inflation since the 1970s.

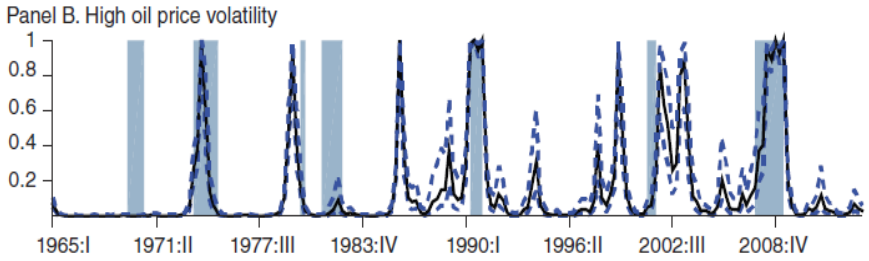
Delle Chiaie, Ferrara and Giannone (2022), on the other hand, have shown that the importance of global factors in explaining the variations of a large group of both oil and non-energy commodity prices has increased since the 2000s.

Bjørnland, Larsen and Maih (2018) take a different perspective and analyse if oil price shocks have a larger negative effect when oil prices are volatile. They ask in particular if there has been a decline in oil price volatility that coincides with the period of the great moderation, i.e., the period of more stable macroeconomic environment since the mid-1980s, which has been suggested by Nakov and Pescatori (2010) and Blanchard and Gali (2007). The framework used in Bjørnland, Larsen and Maih (2018) is based on a Markov Switching New Keynesian model that allows for different regimes for oil price volatility, general macroeconomic volatility

and different regimes for active ('hawkish') and passive ('dovish') monetary policy responses.

Doing so they find no evidence of a decline in oil price volatility that coincides with the Great Moderation. Instead, they find several short periods of heightened oil price volatility throughout the whole sample, many of them preceding the dated NBER recessions. If anything, the post-1984 period has had more episodes of high oil price volatility than the pre-1984 period. According to these results, then, we cannot argue that a decline in oil price volatility has been a factor in the reduced volatility in the macroeconomy observed across countries post 1984. Instead, the paper confirms the relevance of oil as a recurrent source of macroeconomic fluctuations, not only in the past but also in recent times.

Chart 8: The probability of being in a period with high oil price volatility



Source: Bjørnland, Larsen and Maih (2018)

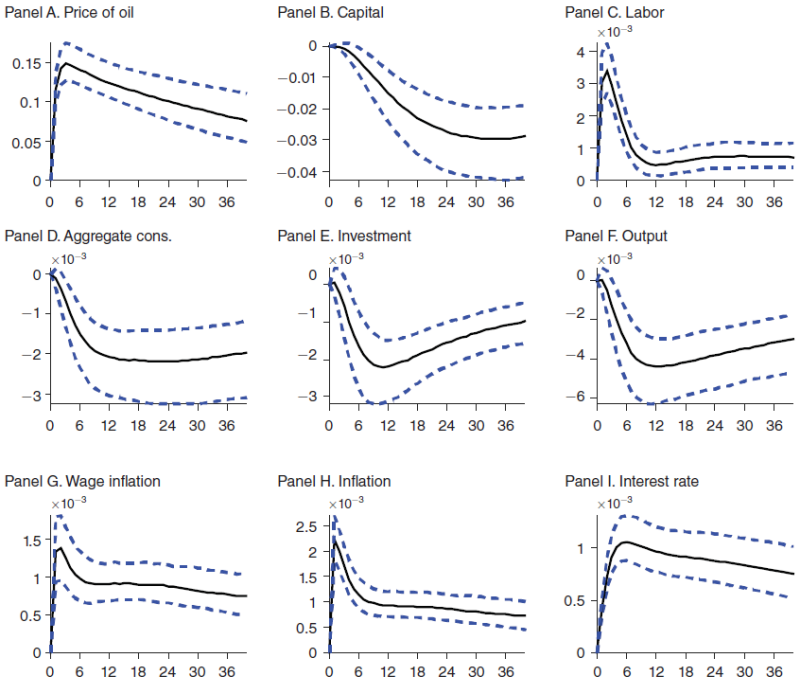
Notes: The figure presents the smoothed probabilities for being in the high oil price volatility state. The shaded areas correspond to the dated NBER recessions.

Chart 8 illustrates this. It graphs the probability of being in a period with high oil price volatility. The figure suggests there is no support for the hypothesis that a fall in oil price volatility coincided with the decline in macroeconomic instability from the mid-1980s (the start of the Great Moderation) noted in many previous studies. Instead it shows that the oil price has displayed several periods of heightened volatility throughout the sample, many of them coinciding with the NBER recessions. Thus, there is no support for the hypothesis that reduced oil price volatility have contributed to reduce macroeconomic instability over time, as was put forward in Nakov and Pescatori (2010) and Blanchard and Gali (2007). Interestingly, the episodes of high volatility correspond well with the historical episodes identified as exogenous oil price shocks in Hamilton (2013).

Having observed the coinciding pattern of heightened oil price volatility and the NBER-dated US recession, a natural follow-up question is how an oil price shock affects the macroeconomy? Chart 9 addresses this question by graphing the generalized impulse responses (over all regimes) to an oil price shock with probability bands. The figure shows that following a standard deviation shock to oil price of approximately 15 percent, US GDP declines gradually, by 0.4-0.5 percent within two years, as the cost of production increases. This will lower profit and reduce capital accumulation and investment by firms, and eventually also consumption by households. With an increased cost of production, firms wish to

substitute with labor, hence, the use of labor increases, pushing up wage growth and inflation rapidly by 0.2–0.3 percentage points. The latter motivates an increase in interest rates of 0.1 percentage point.

Chart 9: Impulse response to a generalized oil price shock



Source: Bjørnland, Larsen and Maih (2018)

Historical decompositions in Bjørnland, Larsen and Maih (2018) confirm that there is a large contribution of oil price shocks to the variability in wage and CPI inflation. In fact, throughout the 1970s, the oil price shocks contributed to both high wage and CPI inflation, and eventually also higher interest rates. But also since the mid 2000s, oil prices have contributed to higher inflation, (and subsequently higher interest rates). Without these shock, the rise in CPI inflation (and interest rates) would have been lower. Interestingly, this is also consistent with the findings in Aastveit, Bjørnland and Cross (2022) reported above regarding the missing disinflation after the financial crisis.

The main take away is that the contribution of the oil price shocks is substantial when oil price volatility is high. In these periods, oil price shocks account for approximately 10 percent of the variability in GDP and around 65 percent of the variability of inflation (after 1–2 years). In contrast, oil price shocks explain a modest 1 percent of GDP and 12 percent of inflation in periods of 'normal times', see Bjørnland, Larsen and Maih (2018). These results suggest an independent role for oil price shocks in the past and present recessions. But they also suggest that high oil price volatility can exacerbate the effect of oil price shocks on inflation.

Finally, an important question to address is to what extent it was the oil price shocks themselves that depressed output over time, or the central bank's contractionary response to inflationary concerns? According to Bernanke, Gertler, and Watson

(1997), contractionary policy was mostly to blame. Bjørnland, Larsen and Maih (2018) confirm the role of monetary policy in magnifying the negative effects of the shocks, as the effect are stronger when policy is hawkish (strong response to inflation). The main reason is that the increase in interest rates in the contractionary phase, although effectively curbing inflation, will exacerbate the oil-led contraction of the economy. However, as it turns out, since the policymakers have been in the high-response (hawkish) regime since the early 1980s, oil price shocks have been contractionary for the US economy in the whole period of the Great Moderation (post 1983/1984), and not just in the Volcker era (1979–1987) as suggested in Bernanke, Gertler, and Watson (1997). This suggest an independent role of oil price shocks in the recessions.

Importantly, although the effects of oil price shocks on inflation are smaller when policymakers are hawkish than dowish, there is still a substantial share of inflation being explained by the oil price shocks. This suggests that during periods of high oil price volatility, stabilizing inflation is difficult. However, this also suggests that central banks need to be swift in their response to curb inflation.

We conclude this section by emphasizing that that volatility matters, and tend to exacerbate the effect of the adverse oil market shock on aggregate activity and inflation. We have shown that the effects of oil price shocks on inflation are smaller when policymakers are hawkish, whereas the effect on output is larger. The main reason is that the increase in interest rates in the contractionary phase, although effectively curbing inflation, will exacerbate the oil-led contraction of the economy. We have also emphasized the importance of being swift in the policy response to prevent inflation expectations and inflation to become persistent. We will return to this discussion in Section 6.

5 The recent energy price increase and consequences for Europe

What are the key drivers of the recent energy price increase? How will it affect real output and inflation in Europe? These questions are of vital interest to researchers, businesses and policymakers, especially in light of the ongoing pandemic and war between Russia and Ukraine.

As can be seen in Chart 9, during the first few months of the covid pandemic, the oil price fell by 85 pct. From the summer of 2020, however, the oil price started to gain momentum, and by the summer of 2021, it had already surpassed the pre-pandemic levels. With rising geopolitical tensions, and the subsequent war in Ukraine, the oil price has fluctuated widely, being more than 130 USD a Barrell in a period. As this is written (June 6, 2022), Brent oil stands at 124 dollar a barrel, 80 percent higher than the pre-pandemic levels, see Chart 10.

Such volatile oil prices are recurrent sources of economic fluctuations, c.f. the discussion in section 2 and 4, and many of the spurs have preceded the dated NBER recessions, c.f. Bjørnland, Larsen and Maih (2018). Furthermore, as inflation

expectation picks up, this will most likely transmit the oil price shocks to inflation, c.f. the discussion in Section 3.

There are several factors that can explain the increase in oil prices since June 2020, and that may have the potential to affect the global economy going forward. Below I will go into detail of four factors behind the commodity price changes, and in the end I will discuss likely consequence for economic activity and inflation, focusing on Europe in particular.

Chart 10: Crude oil prices, Brent blend, 2020-2022

Source: Fred database, St. Louis Fed.

I. Initial plunge offset by increased demand for oil as economic growth picked up

When the pandemic hit the world more than two years ago, oil prices collapsed. The main reason for the decline was the abrupt fall in economic activity and oil demand. In addition, uncertainty was extremely high, in terms of both the severity of the recession and the possible outcome of the pandemic, pushing oil prices all the way down.

The oil producers met the collapse in oil prices by adjusting production levels, in particular shale producers cut both production and deferred investment, but there is a limit to how much one can delay production without damaging capital installation and reservoirs. Storage capacity was also limited, and although shale producers can store underground (by waiting to complete (initiate production) or refracture a well, c.f. Aastveit, Bjørnland and Gundersen (2022) and Bjørnland, Nordvik and Rohrer (2021)) unconventional producers do not have this option. Overall this led to the price collapse.

From the summer of 2020, however, oil price started to pick up again, mainly due to the increased demand for oil following the easing of lock downs, and the cut in production capacity. Throughout 2020/2021, the strong economic rebound increased

demand for oil and oil related products further, and by the summer of 2021, oil prices were back to pre-pandemic levels.

II. Geopolitical concerns and war

During the fall of 2021, geopolitical tensions between Russia and Ukraine added to the oil market concerns, pushing oil prices far away from any fundamentals. Following the outbreak of the war in Ukraine in February 2022, the oil price has increased further, and volatility has also increased. Although oil prices are a bit down from the highest level recorded, volatility is still high, and oil prices have been fluctuating well above 100 USD a barrel.

Such volatile oil prices have been recurrent sources of economic fluctuations over time, and as discussed above, many of the spurs have preceded the dated NBER recessions. There is a deep concern that this will also be the case this time. In addition, the elevated oil prices are already increasing inflation expectations and will also push up inflation going forward.

III. Reduced oil supply due to lack of investment

The main driver of the increased oil prices from the summer of 2020 relates to oil demand. However, due to the ongoing pandemic, the increase has not been met by a sufficient increase in supply capacity. OPEC has increased oil production somewhat, but has limited spare capacity and may also want to take advantage of the gains from high oil prices to boost the economy, see Wall Street Journal, May 5, 2022. Except from shale producers, that can switch on production in a short time, c.f. Bjørnland, Nordvik and Rohrer (2021), conventional producers have long leads between investment and production. On average, it can take 5-7 years between the moment one finds resources to production can start, c.f. Arezki, Ramey and Sheng (2016). As shale producers still make up a small share of total oil and gas production, supply constraints will likely affect the energy market for a long time going forward.

There is also uncertainty as to how many new oil fields that will be developed. There is a push for diverting capital investment from oil and gas towards green investments. This makes the potential for a sustainable increase in supply less likely, implying that oil prices may remain high for a prolonged period, all else equal.

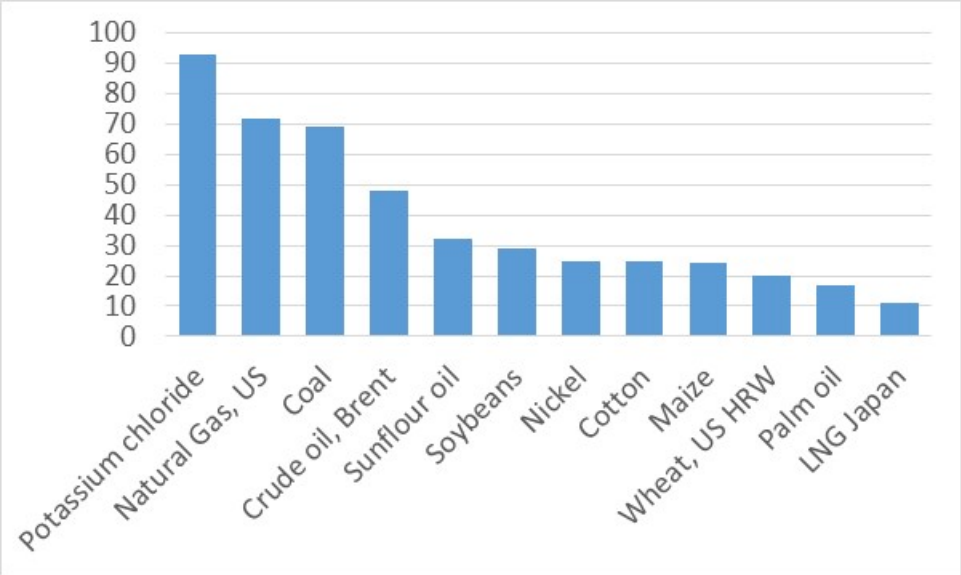
IV. Other commodity prices

The war in Ukraine has also had a large effect on other commodity markets, due to blockades of trade, destruction of productive capacity in Ukraine, and sanction of Russia. As Russia and Ukraine are major commodity exporters, this have had a large effect on commodity prices. Russia is one of the world's largest exporter of

natural gas, wheat, pig iron, nickel, coal, oil and fertilizers among others. Ukraine is an important exporter of food commodities, in particular wheat and sunflower seed oil, see Baffes and Nagle (2022).

The consequence of the disruptions of production capacity and has been that we are now witnessing large price increases in a series of commodities, food commodities in particular, see Chart 11. These commodity price increases will not only impact energy, electricity and fertilizers, we are seeing inflation increase for industrial production, production of digital equipment and their services, food, drink and tobacco, chemicals, to name just a few groups.

Chart 11: Commodity price changes in 2022, percent.



Source: World Bank

Note: Percentage changes in commodity prices, January-June 2022

Going forward, high and volatile commodity prices pose significant risks to the global economy recovery and inflation in Europe. In a recent study, Peersman (2022) has argued that exogenous shifts in international food commodity prices can explain almost 30% of euro-area inflation volatility over the medium term. Increased commodity price shocks have an impact on food retail prices through the food production chain, but also trigger indirect inflationary effects via a depreciation of the euro and rising wages. However, as also pointed out, due to asymmetric wage responses, the inflationary effects are different across member states, depending on whether they are exporters or importers of affected commodities and how higher prices affect household and corporate income.

It is clear that during 2021, most of the increase in oil prices in this period were adjustments from the oil price decline during the pandemic. To the extent that demand is kept high, the increase in oil prices will not have any negative effect on the European economies, although as we saw above, inflation expectations have picked up. So far this is short term inflation expectations. However, the persistence

of the effect of the shock on oil prices can also transmit into more persistent inflation expectations, which is what matter most for monetary policy. Still, recent evidence suggests that long term inflation expectations have remained stable. In line with this, Consolo, Delle Chiaie and Vansteenkiste (2022) suggest that while short-term inflation expectations tend to respond to commodity price changes, long-term inflation expectations remain more stable following oil price shocks. That these prices remain stable should be the main priority for central banks going forward.

Yet, there is a concern that most commodity prices are now elevated, and are expected to remain high for long. The last months, inflation has been increasing further. Although bottlenecks are expected to eventually ease as capacity constraints will ease, there are expectations of supply shortages in several sectors also in 2023. As a result, many forecaster (i.e., IMF) have projected inflation to remain elevated for much longer than before and also compared to both advanced and emerging market and developing economies.

As I have argued above, commodity prices also transmit to inflation via inflation expectations. High and volatile commodity prices therefore pose significant risks to the global economy, and Europe in particular. The effects will be felt on both inflation and growth, and will fall unevenly across countries, depending on how higher prices affect household and corporate income. Still, we expect higher commodity prices to increase overall inflation in Europe in the short and medium term.

On top of this, adverse oil supply shocks will hurt growth. To put some number behind the recent events, we have seen above in Chart 5b that a 10 percent increase in oil prices due to conflict/war (oil specific shock) will reduce GDP in Europe with approximately 0.5 percent. A 30 percent increase, such as what we have experienced in 2022, will reduce GDP in Europe with 1.5 percent, all else equal.

The war in Ukraine has also increased uncertainty that was already on the rise due to new outbreaks of the pandemic, which will affect the global outlook more negatively. Although many countries have opened up since the major outbreaks of the pandemic, there could be new variants in the winter that can lead to higher infection and further disruption to supply chains. Inflation pressure could strengthen even further, and demand even more contractionary monetary policy responses. The recent lockdowns in China due to the strict zero-COVID strategy, could push China's economy further down, with huge consequences for trade. This will most likely dampen the global recovery, affecting in particular emerging and developing economies.

To conclude, the mix of rising energy price and other commodity prices, plus the continuous disruption of the covid pandemic, have already changed inflation expectations and has elevated inflation. Supply shortages due to the war could increase these pressures further, pushing up energy, metals, and food prices. This leaves monetary policy at a crossroad in Europe, with inflation expectation at a rise, which the ECB should already respond to, against the weaker domestic growth outlook. I turn to this now.

6 New challenges for monetary policy

Although the recent commodity spurs are beyond the control of central banks, inflation expectations are not. Empirical evidence (see the discussion above) suggest that demand driven oil price shocks were already transmitted into inflation expectations throughout 2021 and are having their indirect effect on inflation. The war in Ukraine has further increased commodity prices (c.f. Chart 11) and intensified supply disruptions, adding to inflation fears. This will affect countries in Europe differently, depending on energy dependence in consumption and production, and fiscal space, among others.

In the US, fear of inflationary pressures have been emphasised for some time due to expansive fiscal space adding to domestic demand pressures. European countries, on the other hand, are more directly affected by the war in Ukraine, as their import of commodities (gas in particular) are affected. This could lead to broader and more persistent price pressures, and in some countries, also likely a recession (gas dependent countries such as Germany and Italy in particular). Thus, the inflationary effect will differ across countries, and the appropriate monetary policy response should therefore also vary. In Europe, and for ECB in particular, this will be challenging. ECB needs to prevent higher commodity prices to feed further into wages and inflation expectations, thereby driving up prices. This should be their main priority now. Yet, there will be trade-offs between supporting growth and containing inflation in many countries, in particular if the commodity prices remain elevated for a long period.

The mix of increased energy and commodity prices, war in Europe, and a pandemic that has not yet ended, will be challenging. Still, central banks need to prioritize anchoring inflation expectations. During the pandemic inflation expectations was well anchored in most economies. Now inflation expectations is on a rise. With already high inflation and rising energy and food prices, higher inflation expectations could become more widespread also in Europe, and, in turn, lead to further increases in prices. To avoid a wage-price spiral, monetary policy should respond more firmly already now.

Bjørnland, Larsen and Maih (2018) emphasised this dilemma. Independently of whether monetary policy is in the hawkish or dovish state, inflation increases and output falls for a prolonged period of time following an adverse oil price shock. This suggests an independent role for oil price shocks in past and present recessions, as emphasized above. However, they also show that inflation remains out of control for a longer period of time when monetary policy is not responsive. On the other hand, the negative effect on output of an oil price shock is magnified when the policymakers are responsive. One reason is that the increase in interest rates, although more effectively curbing inflation, will exacerbate the oil-led contraction of the economy.

Finally, the analysis above also show that during periods of high oil price volatility, stabilizing inflation is difficult. In particular, we show that there remains a substantial share of variance in inflation explained by the oil price shocks, even when central

banks are responsive (hawkish). This suggest that central banks need to be swift in their response to curb inflation.

In Europe, short term inflation expectations and inflation are now on the rise, while probability of recession has increased. The importance of monetary policy for stabilizing inflation expectations requires swift actions from policy makers to prevent wage-inflation spiral building up. This should be the main priority for ECB now. Yet, there will be trade-offs between supporting growth and containing inflation in many European countries, in particular if the commodity prices remain elevated for a long period. This suggest that there may be a limit as to how far monetary policy may go.

On a final note, monetary policy also work by affecting financial markets, see Rigobon and Sachs (2004) and Bjørnland and Leitemo (2009) among others. The combined effect of higher commodity prices, lower growth and asset prices and elevated inflation suggest more troubling and challenging times ahead for European economies and policymakers.

7 Summary and conclusions

This paper looks at the recent energy price changes following the global pandemic, the recent geopolitical tensions, and the supply disruptions due to the war in Ukraine, and analyses subsequent effects on economic activity and inflation in Europe. Since the seminal contribution of Hamilton (1983), a growing oil-macroeconomic literature has predicted an inverse relationship between oil price changes and economic activity in oil importing countries. Although the existence of this negative relationship is well established by now, there has been substantial disagreement in the literature as to the magnitude of the relationship.

We provide a thorough review of the growing body of literature on the oil-macro relationship, taking into account sources of shocks, global changes, short run price elasticity, and the role of oil exporters versus importers. First, we confirm recent evidence that global demand shocks increase both oil prices and macroeconomic conditions, and that in recent years, demand from emerging countries have been the main source of the oil price fluctuations. Second, we also find an independent role for adverse oil market (i.e., supply) shocks in the past and present recessions, i.e., recessions are not only due the Central Bank's contractionary response to inflationary concerns. Third, we show that European countries are among the most negatively affected globally by these adverse oil market shocks, and furthermore, that high oil price volatility will exacerbates the adverse effects of oil price shocks on the macroeconomy.

We focus in particular on the effect of inflation expectation in transmitting oil price shocks to inflation and looks at evidence following the recent oil price increases. We show that inflation expectations and the associated pass-through of oil price shocks depend on demand and supply conditions in the global oil market, and economic activity (demand) shocks have a significant long lasting effect on inflation expectations and actual inflation. Still, oil supply shocks also matter, and the

persistence of the recent adverse oil supply shocks can explain a large part of the increase in inflations expectations witnessed the last year. This should give cause for concern for central banks.

We also find that during periods of high oil price volatility, stabilizing inflation is difficult. In particular, we show that the recent decades, there a substantial share of the inflation variance is explained by the oil price shocks, even when central banks respond strongly (they are hawkish). This suggests that central banks need to be swift in their response to prevent oil price shocks to transmit into inflation via inflation expectations.

In Europe, short term inflation expectations and inflation are now on the rise, mainly due to the energy and commodity price shocks, while the probability of recession has increased. The importance of monetary policy for stabilizing inflation expectations requires swift actions from policy makers to prevent wage-inflation spiral building up. This should be the main priority for ECB now. Yet, the next year there will be trade-offs between supporting growth and containing inflation in many European countries, in particular if the commodity prices remain elevated for a long period. This suggests more troubling and challenging times ahead for European economies and policymakers, trying to balance growth and inflation in the long run.

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