Appendix – How have growth expectations changed amid trade policy uncertainty?

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This appendix discusses the approach used to estimate market-based US nominal GDP growth expectations in *How have growth expectations changed amid trade policy uncertainty?*

Market based nominal GDP growth expectations

As noted in *How have growth expectations changed amid trade policy uncertainty* it is possible to derive economic growth expectations from financial market prices as these are forward looking.

For the purposes of this analysis, three equity market series were used to derive market-based economic growth expectations.

Firstly, the annual change in the Goldman Sachs basket of cyclical stocks. The stocks in this index are highly correlated to US GDP growth.

Secondly, the dividend yield on stocks in the S&P500. The dividend yield represents the return on the assets owned by shareholders of a company (that is, the providers of financial capital). GDP represents the return on the factors of production for a country (that is, physical and human capital). Dividends have been used in the past to derive both short- and long-term GDP growth expectations.

Thirdly, the annual change in one-year ahead expectations for revenue growth for stocks in the S&P500. There is a simple though somewhat loose, read-through from revenue growth to GDP growth. Furthermore, as a financial/economic concept it isn't affected by changes in shifts in financial market valuations. As a result, no further substantial adjustments were made to this measure.

However, the same could not be said for cyclical stock prices and dividend yields which are impacted by changes in share prices. Changes in expectations for the factors which influence the discounted stream of cash flows that underpin equity valuations can impact share prices. So too can shifts in investor risk appetite with this varying as uncertainty around these factors does.

Therefore, an adjustment needs to be made to remove the impact that risk appetite can have on these equity market-based series. This will help ensure that these series more accurately reflect expectations for economic conditions and are not influenced by shifts in investor's willingness to bear risk.

The following steps were taken to do this and to calculate the final measure:

Remove the impact of economic conditions on risk appetite

Risk appetite can be impacted by a range of factors, including the economic backdrop. Therefore, to get a clean read on risk sentiment, the impact of economic conditions on it needs to be removed. This was done via a 'purging' regression [see for example Hatzius et al (2010)] in which an Ordinary Least Squares regression was run with sentiment for equity market investors as the dependent variable and a measure of economic conditions as an independent variable. The variable used to represent investor sentiment was the difference between bullish and bearish investors in the American Association of Individual Investors *Sentiment Survey*. That used to capture economic conditions was the Federal Reserve Bank of Chicago's National Activity Index. The residual from this regression is the proportion of risk appetite related to equity markets that cannot be explained by economic conditions.

Remove the impact of risk appetite on the equity market series

Armed with this 'clean' measure risk appetite, the impact of shifts in investor risk sentiment was sought to be removed from the equity market-based series. This is so that these series have a better chance of reflecting expectations for economic conditions as opposed to shifts in investor's willingness to bear risk.

This was done via another purging regression. There were two of these regressions done, one for the Goldman Sachs basket of cyclical stocks and one for the S&P500 dividend yield. These were the dependent variables in these

regressions. The 'clean' equity market risk appetite measure was the independent variable in each of the regressions. An additional regressor was also chosen. Given the link between equity and credit markets for companies that issue in both, there is also likely information about risk sentiment in the latter that is relevant to the former. To capture this possibility, the 'excess bond premium' is used as an additional variable to remove risk appetite from these equity market measures and hopefully enable them to provide a less distorted signal of expected economic growth. The excess bond premium is '*a component of corporate bond credit spreads that is not directly attributable to expected default risk and… provides an effective measure of investor sentiment or risk appetite in the corporate bond market*' [Gilchrist & Zakrajsek (2012)].

Scale for comparability and average

The two series calculated from the above steps were then given the same mean and standard deviation as one-year ahead forecasts for nominal GDP growth from the Federal Reserve Bank of Philadelphia's *Survey of Professional Forecasters*. This is so they could be comparable to a forecast for economic growth. This was also done for the series for annual growth in revenue for firms in the S&P500.

Finally, the average of these three measures were taken and used as a proxy for market-based expectations for US nominal GDP growth. Note, the estimates are for nominal rather than real GDP growth. This is because the cash flows which underpin equity market valuations are expressed in nominal terms.

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