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How do oil price forecast errors impact inflation forecast errors? An empirical analysis from US, French and UK inflation forecasts☆

Frédérique Bec [a], Annabelle De Gaye [b]

[a] Thema-University of Cergy-Pontoise, F-95000 Cergy-Pontoise, CREST-ENSAE and Banque de France, Paris, France
[b] Banque de France, DGEI-DCPM, Paris, France

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ABSTRACT

This paper proposes an empirical investigation of the impact of oil price forecast errors on inflation forecast errors for three different sets of recent forecast data: the median of SPF inflation forecasts for the United States and the Central Bank inflation forecasts for France and the United Kingdom. Mainly two salient points emerge from our results. First, there is a significant contribution of oil price forecast errors to the explanation of inflation forecast errors, whatever the country or the period considered. Second, the pass-through of oil price forecast errors to inflation forecast errors is typically multiplied by around 2 when the oil price volatility is large.

1. Introduction

The impact of oil price shocks on macroeconomic and financial variables has been widely scrutinized both theoretically and empirically since the seventies. From a theoretical viewpoint, the models developed by e.g., Bruno and Sachs (1982), Phelps (1994), Ferdered (1996), Rotemberg and Woodford (1996) or more recently Blanchard and Gali (2010) are specifically devoted to this analysis.[1] Only to mention the main effects, a raise in oil price is expected — from a traditional Keynesian view — to have a direct negative impact on aggregate demand due to the decrease in consumption following the real income reduction. The negative impact on aggregate demand can also stem from international wealth redistribution effects (oil exporting vs importing countries) and the decrease of consumers' income due to the reduction of factors' marginal productivity and hence remuneration. A direct negative impact on aggregate supply is also expected since oil is a production input: the increase of its price is expected to reduce firms' profitability. Moreover, the decrease in real wage induced by the oil price shock could reduce labor supply and hence aggregate supply as well. From an empirical point of view, the seminal paper by Hamilton (1983) and his more recent empirical contribution in Hamilton (1996) both emphasize the correlation between oil shocks and recessions.[2] However, this conclusion is challenged by Hooker (1996), Blanchard and Gali (2010), Edelstein and Kilian (2009) or Valcarcel and Wohar (2013) whose results suggest that this correlation has decreased, if not vanished, from the eighties on. Such a weakening is also found in the pass-through of oil shocks to inflation, see e.g., Hooker (2002) for the core U.S. Personal Consumption Expenditures inflation or Herrera and Pesavento (2009) for the US GDP deflator.[3] Nevertheless, the Consumer Price Index (CPI) is a noticeable exception as stressed in Blanchard and Gali (2010): from a five-variable vector autoregression, they find a stable response on impact of US CPI inflation to oil price shocks before and after 1984. As noticed by these authors, this is not surprising since part of the increase in oil prices is reflected mechanically in the oil component of the CPI. From their historical decomposition exercise, they even find that the contribution of oil price shocks to CPI inflation has increased in the recent period. Keeping in mind that the overall CPI inflation can be decomposed into the core CPI inflation and the food and energy components of inflation, this result is compatible with a stable core CPI: if core prices are sticky and/or correctly monitored by a non accommodating monetary policy, then oil price surprises

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E-mail address: bec@ensae.fr (F. Bec).

[1] Since our approach below focuses on macroeconomic aspects, we will not discuss the large literature on the impact of oil price shocks on stock returns and their volatility but will instead refer the reader to the recent contributions of e.g., Driesprong et al. (2008), Narayan and Sharma (2014) or Narayan and Gupta (2015) and the references therein.

[2] A short run impact on production growth rate is also found for respectively European and Asian countries by Cunado and Perez de Gracia (2003) and Cunado and Perez de Gracia (2005), and for a panel of 28 developed and 17 developing countries in Narayan et al. (2014).

[3] As emphasized by these authors, this suggests that "the less accommodative monetary policy of the Volcker–Greenspan era may have been more effective in controlling the expectations of higher inflation that follow an oil price shock".

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are expected to affect headline inflation only. This result supports a widespread belief among professional forecasters that overall inflation forecast errors are mainly due to oil price forecast errors. In its assessment of Eurosystem staff projections for Harmonized Index of Consumer Prices inflation in the Euro area during the period 2000–2012, the ECB notes that: "In annual percentage deviation terms, the one-year-ahead oil price projections were, on average, 13% lower than the actual oil price over the sample period. This is vital to the explanation of why Euro area HICP inflation was underestimated."[4] Indeed, if the impact of oil shocks on inflation was weak, so would be the impact of oil price forecast errors on inflation forecasts errors. To our knowledge, the pass-through of oil price forecast errors into inflation forecast errors has not been evaluated so far. The goal of our paper is to fill this gap.

Beyond the empirical and operational interest of this topic, the microeconomic and macroeconomic consequences of such a link are as large as the number of economic decision rules which rely on inflation forecasts. At the microeconomic level, consequences of inflation forecast errors stem from the implied inefficiency of decisions made by agents whose perception of future relative prices is not correct.[5] A famous macroeconomic illustration is the forward Taylor rule first proposed by Clarida et al. (1998) and Clarida et al. (2000) which relates the interest rate fixed by the central banker to the expected output and inflation gaps: regarding the latter, the expected overall — i.e., including energy — inflation gap is typically taken into account. For instance, the European Central Bank explicitly aims at inflation rates of below, but close to, 2% over the medium term, where the inflation rate is measured by the Harmonized Index of Consumer Prices (HICP) which includes energy prices. For the Bank of England, the inflation target of 2% is expressed in terms of an annual rate of inflation based on the CPI while the Federal Open Market Committee of the Federal Reserve Bank targets a rate of 2% for inflation as measured by the annual change in the price index for personal consumption expenditures: those price indices include energy.[6] Hence, a better understanding of inflation forecast errors is called for to investigate if *i*) there is room for improvement in the inflation forecasting exercise and *ii*) if so, along which dimensions. As a starting point to address these questions, this paper will focus on oil price forecast errors as a potential source of inflation forecast errors. To this end, recent quarterly data are used for inflation forecast errors from the United States, France and the United Kingdom. They come respectively from the Survey of Professional Forecasters (SPF), Banque de France (BdF) and Bank of England (BoE).

In a first step, the empirical analysis is held in a standard linear framework. It reveals that the correlation of these data with oil price forecast errors turns out to be strong for all countries. This suggests that inflation forecast errors are due to oil price forecast errors to the extent that oil price forecast errors may be considered as exogenous with respect to national price index forecast errors. Even though this condition may be challenged for a large country such as the United States,[7] it is more likely to hold in relatively small countries such as France or the United Kingdom. This first result confirms the widely held view among professional forecasters. Yet, it is not very useful since the crude oil prices are very difficult to forecast for the kind of projection horizons typically considered by Central Banks, i.e., no longer than one year ahead. As discussed to great extent in Alquist et al. (2013), the no-change forecast[8] of the nominal price of oil is not outperformed by any of the more sophisticated alternative approaches they consider in their paper. Even though the headline inflation point forecast can hardly be improved from this first finding, it is still possible to use the relationship between the oil price and headline inflation forecast errors to refine the measure of inflation forecast uncertainty, i.e., the predictive density.

This is done in a second step, where the relationship between inflation and oil price forecast errors is allowed to be regime-dependent. Actually, relaxing the linearity assumption reveals that the pass-through is not constant over time : it is found to be more than twice as large during episodes of high oil price volatility as during calmer periods. It was particularly high during the last episode of high volatility during 2008–2009. This feature is exploited to built regime-dependent bootstrapped fan charts for inflation forecasts. It turns out that the uncertainty surrounding overall inflation forecasts is much reduced in low oil price volatility times compared to large volatility periods: the width of the 90%-confidence interval of the e.g., one-year ahead inflation forecast is divided by two in the US and France. For instance, as of say the last quarter of 2013 — which belongs to the low oil price volatility regime — our model predicts a very low deflation risk over 2014 in the US and an even lower deflation risk in France where it does not belong to the 90%-confidence interval.

The remainder of the paper is organized as follows. Section 2 presents some preliminary descriptive statistics for our forecast error data. Section 3 presents the first piece of evidence, found from a linear framework, of the close relationship between oil price and inflation forecast errors. Section 4 extends this setup to allow for a nonlinear relationship and illustrates the relevance of such an approach by proposing regime-dependent fan charts of inflation forecasts. Section 5 concludes.

2. Forecast error data for inflation and oil price

The motivation underlying the choice of the US, French and UK cases, apart from forecast data availability, is twofold: *i*) these countries are very different by nature as consumers and/or producers of oil, and *ii*) the inflation forecast error data we have found are very different by nature.

First, the US and UK are oil producing countries contrary to France. As of 2013, the total oil supply of the United States was 12,342 thousands barrels per day (b/d), more than ten times less in the United Kingdom with 914 thousands b/d — offshore included — and finally only 62,3 thousands b/d in France.[9] Hence, by contrast with France, the US — and to a lesser extent the UK — can be considered as influential on the supply side of the oil market. Then, regarding their total petroleum consumption as of 2013,[10] it ranges from 1508 thousands b/d in the UK and 1767 thousands b/d in France to 18,961 thousands b/d in the US. So, on the demand side of the market, the UK and France can be considered as rather small oil importing countries, for which the oil price can be safely considered as exogenous. By contrast, the US are of course a large country whose oil demand can influence the oil market price — see for instance Alquist et al. (2013) on this point.

Second, regarding the nature of the forecast data, for France and the UK, the inflation forecast data used here are made by a large national economic institution, namely the Banque de France and the Bank of England. By contrast, the median of Survey of Professional Forecasters (SPF) data is used for the US. Even though made by professional forecasters, the forecasts from this survey stem from a much less homogenous framework than those used for France and the United Kingdom. Actually, all the institutions (banks, insurance companies, large firms, etc.) do not respond at each date of the opinion poll, and some may disappear definitely from the panel at any date while new ones may enter it. So these SPF forecast data are by nature very different from the ones from BdF and BoE.

For France, an inflation forecasting exercise is performed each quarter along the lines defined by the European System of Central Banks (ESCB). It consists in providing monthly inflation projections over a 1-year horizon. So, thirteen *monthly* Harmonized Index of Consumer

[4] See p. 76 of the ECB Monthly Bulletin of May 2013.

[5] This view has been popularized by the monetarist and new classical schools of Chicago, with the respective influential contributions of Friedman and Schwartz (1963), Lucas (1972) and Sargent and Wallace (1975).

[6] As noticed in Blanchard and Gali (2010) inter alia, oil price shocks have often been followed by a tightening of the monetary policy in order to contain upwards inflationary pressure.

[7] See e.g., Kilian (2008) or Alquist et al. (2013).

[8] I.e., the forecast stemming directly from a random-walk process.

[9] Source: U.S. Energy Information Administration, International Energy Statistics.

[10] Source: U.S. Energy Information Administration, International Energy Statistics.