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Growth Forecast Revisions Over Business Cycles: Evidence from the Survey of Professional Forecasters

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Abstract
This paper studies how expectations regarding current and future output growth are revised as the state of the economy evolves. We study this issue using GDP growth forecasts from the Survey of Professional Forecasters. We find an asymmetric relationship between forecast revisions and GDP growth. Forecasters make larger forecast revisions during contractions than during expansions when the deviation of the economy from its normal state is controlled for.
Keywords
SPF; GDP growth forecast; Asymmetric forecast revision; Business cycles

1. Introduction

Output expectations play a central role in macroeconomics. Standard macroeconomic theory predicts that expectations about future output, along with the short-term interest rate, are the key determinants of current output. The evolution of output expectations also has a substantial influence on the short-term interest rate. This paper studies how expectations about future output growth are revised as the state of the economy evolves. In particular, we study whether the revisions of output growth forecasts from the Survey of Professional Forecasters (SPF) behave differently depending on economic conditions. Our empirical findings show that there is an asymmetric relationship between forecast revisions and GDP growth. Forecasters make larger forecast revisions when the growth rate declines than when it increases. Using a regression model in which forecast revisions depend on the growth rate, we find the estimated constant and slope coefficient vary depending on economic conditions.

This paper is closely related to the literature on asymmetric business cycles. Recessions are generally sharp and abrupt, while expansions are more gradual (e.g., Neftci, 1984, Van Nieuwerburgh and Veldkamp, 2006, Abbritti and Fahr, 2013). These papers show that business cycles are asymmetric using aggregate variables. Our work complements this literature by providing additional evidence that changes in growth expectations are also sharp and abrupt when the economy deteriorates. Our results have important implications for the study of business cycles in that large and drastic downward adjustments of future growth expectations during economic contractions are likely to contribute to sharp declines in current output growth.1

The paper is organized as follows. Section 2 presents some basic facts about growth forecast revisions from the SPF and then investigates how growth forecasts are revised when the growth rate changes. Section 3 concludes.

2. Forecast revisions and economic conditions

Let $F_t \Delta y_{t+h}$ denote the average forecast of $h$-quarter ahead output growth in the SPF. The survey forecasts, $F_t \Delta y_{t+h}$ and $F_{t-1} \Delta y_{t+h}$, are formulated in period $t$ and $t-1$, respectively. Table 1 reports the basic statistics of the real GDP growth rate ($\Delta y_t$), the change in the growth rate ($\Delta y_t - \Delta y_{t-1}$), and the magnitude of the forecast revision ($\Delta y_t - \Delta y_{t-1}$) for horizon $h \in \{0,1,2,3\}$. We consider these four forecast revisions as the survey includes a “nowcast” to the 4-quarter-ahead forecast.2 The SPF starts from 1969 for $h \in \{0,1\}$ and from 1970 for $h \in \{2,3\}$, and the sample period ends in 2019.3 The real GDP growth rate is taken from the FRED database of the Federal Reserve of St. Louis.

Table 1 presents the historical means and skewness of $\Delta y_t$, $\Delta y_t - \Delta y_{t-1}$ and $F_t \Delta y_{t+h} - F_{t-1} \Delta y_{t+h}$. Interestingly, the means of forecast revisions with $h \in \{0,1,2\}$ are negative and significantly different from zero at the one percent significance level, indicating that the value of $F_t \Delta y_{t+h}$ is lower than that of $F_{t-1} \Delta y_{t+h}$. Although we do not report it here, we also find that the historical mean value of $F_t \Delta y_{t+h}$ is smaller than $F_{t-1} \Delta y_{t+h}$ for $i > 1$. These results indicate that the average forecasts with shorter horizons are consistently lower than those with relatively longer forecast horizons.4 This finding is interesting in that the average change in the growth rate, $\Delta y_t - \Delta y_{t-1}$, is close to zero. When $h = 3$, the table shows the magnitude of the forecast revisions is negative, but statistically zero. This table also shows that the mean of the forecast revision gets closer to zero as the horizon $h$ increases. This is because GDP growth follows a stationary process. The table also shows that the forecast revision tends to be negatively skewed, while the change in the growth rate is positively skewed.
Here we investigate the relationship between forecast revisions and the state of the economy as measured by the GDP growth rate. To this end, we consider a regression model given

\[
F_t \Delta y_{t+h} - F_{t-1} \Delta y_{t+h} = \delta_0 + \delta_1 NBER_t + \delta_2 |\Delta y_t - \Delta y| + \delta_3 \Delta y_t + \epsilon_t \tag{1}
\]

Where \( \Delta y \) is the average growth rate. The recession dummy, \( NBER_t \), is one during recessions and zero otherwise.\(^5\) This model is designed to investigate the presence of a non-linear relationship between the forecast revision and the growth rate. The dummy variable allows us to test whether the constant changes during recessions, while the second explanatory variable, \( |\Delta y_t - \Delta y| \), permits us to examine whether the slope coefficient changes when the GDP growth rate positively or negatively deviates from its average value.\(^6\) Notice that the regression equation (1) can be written as

\[
F_t \Delta y_{t+h} - F_{t-1} \Delta y_{t+h} = \delta_0 + \delta_1 NBER_t + (\delta_2 + \delta_3)(\Delta y_t - \Delta y) + \epsilon_t \quad \text{if } \Delta y_t \geq \Delta y
\]

\[
F_t \Delta y_{t+h} - F_{t-1} \Delta y_{t+h} = \delta_0 + \delta_1 NBER_t + (-\delta_2 + \delta_3)(\Delta y_t - \Delta y) + \epsilon_t \quad \text{if } \Delta y_t < \Delta y
\]

where \( \delta_0 = \delta_0 + \delta_3 \Delta y \). If the coefficient \( \delta_2 \) is estimated to be zero, there is no change in the slope coefficient. Estimation results from the OLS method are summarized in Table 2. The estimates of \( \delta_1 \) are negative and significantly different from zero at the 5 percent level. These results suggest that during recessions forecasters make larger downward adjustments of their growth expectations than what the current growth rate, \( \Delta y_t \), predicts. The coefficient \( \delta_2 \) is estimated to be all negative for all horizons. However, the estimates of \( \delta_2 \) are statistically different from zero at the one or ten percent level only for the first two horizons, \( h \in [0,1] \). The negative estimates indicate that forecasters make larger forecast revisions in absolute value during economic downturns than during expansions. The coefficient \( \delta_3 \) is also estimated to be statistically different from zero for the first two horizons. The estimates of \( \delta_2 \) and \( \delta_3 \) tend to be statistically zero for relatively longer horizons, \( h \in [2,3] \). These results arise since the growth rate follows a stationary process.

### Table 1. Basic statistics: Mean and skewness.

<table>
<thead>
<tr>
<th>Panel A: Mean and skewness of forecast revision</th>
<th>( \Delta y_t )</th>
<th>( \Delta y_t - \Delta y_{t-1} )</th>
<th>( F_t \Delta y_{t+h} - F_{t-1} \Delta y_{t+h} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>2.70</td>
<td>0.00</td>
<td>-0.28***</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.28***</td>
<td>-1.18***</td>
<td>-1.53***</td>
</tr>
</tbody>
</table>

Note: The asterisks, ***, **, and *, indicate statistical significance at the 1, 5, and 10, percent level, respectively.

Fig. 1 illustrates the relationship between the forecast revision and the growth rate for all horizons. The vertical line indicates the average growth rate. The dots represent the actual forecast revisions, and the diamonds indicate the fitted values from the simple regression model. Since the regression model has the dummy variable, each panel has two lines representing the fitted values. The figure shows that there is a nonlinear relationship between the magnitude of the forecast revision and the growth rate. Forecasters make larger downward adjustments of growth expectations than what the explanatory variable \( \Delta y_t \) in (1) predicts when economic activity declines.

### Table 2. Asymmetric forecast revision.

<table>
<thead>
<tr>
<th>Horizon</th>
<th>( \delta_1 )</th>
<th>( \delta_2 )</th>
<th>( \delta_3 )</th>
<th>( R^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( h = 0 )</td>
<td>-0.513*** (0.255)</td>
<td>-0.061* (0.034)</td>
<td>0.187*** (0.025)</td>
<td>0.60</td>
</tr>
<tr>
<td>( h = 1 )</td>
<td>-0.676*** (0.177)</td>
<td>-0.055*** (0.023)</td>
<td>0.070*** (0.018)</td>
<td>0.29</td>
</tr>
</tbody>
</table>
$h = 2$ | $-0.567^{***} (0.159)$ | $-0.006 (0.021)$ | $0.020 (0.016)$ | 0.13  \\
$h = 3$ | $-0.409^{**} (0.161)$ | $-0.024 (0.021)$ | $-0.007 (0.016)$ | 0.05  \\

Note: The asterisks, $^{***}$, $^{**}$, and $^*$, indicate statistical significance at the 1, 5, and 10, percent level, respectively.

Table 3. Asymmetric forecast revisions: Extended model.

<table>
<thead>
<tr>
<th>Panel A: Forecast revisions with financial uncertainty</th>
<th>$\delta_1$</th>
<th>$\delta_2$</th>
<th>$\delta_3$</th>
<th>$\delta_4$</th>
<th>$\delta_5$</th>
<th>$\delta_6$</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$h = 0$</td>
<td>$-0.194 (0.243)$</td>
<td>$-0.055^* (0.031)$</td>
<td>$0.164^{***} (0.024)$</td>
<td>$0.410^{***} (0.073)$</td>
<td>$0.078 (0.056)$</td>
<td>$-0.342^{**} (0.154)$</td>
<td>0.45</td>
</tr>
<tr>
<td>$h = 1$</td>
<td>$-0.587^{***} (0.180)$</td>
<td>$-0.054^{**} (0.023)$</td>
<td>$0.068^{***} (0.018)$</td>
<td>$0.061 (0.054)$</td>
<td>$0.072^{*} (0.042)$</td>
<td>$-0.297^{**} (0.145)$</td>
<td>0.31</td>
</tr>
<tr>
<td>$h = 2$</td>
<td>$-0.631^{***} (0.154)$</td>
<td>$-0.009 (0.020)$</td>
<td>$0.034^{**} (0.015)$</td>
<td>$-0.198^{***} (0.046)$</td>
<td>$0.035 (0.036)$</td>
<td>$-0.234^{**} (0.097)$</td>
<td>0.23</td>
</tr>
<tr>
<td>$h = 3$</td>
<td>$-0.500^{***} (0.149)$</td>
<td>$-0.028 (0.019)$</td>
<td>$0.010 (0.015)$</td>
<td>$-0.245^{***} (0.045)$</td>
<td>$-0.028 (0.034)$</td>
<td>$-0.143^{**} (0.092)$</td>
<td>0.21</td>
</tr>
</tbody>
</table>

Panel B: Forecast revisions with macro
Horizon   \( \delta_1 \)   \( \delta_2 \)   \( \delta_3 \)   \( \delta_4 \)   \( \delta_5 \)   \( \delta_6 \)   \( R^2 \)  
\( h = 0 \)   -0.246 (0.242)   -0.052* (0.031)   0.155*** (0.025)   0.406*** (0.074)   0.085 (0.057)   -0.304 (0.208)   0.44  
\( h = 1 \)   -0.640*** (0.180)   -0.053** (0.023)   0.065*** (0.018)   0.006 (0.055)   0.073* (0.023)   -0.075 (0.155)   0.30  
\( h = 2 \)   -0.650*** (0.148)   0.003 (0.019)   0.017 (0.015)   -0.179*** (0.045)   0.050 (0.035)   -0.535*** (0.126)   0.27  
\( h = 3 \)   -0.523*** (0.148)   0.024 (0.019)   0.000 (0.015)   -0.239*** (0.045)   -0.020 (0.034)   -0.306** (0.123)   0.22

Note: The asterisks, ***, **, and *, indicate statistical significance at the 1, 5, and 10, percent level, respectively.

These empirical results are likely to be consistent with the predictions of a macroeconomic model with downward wage rigidity. As shown in Abbritti and Fahr (2013), a macroeconomic model with downward wage rigidity predicts that negative demand-side shocks drive up real wages rather than lowering them. This increase in the real wage leads to an abrupt and sharp decline in employment and production. On the other hand, positive demand-side shocks increase both production and the real wage. An increase in the real wage puts downward pressure on production over time. Thus, production rises gradually in response to positive demand-side shocks. These models imply that agents revise their growth forecasts more drastically when economic activity declines, and our empirical results appear to be consistent with such predictions.

We extend the regression model (1) to include additional variables such as the short-term interest rate, inflation, and uncertainty measures. The model we consider is given by

\[
F_t \Delta y_{t+h} - F_{t-1} \Delta y_{t+h} = \delta_0 + \delta_1 NBER_t + \delta_2 |\Delta y_t - \Delta y| + \delta_4 \Delta i_t + \delta_5 \Delta \pi_t + \delta_6 \Delta \sigma_t + \varepsilon_t \tag{2}
\]

where \( i_t, \pi_t, \) and \( \sigma_t \) indicate the federal funds rate, inflation, and uncertainty measure.\(^7\) The short-term interest rate and the inflation rate based on the GDP deflator are taken from the FRED database. For the period in which the federal funds rate is effectively zero, we replace the funds rate with the shadow rate of Wu and Xia (2016) to avoid issues regarding the ZLB. We consider the macroeconomic and financial uncertainty measures of Jurado et al. (2015).

We estimate (2) using the financial uncertainty measure for \( \sigma_t \) and report the results in Table 3.A. Then we replace financial uncertainty with macroeconomic uncertainty to estimate (2).\(^8\) The results are summarized in Table 3.B. The panels show that the estimates of \( \delta_1, \delta_2, \) and \( \delta_3 \) are broadly similar to those from Table 2. As shown in Panel A and B, the estimates of \( \delta_1 \) are statistically different from zero for horizon \( h \in [1,2,3] \). The estimates of \( \delta_2 \) are significantly different from zero at either the five or ten percent level for \( h \in [0,1] \). However, the estimates of \( \delta_2 \) are statistically zero for the remaining horizons. We also find the coefficient \( \delta_3 \) to be significantly different from zero for \( h \in [0,1,2] \) in Panel A and for \( h \in [0,1] \) in Panel B. As discussed before, the estimates of \( \delta_2 \) and \( \delta_3 \) are statistically zero for relatively longer horizons since the growth rate follows a stationary process.

For horizon \( h = 0 \), the coefficient \( \delta_4 \) is estimated to be positive, implying that a rise in the short-term interest rate is associated with an upward adjustment of the current growth forecast. A rise in the short-term interest rate is often interpreted as a signal that the economy is strong enough to withstand contractionary monetary policy (e.g., Romer and Romer, 2000). As \( h \) rises from 0 to 3, we find that the estimate of \( \delta_4 \) declines from 0.410 to -0.245 in Panel A, and 0.406 to -0.239 in Panel B. These results may arise from the fact that the contractionary effect of monetary policy dominates the signaling effect as horizon \( h \) increases. Notice that the estimates of \( \delta_4 \) are negative and statistically different from zero for horizon \( h \in [2,3] \).
Panel A and B show that the change in inflation is not related to the forecast revision except for \( h = 1 \). Turning to the uncertainty measures, we find that a rise in financial uncertainty lowers growth forecasts. The coefficient on financial uncertainty, \( \delta_6 \), is estimated to be negative and statistically different from zero for all horizons. Regarding macroeconomic uncertainty, we find the coefficient \( \delta_6 \) is statistically significant for only horizon \( h \in [2,3] \).

Fig. 2 shows the actual data for the forecast revision and the fitted values based on the regression model, (2), with macro uncertainty. The scatter plots of the fitted values against the growth rate resemble those of the actual data. As pointed out before, the magnitude of the forecast revision is greater when the output growth rate negatively deviates from its mean.

3. Conclusion
This paper studies how growth expectations are revised as GDP growth evolves. Our findings indicate there is an asymmetric relationship between forecast revisions and GDP growth. Survey forecasters make larger forecast revisions during contractions than during expansions. We contribute to the literature on asymmetric business cycles by introducing novel evidence that the magnitude of forecast revisions is asymmetric.

References

☆We are grateful to the editor, Evan Wigton-Jones, and an anonymous referee for many helpful comments and suggestions.
1 Notice that standard macroeconomic theory suggests that current output is determined by expected future output.
2 Notice that in the case of \( h = 3 \) we need the 4-quarter ahead output growth forecast to calculate the forecast revision.
3 There are two missing values for \( F_t \Delta y_{t+3} - F_{t-1} \Delta y_{t+3} \) in the 1970s.
4 Forecasters may be more pessimistic about the near future relative to the distant future. As shown in Nimark (2014), negative news is more frequent during recessions than positive news during expansions. The size
of the forecast revision can be greater during contractions than during expansions due to a greater frequency of negative news. The fact that the historical means of the forecast revisions are negative is also consistent with the hypothesis that forecasters have an asymmetric loss function, in which it is more costly to overpredict future output growth than to underpredict it (e.g., Capistrán, 2008, Lee and Wang, 2014). The degree of underprediction is low for relatively longer forecast horizons due to the stationarity of the real GDP growth rate. Recall that the forecast of a stationary variable converges to its average value as the forecast horizon increases.

5 The growth rate, instead of $\Delta y_t - \Delta y_{t-1}$, is considered as an explanatory variable since the first difference of the growth rate has a very low explanatory power.

6 We used $|\Delta y_t - \Delta y|$ instead of $NBER_t \times \Delta y_t$ since the former improves the model’s fit for the forecast revision data.

7 The first-differences of the additional explanatory variables are used to account for the forecast revision since the changes reflect newly available information between period $t$ and $t - 1$.

8 Our results are not altered when we incorporate credit spread into the model.