Uncertainty shocks and recessionary risks

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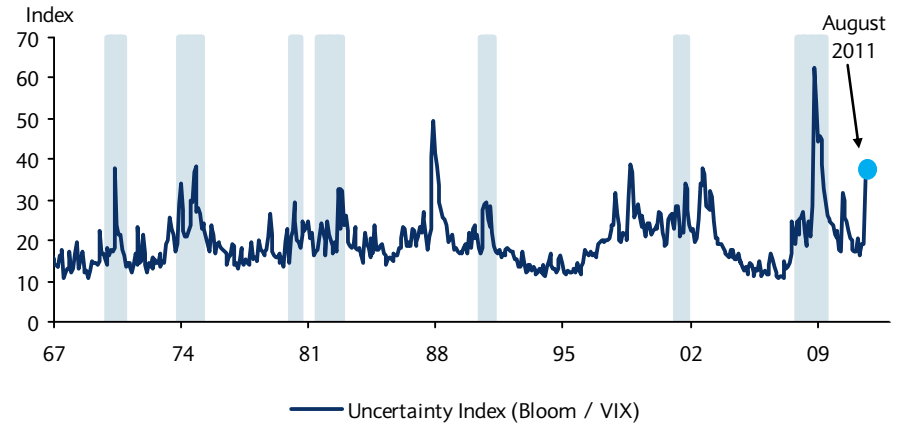
- As the US confronts another bout of increased uncertainty, concerns about the near-term outlook have risen. We find that heightened uncertainty can cause firms to postpone hiring and investment decisions, which often plays a role in slowing economic activity. For example, when we use the VIX index as a proxy for macro uncertainty, our estimates indicate that a 10pt increase reduces private nonfarm payroll growth by 75k and lowers growth in investment on equipment and software by 3pp (q/q, saar) and on structures by 6pp (q/q, saar).
- Uncertainty and confidence interact in a meaningful way. Uncertainty plays only a modest role in economic decisions when confidence is high, but can have a more negative influence when confidence is depressed. Thus, a current risk is that the recent rise in uncertainty can have a more deleterious effect on private job creation, particularly since business confidence has yet to recover to pre-recession levels.
- Historically, a rise in uncertainty alone is generally insufficient to tip the economy into a recession. For example, the US has withstood several episodes in which uncertainty has spiked, such as the 1987 stock market crash and 1997 Asian financial crisis, and the economy did not fall into a recession.
- A few of our recession prediction models are currently flashing some warning signs, but are not signaling an imminent risk that the economy will tip back into recession. However, one clear risk is that excessive fiscal tightening could slow the economy sufficiently and risk pushing it back into recession.

Figure 1: The US confronts another uncertainty shock



Source: Chicago Board Options Exchange, Nick Bloom, Haver Analytics

The resurgence of uncertainty

Several factors have conspired to push market-based measures of uncertainty higher

The European sovereign debt crisis, US debt ceiling debate, S&P downgrade of US sovereign debt, and concerns about the economic outlook have conspired to cause market-based measures of uncertainty to spike. The VIX index, which captures expected swings in the S&P 500 and is sometimes referred to as the "fear index," averaged about 35 in August, versus its July average of 19. As we have written previously, the rise in uncertainty associated with the events in August is likely to weigh on job growth in the coming months (see "The weight of debt ceiling negotiations on job growth," *Global Economics Weekly*, July 15, 2011). As the August payroll report confirmed, job growth has softened considerably and has raised concerns about the near-term outlook. In general, we view heightened uncertainty as a powerful force that can exacerbate softness in economic activity, since it often causes firms to postpone new hiring and investment plans. However, we also find that an increase in uncertainty is generally insufficient – on its own – to push the economy into recession.

Uncertainty exerts a powerful force on the outlook

Although historically, uncertainty has been insufficient – on its own – to cause a recession

Measuring uncertainty and its macro effect

In general, macroeconomic uncertainty is inherently difficult to quantify. One measure, however, that does reflect uncertainty is the VIX index, which approximately captures the expected volatility in the S&P 500 index. The higher the VIX, presumably the more uncertain is the economic environment. Although the VIX has a relatively short history, we use a series from Bloom (2009) that computes the daily volatility of the S&P 500 going back to 1967, which is a measure that is highly correlated with the VIX index, and then splice that index to the VIX starting in 1990. The resulting "uncertainty index" is shown in Figure 1. Recently, the index has spiked because of the uncertainty created primarily by the European crisis, the political difficulties associated with raising the US debt ceiling, and the S&P downgrade of US sovereign debt. A message from Figure 1, however, is that although uncertainty does rise when the economy is already in a recession, it can also spike in the midst of an expansion and not necessarily trigger a recession. For example, uncertainty occasionally spikes because of financial events, such as the 1987 stock market crash and 1997 Asian financial crisis – two clear episodes that increased uncertainty, yet did not lead to a recession. Uncertainty also remained elevated after the 2001 recession because of the tech collapse, fears of deflation, and geopolitical uncertainty following September 11, yet did not lead to a double-dip recession. As Figure 1 shows, there are several other examples over the past 20 years of similar spikes in volatility that were not followed by a recession.

The economy has persevered through previous bouts of heightened uncertainty

Uncertainty can, however, exacerbate an economic soft patch

Heightened uncertainty, however, can have an adverse effect on economic activity and exacerbate a soft patch. When uncertainty is elevated, the prospect of a negative outcome in the future is higher, so firms are often more cautious about making long-term commitments, such as hiring new workers or undertaking new capital investments – that is, firms often put plans to expand their businesses on hold.[1] Consequently, episodes of heightened uncertainty are often followed by softness in new job creation and a slowing in capital expenditures. For example, the VIX increased from about 17 in April 2010 to about 32 in May 2010 following events connected to the crisis in Europe. Private nonfarm payroll growth averaged 187k in March and April, prior to the flare-up, but then down-shifted to an average of 57k in May and June. The slowdown in job growth was also persistent, as new net job creation did not break the 150k mark again until December 2010.

[1] Bernanke (1983) elaborated in detail on these forces and how they affect investment decisions.

To more broadly illustrate the dimension of the relationship, Figure 2 shows the correlation between the uncertainty index and growth in private nonfarm payrolls. The straight line in Figure 2 is a simple regression line and captures the general direction and magnitude of the relationship. Historically, job creation generally increases as uncertainty declines, and vice versa. Clearly, however, many factors influence payroll growth – so to estimate the relationship between payroll growth and uncertainty more precisely, we use an econometric model that also takes into account a range of economic factors.[2] According to estimates from this model, a 10pt rise in the VIX index on a m/m basis lowers private nonfarm payroll growth the following month by about 75k. These estimates suggest that if uncertainty remains elevated at its current level of around 30, net private job creation would proceed at a pace of around 90k jobs per month. If, instead, the VIX receded to levels consistent with last June (e.g., about 20), the model indicates that private job growth would proceed at a pace of about 165k. Thus, a more stable environment would do a considerable amount to boost the medium-term trajectory of private hiring.

We find that a 10pt rise in the VIX lowers private payroll growth by 75k in the following month…

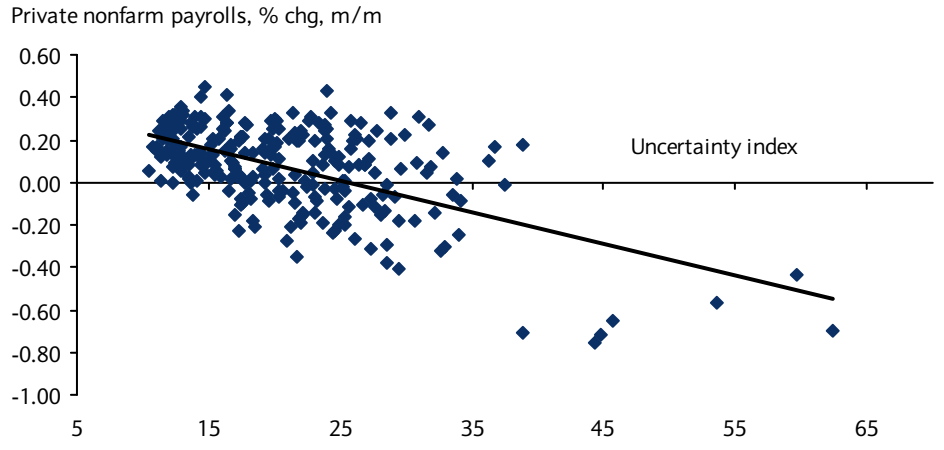
Uncertainty also has a measurable effect on business fixed investment. Using a framework similar to that for payrolls, as is explained in the appendix, we find that a 10pt rise in the VIX index slows new investment in equipment and software by about 3pp (on a q/q % change basis, saar). The rise in the VIX, however, has to be sustained over the entire quarter, since our models for capital investment spending use the average change in the VIX from one quarter to the next. For structures, the effect is about twice as large, with a 10pt rise in the VIX reducing growth in structures by about 6pp. The larger effect of uncertainty on structures likely reflects the larger commitment and expense typically associated with new construction, so a rise in uncertainty often makes firms more cautious about undertaking such projects, compared with new investments in equipment and software. The timing of when a change in uncertainty affects structures differs, however. Equipment and software tend to decline in the same quarter as the rise in uncertainty, since firms are likely to cancel orders for certain capital goods when uncertainty rises, so the effect is immediate. In contrast, our estimates indicate that uncertainty hits structures with a one-quarter lag, presumably because building a new warehouse or retail outlet takes planning and the projects have more inertia than the decision to purchase new capital goods.

…a 3pp slowing in equipment and software growth…

…and a 6pp slowing in the growth of structures

Higher uncertainty affects equipment and software quickly, but structures with a lag

Figure 2: Heightened uncertainty is correlated with weaker job growth



Source: Bureau of Economic Analysis, NBER, Haver Analytics

[2] Technical details of the models discussed in this piece are provided in the appendix.

Confidence matters

The effect of higher uncertainty depends on confidence

Although uncertainty, on average, does affect hiring and investment decisions, the relationship also appears to depend on the level of business confidence. Incorporating the National Federation of Independent Businesses (NFIB) optimism index (Figure 3) into our econometric framework, we find the effect of uncertainty is much smaller when business confidence is high. For example, the 1987 stock market crash and 1997 Asian financial crisis, which both occurred when confidence was relatively high, did not lead to a noticeable slowing in the pace of job creation. In contrast, we find that a rise in uncertainty in an environment in which confidence is low can greatly slow the pace of job creation. Using again last summer's example, hiring slowed substantially following the May 2010 flare-up of the European crisis and spike in the VIX, which was also a period when business confidence was quite subdued. To more broadly illustrate the relationship, Figure 4 distinguishes the correlation between the uncertainty index and private payroll growth based on whether business confidence is high or low. The solid lines in Figure 4 are simple regression lines describing the direct relationship between the uncertainty index and job growth using sub-samples based on the level of business confidence. When confidence is low, the negative relationship between uncertainty and job growth is readily apparent, whereas the correlation is about zero when business confidence is high. To measure how uncertainty and business confidence interact more precisely, we incorporate into our model from the previous section a channel that allows the effects of uncertainty on job creation to decline smoothly as business confidence rises. We find that when the NFIB index is at 95, which is a relatively depressed level, a 10pt increase in the VIX results in about a 100k decline in private payroll growth. Alternatively, when the NFIB is at 115, the effect of a 10pt rise in the VIX is associated with about a 15k decline in private payroll growth. Thus, a current risk is that the recent rise in uncertainty could have a more deleterious effect on private job creation, particularly since business confidence has yet to recover to pre-recession levels.

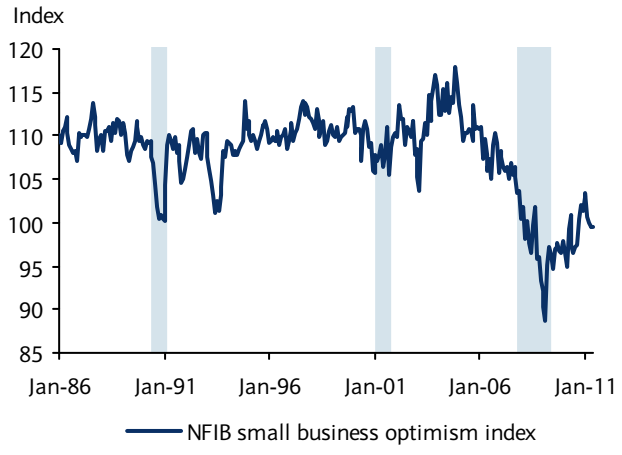
When confidence is low, the effect of uncertainty is amplified

High confidence mitigates the negative impact of heightened uncertainty

The lasting fingerprint of an uncertain environment

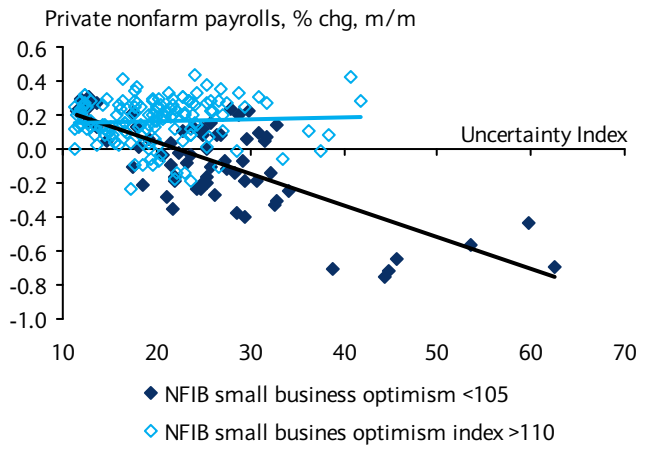
To gauge the effect of a rise in uncertainty on the economy over time, we expand our model to allow for interactions between private job growth, business confidence, and the uncertainty index. This expanded model (ie, a vector autoregression) allows us to "shock"

Figure 3: Business confidence remains subdued



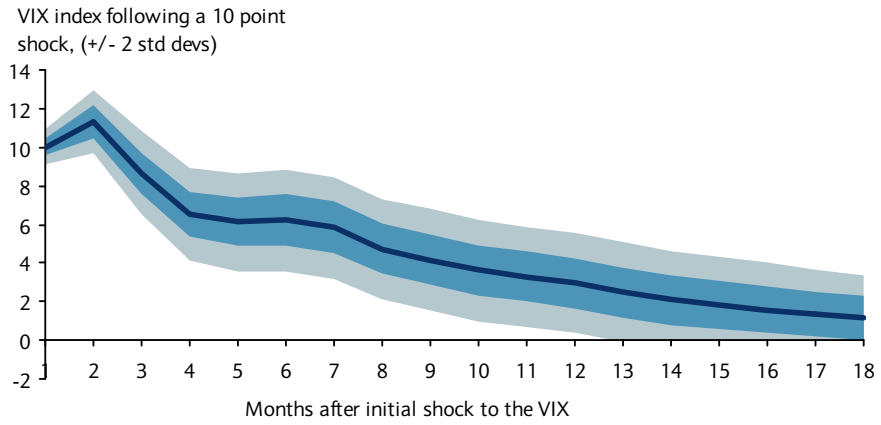
Source: NFIB, NBER, Haver Analytics

Figure 4: Pessimism + uncertainty = weak job growth



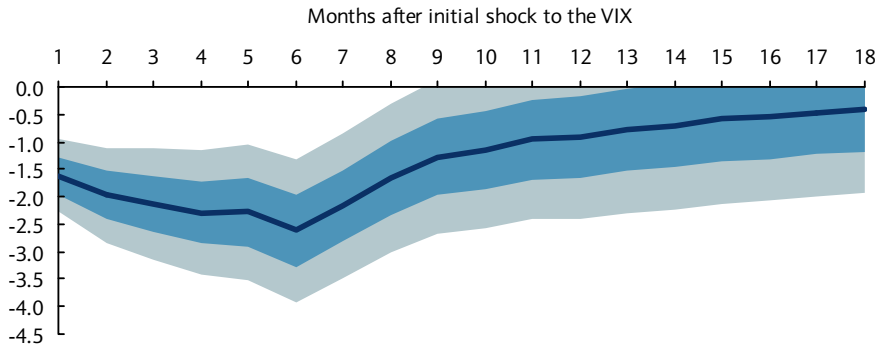
Source: NFIB, CBOE, Nick Bloom, Haver Analytics

Figure 5: A rise in the VIX tends to unwind slowly



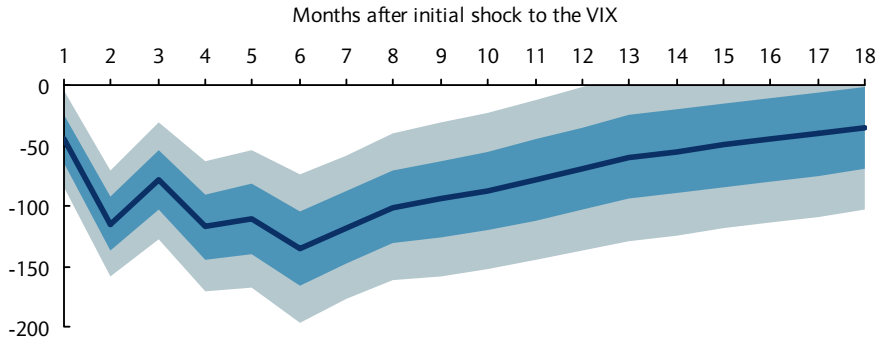
Source: Barclays Capital

Figure 6: An increase in uncertainty exerts a persistent weight on business confidence…



Source: Barclays Capital

Figure 7: …and job growth



Source: Barclays Capital

the uncertainty index and then trace the effects on both business sentiment and private job creation over several months. Importantly, the model indicates that a rise in uncertainty does not unwind immediately, but dissipates slowly over the course of about a year. In terms of its impact, Figures 5 and 6 show that this model indicates that a 10pt increase in the uncertainty index causes about a 2pt decline in the business sentiment index that lasts several months. Figure 7 shows that net private job creation is pushed lower by about 100k per month for close to a year after the shock. The substantial effect on job growth reflects the persistent increase in the VIX, as well as the negative feedback of lower confidence that weighs on job growth. Importantly, Figures 5, 6, and 7 are not a forecast, so should uncertainty dissipate sooner than the path shown in Figure 5, the effect on job creation would also be shorter lived. Of course, these estimates suggest a considerable range of possible outcomes, but the key point is that an increase in uncertainty can leave a lasting fingerprint on new job creation.

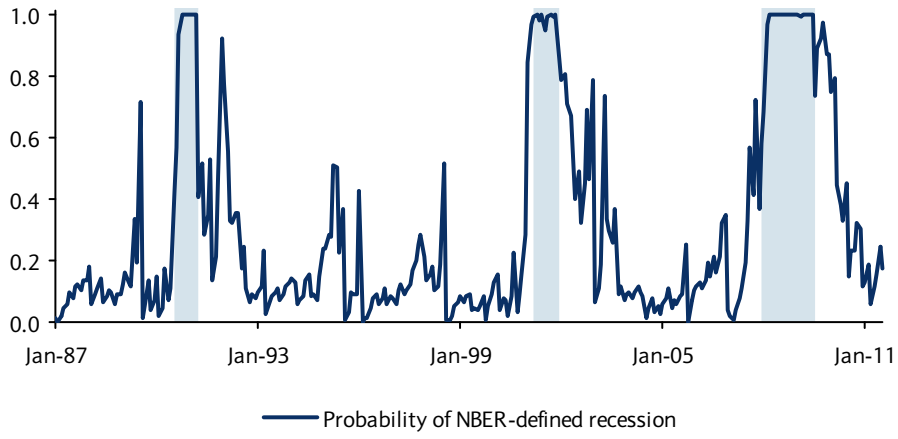
The weight of heightened uncertainty on job creation can linger for up to a year

Handicapping recessionary risks

We use three different recession prediction models to assess the risk of a near-term recession

The resurgence in uncertainty and sovereign risk concerns in Europe, as well as any attendant potential spillovers to the US, have raised concerns about another recession in the US. While we are not forecasting a near-term recession, the slow pace of growth so far this year and prospect for fiscal tightening pose some risk. To assess the risk, we pull some of our recession prediction models off the shelf. The first essentially tracks the business cycle on a monthly basis and sends a signal of whether the economy is currently in an NBER-defined recession.[3] The second model uses a mix of economic and financial data to assess the potential that the economy will be in a NBER-defined recession in three months, so provides a leading signal on where the economy may be headed. The third model is more ambitious and looks for periods when the economy hits a "stall speed," which is typically followed by a NBER-defined recession in six months. In all, we choose to use different modeling frameworks, with each incorporating a different set of data, since no single model has a foolproof record in terms of predicting recessions.

Figure 8: Warning signals have risen, but do not indicate a near-term recession



Source: Bureau of Economic Analysis, NBER, Haver Analytics

[3] The Business Cycle Dating Committee at the National Bureau of Economic Research (NBER) is the quasi-official arbiter of determining specific dates when the US was in a recession. It seeks accuracy, not timeliness, so its calls are typically made well after a recession has begun, or ended.

The first model is sending only a modest signal that a recession is imminent

The first model, which tracks the current phase of the business cycle, generates a probability each month assessing whether the economy is in recession.[4] The model uses a regime-switching framework, which uses the Chicago Fed's National Activity Index as input. The regime-switching framework is useful because it takes into account that the economy shifts between expansions and recessions and that these swings are persistent (ie, they last several months or quarters). Then, based on the value of the economic activity index, as well as its recent history, the model weighs the odds of whether the recent pattern of movements in the index is more consistent with an expansion or recession. The probability estimates over the past three recessions are given in Figure 8 and show that the model does a reasonably good job of identifying periods in which the economy slips into recession. The model, however, is not well equipped to assess the probability of whether the economy will be in a recession at some point in the future – say, in three months.

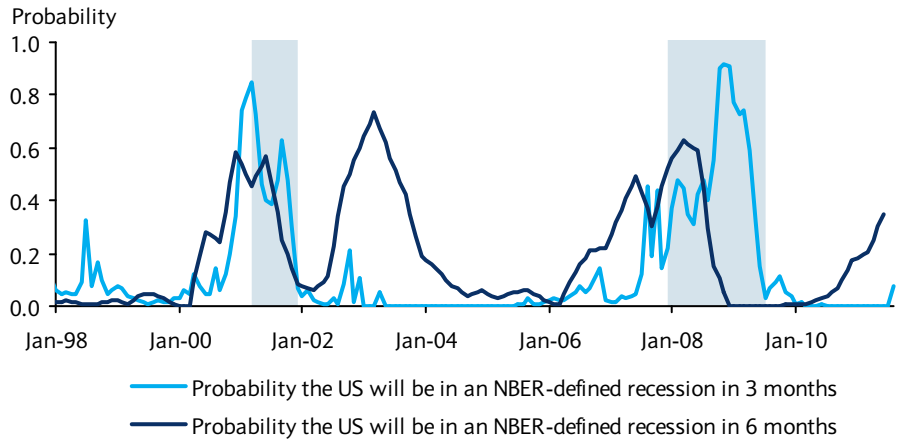
The second model also indicates only a very small chance of a recession in the near term

To generate a more forward-looking indicator, we use a model that generates a probabilistic estimate of whether the economy will be in a recession in three months based on a set of economic and financial data. Specifically, the model incorporates the 1s10s spread, the uncertainty index, and the activity index. The 1s10s spread is the most valuable indicator in predicting recessions and, according to estimates from the model, is about 25 times more important when assessing the likelihood of a recession compared with the uncertainty index. These estimates underscore our earlier point, which is that although uncertainty is a powerful force in shaping the outlook, it is often insufficient – on its own – to tip the economy into a recession. With the Fed currently holding short-term rates at exceptionally low levels, Figure 9 shows that the model is currently flashing only a weak warning signal – despite the rise in uncertainty – that the economy will be in a recession in three months.

Based on one of our models, the 1s10s spread is 25 times more important in signaling a recession than the VIX index

The third model, which looks further into the future and tries to assess the potential for a recession in six months, is sending the strongest warning signal. In this model, the economy is either: 1) experiencing a period of rapid growth, which typically reflects an inventory driven bounce; 2) expanding at a pace consistent with a mature expansion; 3) stalling; or 4) in an NBER-defined recession. To estimate which phase the economy is in at any point in

Figure 9: Forward-looking warning signals have also risen, but do not indicate a near-term recession



Source: Bureau of Economic Analysis, NBER, Haver Analytics

[4] The model is based on the frameworks in Kim and Nelson (1999a), Davig (2008), and Bai and Wang (2010).

time, we again use a regime-switching framework that attaches a probability to each of the four phases based on fluctuation in real gross domestic income.[5] We use GDI instead of GDP because, as Figure 10 shows, GDI often slows notably before the onset of a recession, even when GDP does not – but otherwise closely tracks GDP.

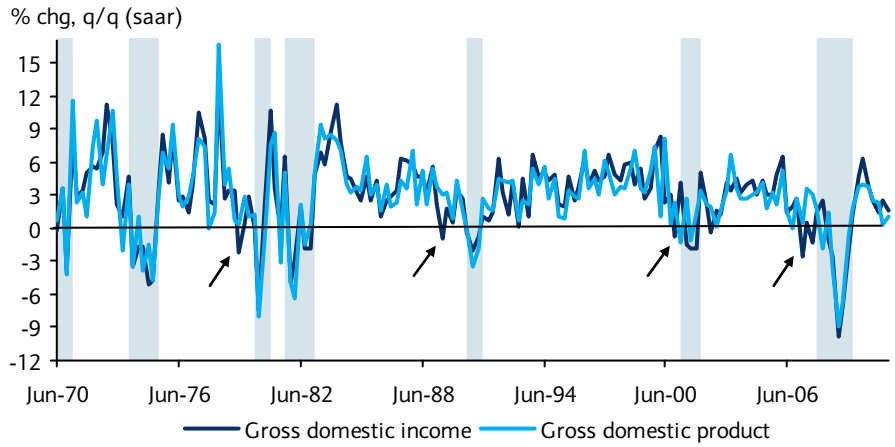
The third model indicates about a 1 in 3 chance of a recession in the next six months

The stall-speed model is designed to predict recessions about six months in advance, but the longer horizon comes at a cost, as the model is more likely to generate "false positives" – that is, signal that the economy is stalling and heading into a recession without a recession occurring. Figure 9 reports the probabilities from this model compared with the model that produces the signal three months ahead. Currently, the weak growth earlier this year has raised the probability that the economy has entered a stall phase to a bit above 0.30 – so is signaling that a recession is about 30% likely in about six months. In the recovery following the 2001 recession, however, which also experienced a soft patch after the initial inventory-led bounce, the model produced estimates that the economy was entering a recession that exceeded the current estimate. In other words, while this model has sent warning signals well ahead of previous recessions, it has also offered false positives. In general, we certainly view the recent rise in the probability attached to the stall phase as a warning sign regarding future growth, but it is not sufficiently strong to signal convincingly that a recession is imminent either this or next year. Thus, we forecast gradually increasing growth over the remainder of this and next year, but the warning signal from the recession prediction model underscores the elevated uncertainty about the near-term outlook.

A risk is that fiscal policy could tighten more than expected in the near term, which could push the economy close to recession

One notable omission from our framework is the role of fiscal policy. We tried several fiscal measures in our various frameworks and found that they have historically played a tangential role in terms of signaling recessions. However, one clear future risk is that excessive fiscal tightening could slow the economy sufficiently to push it back into a recession. The biggest near-term risk from fiscal policy is the pending expiration of the payroll tax cut and emergency unemployment compensation at the end of this year. Our forecast currently assumes that both will be extended, but if Congress and the administration cannot come to an agreement regarding their extension, near-term risks of slower growth and prospects of another recession will likely increase.

Figure 10: GDI often dips before GDP prior to recessions



Source: Bureau of Economic Analysis, NBER, Haver Analytics

[5] Our methodology combines methods from Chauvet and Hamilton (2006), Davig (2008), and Nalewaik (2011).

Appendix

Estimating the effect of uncertainty on job growth

To gauge the potential drag from elevated uncertainty, as well as potential gains from a reduction in uncertainty, we estimate the following time-series model for nonfarm payrolls

$$\%\Delta NFP_t = a + b(\%\Delta NFP_{t-1}) + cX_{t-1} + d\sigma_{t-1} + \varepsilon_t,$$

where $\%\Delta NFP$ is the monthly percentage change in private nonfarm payrolls, X_{t-1} is the Chicago Fed National Activity Index, and σ is the the uncertainty index. The activity index is a broad index measuring real economic activity that we use, instead of more common measures such as real GDP, because it is available on a monthly basis going back to 1967. We use the lagged value for the uncertainty index because nonfarm payrolls reflect payrolls as of the 12th of each month – so any rise in uncertainty over the course of, say, August is more likely to negatively affect estimates of new job creation in September, rather than August. We estimate the model using US data from 1967 to 2011, which yields

$$\%\Delta NFP_t = .25 + .14\,(\%\Delta NFP_{t-1}) + .13\,X_{t-1} - .007\sigma_{t-1} + \varepsilon_t,$$

where each coefficient is statistically significant based on conventional levels.

To measure how confidence may interact with uncertainty, we extend the model by including an interaction term that allows the effect of uncertainty to vary with the level of business confidence as follows

$$\%\Delta NFP_t = a + b(\%\Delta NFP_{t-1}) + cX_{t-1} + d\sigma_{t-1} + f(\sigma_{t-1}\,NFIB_{t-1}) + \varepsilon_t,$$

where all variables are defined as before, with the addition of $NFIB_{t-1}$, which is the National Federation of Independent Businesses optimism index. Estimation yields

$$\%\Delta NFP_t = .19 + .22(\%\Delta NFP_{t-1}) + .09X_{t-1} - .05\sigma_{t-1} + .0003(\sigma_{t-1}\,NFIB_{t-1}) + \varepsilon_t,$$

where the positive coefficient on the interaction term, $(\sigma_{t-1}\,NFIB_{t-1})$, indicates that as confidence rises, the effects of uncertainty decline.

We use a similar approach for business fixed investment, by estimating the following regressions

$$\%\Delta ES_t = a + bX_{t-1} + c\sigma_t + d\sigma_{t-1} + \varepsilon_t,$$

$$\%\Delta S_t = a + bX_{t-1} + c\sigma_t + d\sigma_{t-1} + \varepsilon_t,$$

where $\%\Delta ES_t$ denotes the quarterly percentage change in real investment in equipment and software and $\%\Delta S_t$ denotes the quarterly percentage change in real investment in structures. Eliminating the insignificant explanatory variables, which are the lagged value of the uncertainty index for the equipment and software equation and the contemporaneous value of the uncertainty index for the equation for structures, yields the following estimates

$$\%\Delta ES_t = 11.1 + 7.3X_{t-1} - .28\sigma_t + \varepsilon_t,$$

$$\%\Delta S_t = 11.6 + 5.5X_{t-1} - .55\sigma_{t-1} + \varepsilon_t.$$

The expanded model of private nonfarm payrolls that produces Figures 5, 6, and 7 is a vector autoregression, as follows

$$Y_t = A + B\,\Sigma Y_{t-j} + \varepsilon_t,$$

where Y_t is a vector containing the NFIB optimism index, the uncertainty index, and private nonfarm payroll growth (m/m %). The sample runs from 1990 to 2011. We estimate the model with six lags and compute impulse responses using a Cholesky decomposition, in which we assume that shocks to uncertainty affect business confidence and nonfarm payrolls contemporaneously.

Recession prediction models

The first recession prediction model, which basically tracks the current state of the business cycle on a monthly basis, uses the following regime-switching framework

$$X_t = \gamma(S_t) + \rho(S_t)(X_{t-1}) + \varepsilon_t,$$

where S_t denotes either "expansion" or "recession," so allows the coefficient to shift depending on the phase of the business cycle. As before, X_t is the Chicago Fed National Activity Index. We also allow the variance of the disturbance term, ε_t, to shift independently of the cycle, so that it can account for the decline in macroeconomic volatility during the so-called Great Moderation (roughly, 1984-2007) and more disruptive periods, such as the most recent recession and the 1970s. We estimate the model using data from 1967 to 2011. We also experimented with including the uncertainty index as an additional explanatory variable, but found that it was statistically insignificant, so excluded it from the final specification. Also, the insignificance of the uncertainty index is consistent with our earlier point – that is, heightened uncertainty can definitely weaken the outlook, but is often insufficient to push the economy into a recession. The economy then transitions between expansions and recessions based on a (2x2) probability matrix, as well as periods of high and low volatility based on an another independent (2x2) probability matrix. All the transition probabilities are estimated simultaneously with the equation above that describes the activity index. Specifics of the estimation method are described in Kim and Nelson (1999).

The model offering the three-month-ahead signal is a probit model, which is a particular type of non-linear regression model that is often used when the dependent variable data are binary – that is, "0 or 1," which, in our case, denotes either an expansion or contraction. The basic framework is as follows

$$\text{Prob}[Recession_{t+3} | Data\ as\ of\ time\ t] = \Phi\ [\alpha + \beta(1s10s_t) + \gamma(VIX_t) + \phi(X_t)],$$

where Φ is the standard normal cumulative distribution function.

The third model is similar to the first, since it also posits that the economy grows at different rates depending on the phase of the business cycle. The number of phases, however, is expanded beyond just recessions and expansions to include an inventory rebound phase and a stall-speed phase. In this framework, we model the growth rate of real GDI as follows:

$$\%\Delta GDI_t = \gamma(S_t) + \varepsilon_t,$$

which conveys that the average growth rate of GDI varies according to the phase of the business cycle, S_t. As in Chauvet and Hamilton (2006) and Nalewaik (2011), we treat recessions as observed, based on NBER dates. The economy then transitions from phase to phase based on a (4x4) probability matrix, which is estimated simultaneously with the equation above that describes GDI growth.

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