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Abstract

Fluctuations in upside risks to unemployment over the medium term are examined using quantile regressions. U.S. experience reveals an elevated risk of large increases in unemployment when inflation or credit growth is high and when the unemployment rate is low. Inflation was a significant contributor to unemployment risk in the 1970s and early 1980s, and fluctuations in credit have contributed importantly to unemployment risk since the 1980s. Fluctuations in upside risk to unemployment are larger than fluctuations in the median outlook or downside risk to unemployment. Accounting for inflation and the state of the business cycle is important for understanding the role of financial conditions in shaping unemployment risk. The analysis suggests that fluctuations in near-term risks to unemployment decreased after 1984 because inflation stabilized, but fluctuations in medium-term risks increased owing to the large swings in credit in recent decades.

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"[A] central bank seeking to maximize its probability of achieving its goals is driven, I believe, to a risk-management approach to policy. By this I mean that policymakers need to consider not only the most likely future path for the economy but also the distribution of possible outcomes about that path."

Federal Reserve Board Chairman Alan Greenspan, 29 August 2003.

1. Introduction

Policymakers have long been concerned about risks to the achievement of their objectives. For example, participants in the Federal Open Market Committee (FOMC) assess the balance and magnitude of risks to their individual projections of inflation and unemployment. Similarly, central banks have used fan charts to summarize their expectation for the distribution of possible outcomes and applied judgment in the generation of such distributions, including assessments of unusually large risks (e.g., the width of the fancharts) and the balance of risks (e.g., skew relative to expected outcomes).[1]

Recently, the unemployment rate in the United States has fallen to a level at the low end of its historical distribution, and commentary has questioned whether the late stages of an economic expansion is accompanied by a buildup of imbalances – imbalances that may sow the seeds of the expansion's end. For example, the minutes of the FOMC's meeting in March 2018 noted that "A few participants expressed concern that a lengthy period in which the economy operates beyond potential and financial conditions remain highly accommodative could, over time, pose risks to financial stability".

[1] For example, the Monetary Policy Committee of the Bank of England includes such assessments in its *Inflation Report*.

I examine changes over time in the risk of large changes in the unemployment rate over several years in the United States using a statistical approach. Quantile regressions reveal an elevated risk of a large increase in unemployment over the medium term when the unemployment rate is low. The level of the unemployment rate appears to be quantitatively important for understanding the risk of a large increase in unemployment and contributes a sizable share of fluctuations in the 90th percentile of changes in the unemployment rate over the next three years.

The link between unemployment risk and broader macroeconomic and financial conditions is considered. Inflation has been an important contributor to unemployment risk in the United States since the 1960s – primarily in the 1970s and early 1980s. Since the early 1980s, the most important contributor to unemployment risk at a three-year horizon, among the factors considered and beside the level of the unemployment rate, has been credit growth. Rapid credit growth appears to raise the risk of a large increase in unemployment, consistent with research emphasizing credit growth as a macroeconomic risk factor and the emphasis of the Basel Committee on credit in its guidance regarding the countercyclical capital buffer (BCBS, 2010).[2] For example, rapid credit growth implied elevated risk of a large increase in unemployment in the late 1980s and mid-2000s, while muted advances in credit implied a low amount of unemployment risk in the early-to-late 1990s and since 2011.

In contrast, financial conditions – as gauged by the spread between the yields on a BBB-rated corporate bond and the 10-yr Treasury security – has not contributed significantly to unemployment risk at a three-year horizon during most time periods, but is a closely associated with risks to unemployment at a one-year horizon.

[2] Schularick and Taylor (2012), among others, find that credit growth has some power to predict financial crises. Kiley (2018) examines this conclusion and the empirical approach, highlighting the relatively poor fit of these types of empirical models and the support for other risk factors, including growth in equity prices and house prices and the current account deficit.

More generally, accounting for inflation and the business cycle is important for understanding the role of financial conditions in shaping unemployment risk. The importance of controlling for inflation and the state of the business cycle, via the level of the unemployment rate, is apparent at both the medium-term (three-year) horizon emphasized herein and at shorter horizons (e.g., one-year) and affects the links between risks to economic activity ("growth at risk") and financial conditions explored in other research. For example, Adrian, Boyarchenko, and Giannone (forthcoming) find that a tightening in financial conditions has markedly larger negative effects on the adverse tail of economic activity (i.e., low growth) than on the central tendency or upside-tail to economic activity. However, their analysis did not control for the state of the business cycle (e.g., did not control for whether economic activity was above or below trend). Conditioning projections of risks to economic activity on both financial conditions and the level of the unemployment rate, which is a good summary of the state of the business cycle in the United States, suggests less asymmetric effects of financial conditions on the expected distribution of economic activity than the approach of Adrian, Boyarchenko, and Giannone (forthcoming).

Finally, the analysis demonstrates that the fluctuations over time in upside risk to unemployment are much larger than those in downside risk to unemployment. This type of asymmetry echoes that found in Adrian, Boyarchenko, and Giannone (forthcoming). This asymmetry has a long history in business cycle analysis (e.g., Sichel (1993)), adding to this earlier research the idea that such asymmetries fluctuate over time.

This set of results suggests several patterns. Medium-term risks to unemployment have fluctuated more significantly since 1985 then before, owing to wide swings in credit over this period. At the same time, near-term risks to unemployment have fluctuated less widely, reflecting relative stability in inflation after the Volcker disinflation. This suggests that distinguishing between near-term and medium-term risk factors is important. Turning to recent conditions, unemployment risk was low in the years leading up to 2017, reflecting high unemployment, muted credit growth, and low inflation over this period. However, unemployment risk had returned to its typical level by the end of 2017, with the unemployment rate low by historical standards, credit growth approaching average levels, and inflation only a bit below levels seen in recent decades.

The analysis herein is related to a growing literature on the determinants of the risks to economic activity, sometimes referred to as "GDP at Risk". For example, Cecchetti and Li (2008), Adrian, Boyarchenko, and Giannone (forthcoming), Adrian and Duarte (2017), IMF (2017), and Cecchetti and Schoenholtz (2018) consider the use of quantile regressions to assess the distribution of future percent changes in GDP at various horizons.[3] These analyses have tended to emphasize risks to the GDP outlook linked to financial stability concerns, and therefore focus on data such as the change in house prices, measures of the state of financial conditions, or credit aggregates.

The analysis herein differs along two dimensions. First, the focus is on unemployment, as the unemployment rate is arguably a better gauge of the cyclical state of the U.S. economy than the percent change in GDP (e.g., Basistha and Startz, 2008). As noted above, controlling for the business cycle appears to alter the link between financial conditions and medium-term risks to economic activity. Second, inflation is included as a risk factor, which seems critical given the role of high inflation in driving shifts toward a more restrictive monetary stance and subsequent U.S. recessions (e.g., Romer and Romer, 1989).

Section 2 discusses the framework for assessing unemployment risk and the data used in this study. Section 3 considers the relationship between unemployment risk, the

[3] Adrian and Duarte (2017) present a macroeconomic model that could motivate the notion of GDP at Risk.

corporate bond spread, nonfinancial private sector borrowing, and inflation. Section 4 considers the degree to which the results are robust to changes in the specification. Section 5 illustrates how the framework can shed light on variation over time in business-cycle asymmetry. Section 6 illustrates how distinguishing between near-term and medium-term risks links the analysis herein to Adrian, Boyarchenko, and Giannone (forthcoming). Section 7 concludes.

2. Data and framework

Figure 1 presents the civilian unemployment rate for the noninstitutional population in the United States and the unemployment rate for men aged 25-54 (the unemployment rate for prime-age men). The latter subset of the population has historically had a more stable attachment to the labor force and hence the unemployment rate in this group has been emphasized in some research. Both series exhibit a tendency to rise sharply during recessions (the shaded regions) and to decline during expansions, with the pace of declines during expansions generally more moderate than the pace of increases during recessions. This visually-apparent pattern is suggestive of some type of asymmetry in the distribution of changes in unemployment.

The factors that may influence the risks associated with the outlook for unemployment are drawn from the recent literature on imbalances that may presage financial instability as well as the larger (as well as older) literature on business cycles. For example, Cecchetti and Li (2008), Adrian, Boyarchenko, and Giannone (forthcoming), and IMF (2017) consider (alternative subsets of) financial conditions and credit as potential predictors of quantiles of economic activity as measured by the percent change in GDP (i.e., GDP at Risk); the literature on financial crises examines similar predictors (e.g., Kiley, 2018). Recessions have been shown to be preceded, albeit with relative short lags, by increases in credit spreads or other measures of tightening financial conditions (e.g., Faust et al, 2013; Favara et al, 2016). In addition, U.S. recessions – at least prior to 2000 – tended to be associated with clear shifts in monetary policy to bring inflation down from undesirably high levels (Romer and Romer, 1989). In light of these earlier analyses, the analysis examines the relationship between the distribution of unemployment risk and the spread between a BBB-rated corporate bond, the (log) change in the ratio of private-sector nonfinancial borrowing to nominal GDP over the previous four years (expressed at an annual rate, and a measure of "excessive" credit growth), and the four-quarter percent change in the personal consumption expenditures price index. Figure 2 presents the time series of each variable. It is clear that the bond spread tends to be low during expansions and rise before and during recessions. Credit (relative to GDP) appears less closely tied to the business cycle. Inflation was significantly higher during the 1970s and early 1980s than during other periods.

To examine changes over time in the risk of a large increase in the unemployment rate ($U(t)$), the analysis examines projections of the change in unemployment over the next 12 quarters (three years) through consideration of the following equation:

(1) $$P\{U(t+12) - U(t)\} = a_0 + a_1 U(t) + a_2 \Delta_4 p(t) + a_3 \Delta_{16}\left(\frac{c(t)}{y(t)}\right) + a_4\left(r_{bbb}(t) - r_{tsy}(t)\right).$$

In equation (1), $\Delta_4 p(t)$ is the four-quarter change in (the natural logarithm of) the personal-consumption expenditures price index up through the current quarter, $\left(r_{bbb}(t) - r_{tsy}(t)\right)$ is the spread between a BBB-rated corporate bond and a 10-yr Treasury security, and $\Delta_{16}\left(\frac{c(t)}{y(t)}\right)$ is the change over the past 16 quarters (4 years) in (the natural logarithm of) nonfinancial private-sector credit outstanding divided by (nominal) GDP. Based on conventional wisdom and historical narratives, high values of each of these variables is expected to increase projections of the unemployment rate and thereby raise unemployment risk. However, this conventional wisdom primarily refers to previous work on the expectation of the change in unemployment conditional on these variables (that is, the least-squares projection), and the analysis herein will focus on the distribution of risk—and in particular on time-variation in the size of the upper tail of unemployment risk.

As a result of this focus on the upper tail of risks to unemployment, the approach looks at several alternative projections. The minimum mean-squared error projection – that is, the projection obtained by an ordinary least squares regression of the change in unemployment over the subsequent 12 periods – is considered to judge the strength of the relationship between the determinants considered and the expected outcome. The coefficients from these projections are then compared with those from projections for various quantiles of the distribution of the change in unemployment spanning from the 10^{th} percentile (that is, the 10 percent tail of the expected change in the unemployment rate, involving small increases in unemployment) to the 90^{th} percentile (the upper 90 percent tail, involving large changes in unemployment). These comparisons highlight whether some of the determinants appear to be more sizably linked to various points in the distribution of risks for unemployment – for example, whether high inflation is particularly associated with an elevated risk of a large increase in unemployment but not with other parts of the distribution of risks or, alternatively, whether inflation shifts the entire distribution of risks to unemployment rather than affecting one side of the distribution of risks more than the other side.

The core of the investigation will focus on the evolution of the 90^{th} percentile of the distribution of changes in unemployment. This focus will examine both the magnitude of time-variation in unemployment risk and the contribution of the factors entering equation (1) to this time-variation. Note that there is no time-variation in this definition of unemployment risk if the indicators considered – the lagged value of unemployment, inflation, credit growth, and the BBB spread – enter with coefficients of zero, as the 90^{th} percentile of the distribution is a constant (a_0) in that case.

The focus on the change in the unemployment rate is consistent with the notion that recession risk is associated with the risk that the unemployment rate increases substantially. At the same time, the level of the unemployment rate is of independent interest, and section 5 will consider the evolution over time in the distribution of the level of the unemployment rate.

Before turning to results, a bit more review of quantile regressions may help some readers. While quantile regressions are less widely used in macroeconomics than least squares, the GDP at Risk literature has used the approach extensively. Moreover, the intuition is fairly straightforward: Quantile regression simply weights errors in the projections more heavily for errors near the quantile of interest and less heavily for errors distant from the quantile of interest. For example, the 50th percentile quantile regression – the median regression – finds the coefficients that minimize the least absolute deviation of the errors from the projection (rather than least squared deviation in ordinary-least squares regression). This approach places relatively more weight on deviations close to the center of the error distribution (e.g., close to the estimated median) than least squares, as absolute deviations are relatively smaller for larger errors than are squared errors. (For a formal discussion of quantile regression, see Kroenker and Hallock (2001)).

3. Unemployment Risk, Financial Conditions, Inflation, and the State of the Business Cycle

The analysis uses data from 1962:Q1 to 2014:Q4, with the start date determined by the availability of data on the spread between a BBB-rated corporate bond and the 10-yr Treasury yield. (Note that this extends the twelve-quarter ahead change in the unemployment rate through 2017:Q4.)

Table 1 reports coefficient estimates for the least-squares projection, the median (least-absolute deviation) or 0.5 quantile projection, the 0.9 quantile (90th percentile) projection, and the 0.1 quantile (10th percentile) projection. Several patterns are apparent. Unemployment is mean-reverting, and hence a high value of the unemployment rate is associated with a *lower expected change* in the unemployment rate over the next three years (that is, less risk of additional unemployment, $a_1 < 0$). This tendency is true for the mean projection (least squares), the median projection, and the tails of the unemployment projection (the 10th and 90th percentiles). High inflation is associated with greater unemployment risk ($a_2 > 0$), and this tendency is also true across the different types of projections considered. In contrast, the magnitude of the coefficient on credit (a_3) is much larger for the 90th-percentile projection than it is for the mean, median, or 10th percentile projections. Periods of rapid credit growth relative to nominal GDP have a disproportionate effect on the upper (bad) tail of the unemployment risk distribution, a notion consistent with the view of the link between credit and GDP at Risk described in Cecchetti and Li (2008), IMF (2017), and Cecchetti and Schoenholtz (2018). Finally, the effect of the BBB spread is positive – so that tight financial conditions imply upside risk to unemployment over the medium term.

Note that the coefficients in table 1 clearly suggest that the state of the business cycle—that is, the level of the unemployment rate—influences the risk distribution. While this effect is largely a shift effect – that is, is largely constant across quantiles, it will have implications for assessments of the link between financial vulnerabilities and the risk of large increases in unemployment, as discussed later in section 5. As a result, controlling for the state of the business cycle may be important for assessments of risk such as that in Adrian, Boyarchenko, and Giannone (forthcoming) and IMF (2017).

While table 1 only reports the coefficients from the least-squares (mean), median, 90th percentile, and 10th percentile projections, the patterns across quantiles are similar to those gleaned from comparing the 10th-percentile, median and 90th-percentile projections, as can be seen in figure 3. A low level of unemployment and high inflation both point to elevated unemployment risk and this relationship is relatively stable across quantiles, while rapid credit growth implies elevated upside unemployment risk – that is, elevated risk of bad outcomes (the 80th and 90th percentiles of the distribution), with little association to the central tendency. Tighter financial conditions also, as captured by a higher BBB spread, do not appear to have a statistically significant link to unemployment risk over the three-year horizon, although the point estimate suggests that a tightening in financial conditions raises unemployment risk three years hence. However, the lack of statistical significance is perhaps not surprising, as the projections involve four covariates and attempt to estimate relationships across quantiles of the distribution. This is challenging as the sample period of just over 50 years provides relatively few independent observations at a three-year horizon.

Turning from statistical to economic description, the nature of unemployment risk and its variation over time can be understood better through an examination of the upper tail of the distribution of the change in unemployment over the next three years. In the remainder of the analysis, unemployment risk will be summarized by the predicted 90th percentile for the change in the unemployment rate over the next three years. This value of unemployment risk is a function of the variables included in the projection, and our discussion will also highlight the contribution of each factor.

Figure 4 summarizes the variation in the upper-tail of unemployment risk as predicted by equation (1). There are clearly some periods when the risk of an increase in the unemployment rate is very low. In particular, the predicted 90th percentile of the change in the unemployment rate over the next three years is *negative* during some periods, such as 1975, 1983, 1991-1995, and 2010-2014; each of these periods follows a recession and saw elevated unemployment, which the projection equations imply lowers the risk of further increases in unemployment. The simple interpretation is mean-reversion. A related, albeit speculative, interpretation is that recessions are periods during which the imbalances that could precipitate a rise in unemployment are unwound, and hence the risk of further large increases in unemployment is relatively low immediately following a recession.

Moreover, there are several periods during which the upper-tail of the distribution for the change in the unemployment rate over the next three years is very large – 1974, 1979, 1987-1990, the years leading up to 2000, and 2005-2007. Each of these periods is followed by a recession.

The variation over time in unemployment risk also owes to different factors during different periods, as can be seen by focusing on the individual contributions from each variable shown in the bottom panels of figure 3. During the 1970s, most of the fluctuations in unemployment risk owe to inflation. Since the Volcker disinflation, the level of inflation has not been a notable contributor to the estimate of unemployment risk from the projection. In contrast, a significant portion of fluctuations in unemployment risk since the 1980s owes to credit. During the late 1980s and mid-2000s, rapid credit growth implies elevated risk of a large increase in unemployment. Both of these periods were followed by financial crises – the Savings and Loan Crisis and the Global Financial Crisis. On the flip side, the reduction in the pace of borrowing following these crises lowered the risk of a large increase in unemployment, as can be seen in the negative contributions of credit to the size of the upper-tail of the change in the unemployment rate during the early-to-mid 1990s and the early-to-mid 2010s. The BBB spread typically contributes only modestly to the magnitude of unemployment risk, while the level of the unemployment rate is a sizable contributor to the variation of unemployment risk. At the same time, the only period during which the level of the unemployment rate was the sole sizable contributor to unemployment risk was the late 1990s, 2000, and 2017 – and the first two were periods followed by a recession but during which inflation, the BBB spread, and credit growth were near average levels.

Finally, unemployment risk had returned to a typical level by the end of 2017, with the 90th percentile of the projected change in the unemployment distribution over the following three years equal to about 2 percent. For comparison, similar levels were reached in 1986 and 1998.

An alternative way to see the typical importance of the contributions is to consider their contribution to the variance of estimated unemployment risk. The variance of the BBB spread contribution is less than 8 percent of the variance of projected unemployment risk. The variance of the contribution of inflation is about 20 percent that of the total and the variance of the contribution of credit is a touch more than 25 percent that of the total. The variance of the contribution of the level of unemployment is about 45 percent of the variance of the total. (These shares sum to 99.7 percent – as the contributions are not orthogonal, and hence do not sum to 100 percent exactly.) Overall, inflation and credit contribute (jointly) as sizably to variation over time in unemployment risk as does the level of the unemployment rate itself.

Section 4. Robustness

Section 4.1. Alternative measure of unemployment

While the total civilian unemployment rate is the measure of labor utilization of most direct interest to policymakers, the substantial swings in the demographic composition of the U.S. workforce imply that it is useful to consider whether the results are similar when the analysis focuses on alternative measures of unemployment. As an alternative that may be subject to fewer structural shifts, figure 5 presents the measure of unemployment risk – the 90th percentile projection conditional on the same set of variables – for the unemployment rate of males aged 25 to 54 (i.e., prime-age males).

The story told in the figure is very similar to that from figure 4. Inflation contributed sizably to unemployment risk in the 1970s and early 1980s, but not since then. Credit (relative to GDP) contributed importantly in the mid-to-late 1980s and the mid-2000s (boosting unemployment risk), and in the early 1990s and first half of the 2010s when deleveraging lowered unemployment risk. The BBB spread generally did not contribute sizably, and the level of unemployment tended to contribute importantly—with low unemployment signaling elevated unemployment risk and high unemployment signaling low unemployment risk.

Section 4.2. Alternative horizon of unemployment risk

The analysis so far has focused on the evolution of the upper-tail of the change in the unemployment risk at a three-year horizon. This horizon is consistent with that used by the FOMC in its Summary of Economic Projections and with the focus on medium-term financial and credit cycles in the related GDP at Risk literature (e.g., Adrian, Boyarchenko, and Giannone, forthcoming). However, business-cycle research on the relationship between financial conditions and economic activity or recessions has typically focused on a shorter horizon (e.g., Faust et al, 2013; Favara et al, 2016).

Figure 6 considers the course of unemployment risk over an eight-quarter horizon. Overall, the results are very similar. For example, inflation contributed sizable to unemployment risk in the 1970s and early 1980s, credit (relative to GDP) contributed importantly in the mid-to-late 1980s and the mid-2000s (boosting unemployment risk. While the BBB spread generally did not contribute sizably, the contributions are a larger share of overall fluctuations in unemployment risk at a horizon of eight years, consistent with the literature emphasizing bond spreads as an indicator of near-term recession risk.

Figure 7 focuses on a yet-shorter horizon of one year and presents the pattern of coefficients for the quantile regressions of the 1st through 9th decile for all four variables considered, as presented for the three-year horizon in figure 3. This shorter horizon is among those emphasized in, for example, Adrian, Boyarchenko, and Giannone (forthcoming) (and is significantly shorter than the medium-term emphasize herein and in Adrian et al, 2018). Several comparisons to results at the three-year horizon are salient. First, the level of the unemployment rate is important at the one- and three-year horizons (both economically and statistically), with a larger degree of mean reversion expected at longer-horizons. Second, inflation is also important across all quantiles at both horizons, although there appears to be a somewhat larger coefficient on inflation associated with upside (greater than 5^{th} decile) than downside (lower then 5^{th} decile) risk to unemployment. The strong economic and statistical relationships between these traditional business-cycle variables and unemployment risk across the distribution suggests controlling for these factors is important when assessing the role of other variables. Finally, tighter financial conditions (a higher BBB spread) affects unemployment risk across the distribution and has a somewhat larger relationship with upside risk to unemployment at a one-year horizon, whereas credit growth is not related to unemployment risk at any point along the distribution at a one-year horizon; these results are the opposite of those at a three-year horizon, suggesting that the links between unemployment risk, financial conditions, and credit conditions depend on the horizon of interest. Note that the link between financial conditions and upside risk to unemployment at the one-year horizon bear similarities to those in Adrian, Boyarchenko, and Giannone (forthcoming), but there are also differences that are explored in section 6.

Section 5: Asymmetry in the Risks to the Level of Unemployment

The results so far have emphasized the risk of a large increase in unemployment. A complementary issue is the risk of a high level of unemployment. This is of interest both because a high level of unemployment is suggestive of significant deviations of economic activity from desirable levels and because previous research has emphasized asymmetries in the level of unemployment as an important business cycle regularity, with the evidence suggesting more significant upside risks to the level of unemployment than downside risks (e.g., Sichel, 1993).

Figure 8 presents the 10th-percentile and 90th-percentile projections for the level of unemployment 12 quarters ahead as the blue shaded region and the median projection as the black line. Downside risk to the level of unemployment is usually smaller than upside risks, as the shaded region above the median is typically wider than that below the median. In addition, there is substantial variation over time in the distribution of risks, with upside risk more variable than downside risk.

Table 2 explores these features further through some summary statistics for these projections. As can be seen by comparing the mean or median for the 10th-percentile, median, and 90th-percentile projections, the typical distance between the 10th-percentile and median is less than that between the median and the 90th-percentile, illustrating that upside risks to the level of unemployment are greater than downside risks. Moreover, the variance of the 90th-percentile if four times that of the 10th-percentile, so upside risk to unemployment fluctuates much more than downside risk.

The bottom panels of the table decompose the source of these variations in upside risk to the level of unemployment, according to the estimated projection equations, as gauged by the difference between the median and 90th-percentile projection for the level of unemployment. Fluctuations in upside risk to unemployment over the medium term have been larger since 1985 than before. Moreover, the most important variable explaining variation in upside risk to unemployment is credit. The importance of credit in explaining the fluctuations over time in the difference between the median and 90th percentile projection for the level of unemployment owes to the fact that the coefficients on credit are very different across quantiles. In contrast, the differences in the coefficient on inflation across quantiles is more muted—that is, inflation shifts the entire distribution of unemployment, whereas credit is estimated to primarily shift the upside tail of the unemployment distribution.

Adrian, Boyarchenko, and Giannone (forthcoming) and IMF (2017) similarly find that downside risks to economic activity (that is, upside risk to unemployment) vary more than upside risks to economic activity and suggest this owes importantly to differences in the effects of financial conditions on the shape of the distribution of risks to economic activity, a topic considered in the next section.

Section 6. Near-term and Medium-term Unemployment Risk and Financial Conditions

Adrian, Boyarchenko, and Giannone (forthcoming) examine the link between quantiles of GDP growth over a one-year horizon and financial conditions in the United States and find substantial asymmetry in the effects—with tighter financial conditions have a more pronounced effect on downside risk to growth than upside risks.

Comparison of the pattern of coefficients across variables in figure 7 suggests that unemployment risk at the one-year horizon shares with the GDP@Risk concept of Adrian, Boyarchenko, and Giannone (forthcoming) the link between financial conditions as captured in variables like credit spreads and time-variation in the asymmetry of risks to economic activity. In particular, the BBB spread appears to have a larger effect on upside risk to unemployment than on downside risk or the median projection. Table 3 examines this possibility through the same lens as used earlier for the three-year horizon in table 2 by reporting the variance of the difference between the projections for the quantile regressions of the 90th and 50th percentiles and the contributions of each variable to this time-variation; by construction, a variable contributes nothing to this concept if its coefficient is identical at the 90th and 50th percentile. Upside risk to unemployment is more variable than the median projection or downside risk, just as at the three-year horizon. Moreover, the key actor is the BBB spread/financial conditions, as can be seen in the variance contributions in the bottom panel and echoing the result for GDP@Risk from Adrian, Boyarchenko, and Giannone (forthcoming).

A striking result can be seen via comparison of the change in fluctuations in near-term risks to unemployment between the pre- and post-1985 periods and the change in fluctuations in medium-term risks to unemployment shown in the bottom rows of tables 4 and 3, respectively. Near-term fluctuations in risk have decreased post-1985, but medium-term risks have increased according to the quantile regressions. This occurs because credit growth is important for medium-term risks and has swung more widely post-1985, whereas inflation – which affects the upper tail of the unemployment distribution at the one-year horizon more than it affects the median, as shown in figure 7 – has been more stable post-1984 and hence near-term fluctuations in unemployment risk have moderated. (Note that the BBB spread, which also asymmetrically influences quantiles of unemployment projections at a one-year horizon, has an identical variance for the 1962-1984 and 1985-2017 period, so this factor does not account for the shifts in the variability of unemployment risk across time periods.) These results highlight the importance of distinguishing between near-term and medium-term risks.

A final takeaway is how the approach herein, which conditions the quantile projections on the level of the unemployment rate to control for the state of the business cycle and on inflation, reveals the importance of controlling for these factors. In particular, the macroeconomic controls limit the asymmetry in the link between financial conditions and unemployment risk. Figure 9 reports the coefficient across deciles on the BBB spread at the one-year horizon for the case including the level of the unemployment rate and inflation and the case without these controls. As can be clearly seen, failure to include these business cycle controls accentuates the appearance of asymmetry in the link between financial conditions and economic activity.

An interpretation of these results is that financial conditions and credit conditions depend importantly on business cycle factors. As a result, it is important to control for business cycle factors when considering the relationship between unemployment risk or growth at risk and financial conditions.[4]

Section 7: Conclusions

The emphasis of policymakers on risk management illustrates the importance of understanding the factors that shape the risks to the economic outlook. The analysis herein has examined the relationship between the 90th percentile of the projected change in the unemployment rate over the next three years – unemployment risk over the medium term.

The projection, based on a quantile regression, implies large variation over time in the magnitude of unemployment risk over the medium term. The level of inflation was a large contributor to unemployment risk in the 1970s, but has not been a notable contributor since the Volcker disinflation. Since the 1980s, fluctuations in credit have been important in shaping whether unemployment risk has been high or low. Moreover, the level of unemployment has a sizable effect on projected unemployment risk – with low unemployment implying a higher value for the upper tail of the change in the unemployment rate.

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[4] Adrian et al (2018) consider the link between financial conditions and the cumulative percent change in GDP over a three-year horizon, more akin to the medium-term focus in much of the analysis herein, and find that loose financial conditions increase downside risks to economic activity. In the absence of controls for inflation and the level of unemployment, the 90th-percentile regression reveals a negative coefficient on the BBB spread – that is, confirms that looser financial conditions appear to increase downside risks to economic activity when the additional controls are not included. As reported in table 1, this result does not occur when the additional controls are included, further highlighting how controlling for the business cycle may be important. That said, Adrian et al (2018) consider many countries in a panel setting, and these additional observations may provide aid in estimating relationships in the tail of the distribution of outcomes, as the sample sizes are otherwise small.

Fluctuations in upside risk to unemployment appear to be larger than fluctuations in the median outlook or downside risk to unemployment. Moreover, upside risks to unemployment at a medium-term horizon are estimated to depend primarily on fluctuations in credit, suggesting credit is an important factor when judging macroeconomic risk over the medium term. In addition, there appears to have been a decrease in fluctuations of near-term risk to unemployment post-1984 owing to stable inflation, but an increase fluctuations in medium-term risk, highlighting the importance of distinguishing between near-term and medium-term risk factors.

Accounting for inflation and the business cycle is important for understanding the role of financial conditions in shaping unemployment risk. Inclusion of the unemployment rate in the projections tempers somewhat the asymmetry in the link between financial conditions and asymmetry in business cycle risk suggested in Adrian, Boyarchenko, and Giannone (forthcoming). This likely owes to the correlation between business cycle dynamics and financial conditions, and suggests that analysis of macroeconomic risk factors should consider the state of the business cycle as captured in variables such as the unemployment rate.

The results imply that the risk of a large increase in unemployment over the medium term was low from 2010 through the mid-2010s and had increased to a historically-typical level by the end of 2017.

The analysis of unemployment risk may provide useful information to policymakers and economists interested in understanding the magnitude and indicators of possible risks to the unemployment rate. This information may even be more valuable than that of related GDP concepts, as unemployment is directly tied to the dual mandate of the Federal Reserve and has historically been a better indicator of the state of the business cycle in the United States than GDP.

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Table 1: Alternative Projections of the Change in Unemployment (+12 quarters) On Explanatory Variables

$$P\{U(t+12)-U(t)\}=a_0+a_1U(t)+a_2\Delta_4 p(t)+a_3\Delta_{16}\left(\frac{c(t)}{y(t)}\right)+a_4\left(r_{bbb}(t)-r_{tsy}(t)\right).$$

	Least Squares		**Median (0.5 quantile)**		**0.9 quantile**		**0.1 quantile**	
	Coefficient	90% confidence interval	Coefficient	90% confidence interval	Coefficient	90% confidence interval	Coefficient	90% confidence interval
a_0	3.33	(2.13,5.19)	3.04	(1.57,4.82)	3.83	(1.63,8.60)	1.78	(1.01,3.34)
a_1	-0.91	(-1.16,-0.74)	-0.95	(-1.15,-0.65)	-0.89	(-1.31,-0.61)	-0.71	(-0.94,-0.55)
a_2	0.30	(0.12,0.48)	0.41	(0.11,0.56)	0.38	(-0.06,0.55)	0.14	(0.01,0.38)
a_3	0.19	(-0.01,0.43)	0.10	(-0.12,0.39)	0.64	(0.03,0.91)	0.02	(-0.15,0.13)
a_4	0.54	(-0.15,0.87)	0.56	(-0.21,0.97)	0.72	(-0.17,1.47)	0.34	(-0.15,0.68)

Notes: Estimation period is 1962Q1 to 2014Q4. In all cases, confidence intervals derived via a block bootstrap (using a block length of 12) using (Y,X) pair resampling.

Table 2: Time Variation in Projections for the Level of the Unemployment Rate

Three-year Horizon

	Type of Projection				
Summary Statistic	Median	10th percentile	90th percentile	Median-90th percentile	
Mean	5.83	4.61	7.84	2.01	
Median	5.62	4.44	7.90	2.03	
Variance	1.52	0.61	2.68	0.79	
	Variance of Median-90th percentile				
		Contribution of			
Time period	Overall	Inflation	Credit	BBB spread	Lag level
1962-2017	0.79	0.01	0.82	0.02	0.01
1962-1984	0.22	0.01	0.22	0.02	0.01
1985-2017	1.19	0.00	1.23	0.02	0.01

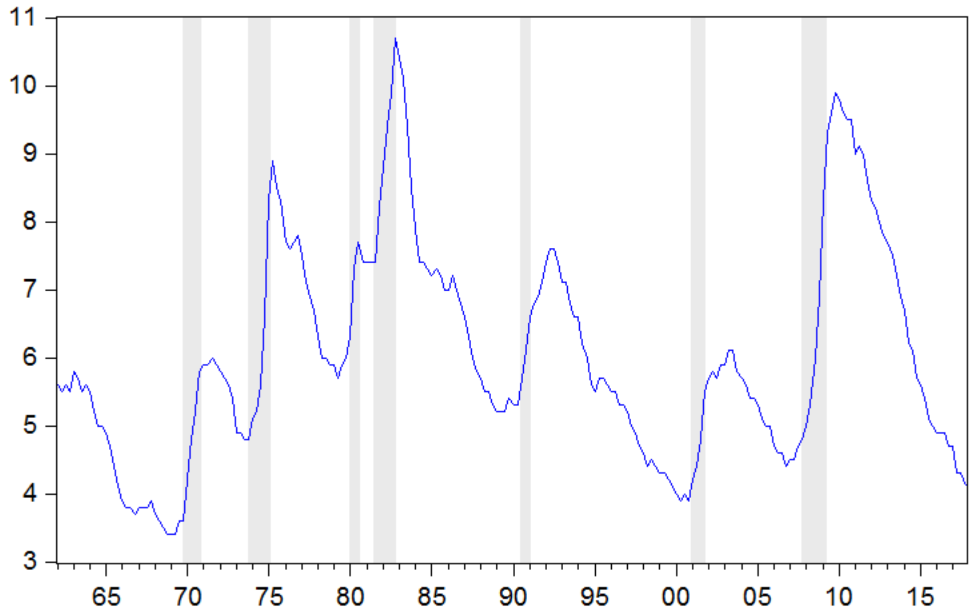
Table 3: Time Variation in Projections for the Level of the Unemployment Rate

One-year Horizon

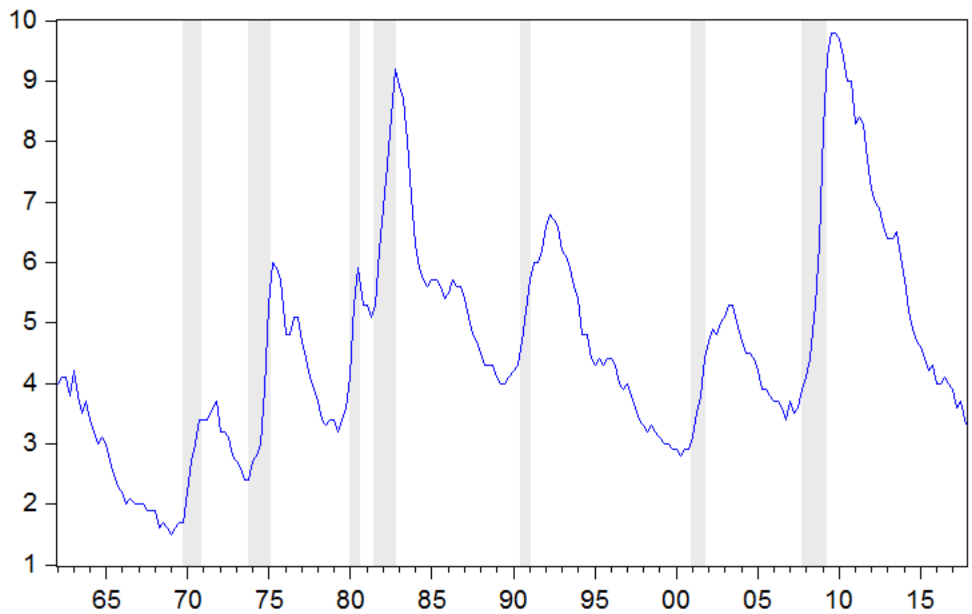
	Type of Projection				
Summary Statistic	Median	10th percentile	90th percentile	Median-90th percentile	
Mean	5.87	5.25	6.92	1.05	
Median	5.54	4.99	6.52	1.00	
Variance	2.26	1.50	3.20	0.24	
	Variance of Median-90th percentile				
		Contribution of			
Time period	Overall	Inflation	Credit	BBB spread	Lag level
1962-2017	0.24	0.09	0.01	0.17	0.05
1962-1984	0.33	0.10	0.00	0.17	0.06
1985-2017	0.13	0.02	0.02	0.18	0.04

Figure 1

A. Civilian Unemployment Rate (Total Non-institutional Population)

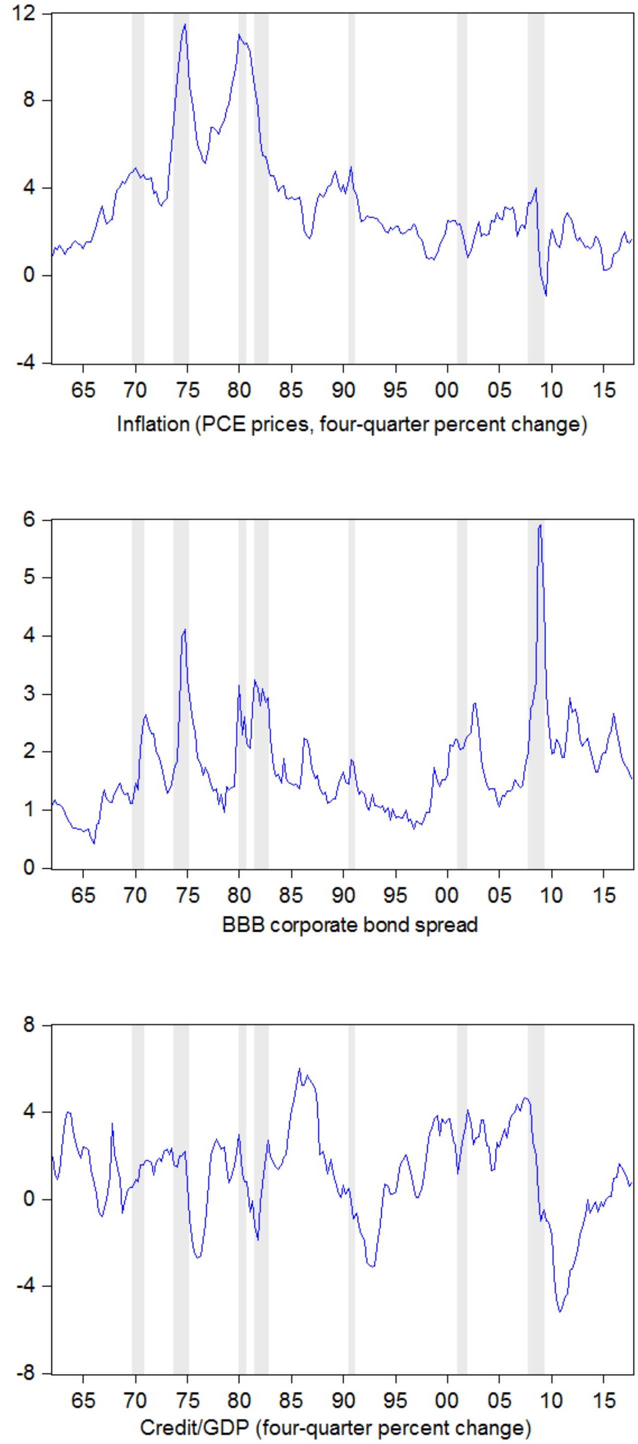


B. Unemployment Rate for Males, aged 25-54



Source: U.S. Bureau of Labor Statistics, retrieved from FRED, Federal Reserve Bank of St. Louis

Figure 2: Inflation, the Corporate Bond Spread, and Credit/GDP



Sources: U.S. Bureau of Economic Analysis, retrieved from FRED, Federal Reserve Bank of St. Louis; Board of Governors of the Federal Reserve System (US), retrieved from https://www.federalreserve.gov/econres/us-models-package.htm and staff; Bank for International Settlements, retrieved from FRED, Federal Reserve Bank of St. Louis.

Figure 3: Coefficients for Projections of the Change in Unemployment, 3-year Horizon, for the 1st through 9th Deciles

(Median Estimate and 90-percent Confidence Intervals)

(Quantile Regressions from 10th to 90th Percentile)

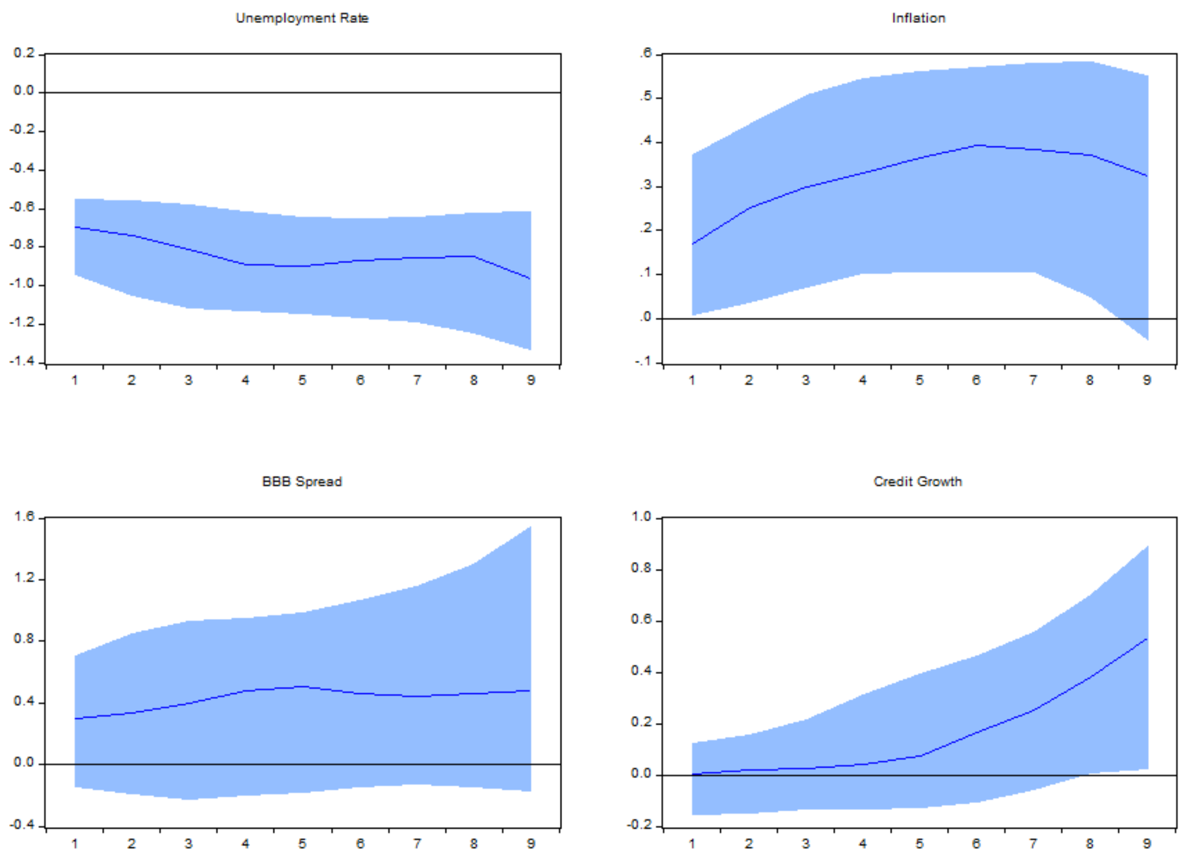
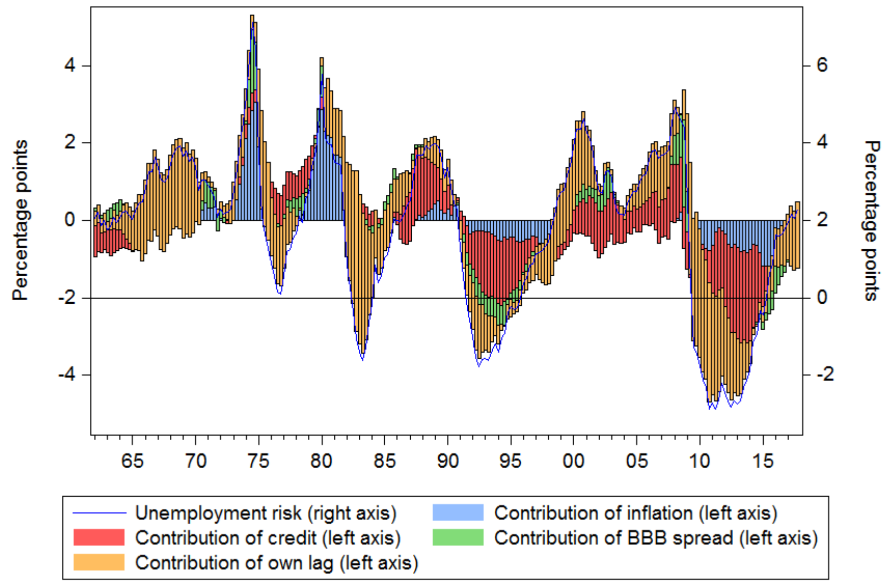


Figure 4: Unemployment Risk and Contributions of Explanatory Variables

(90th percentile for change in unemployment rate over subsequent 12 quarter)
(Contributions based on equation (1))



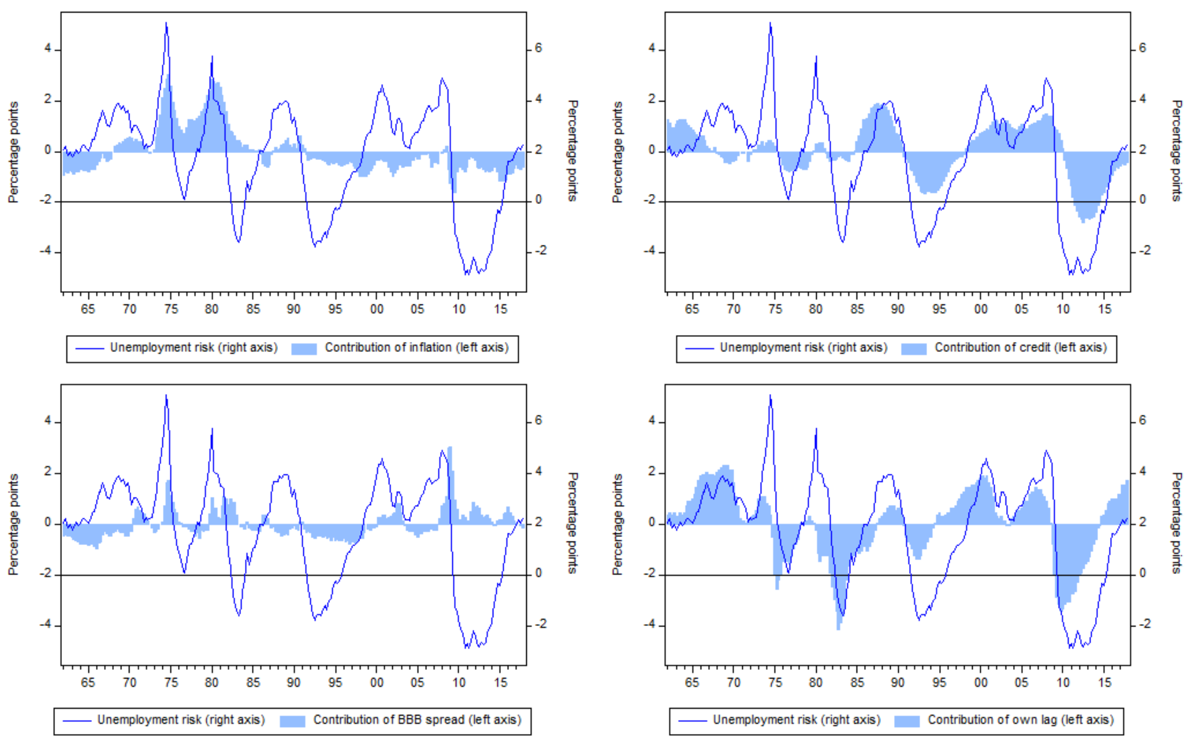


Figure 5: Unemployment Risk (Prime-Age Males) and Contributions
(90th percentile for change in unemployment rate over subsequent 12 quarter)
(Contributions based on equation (1))

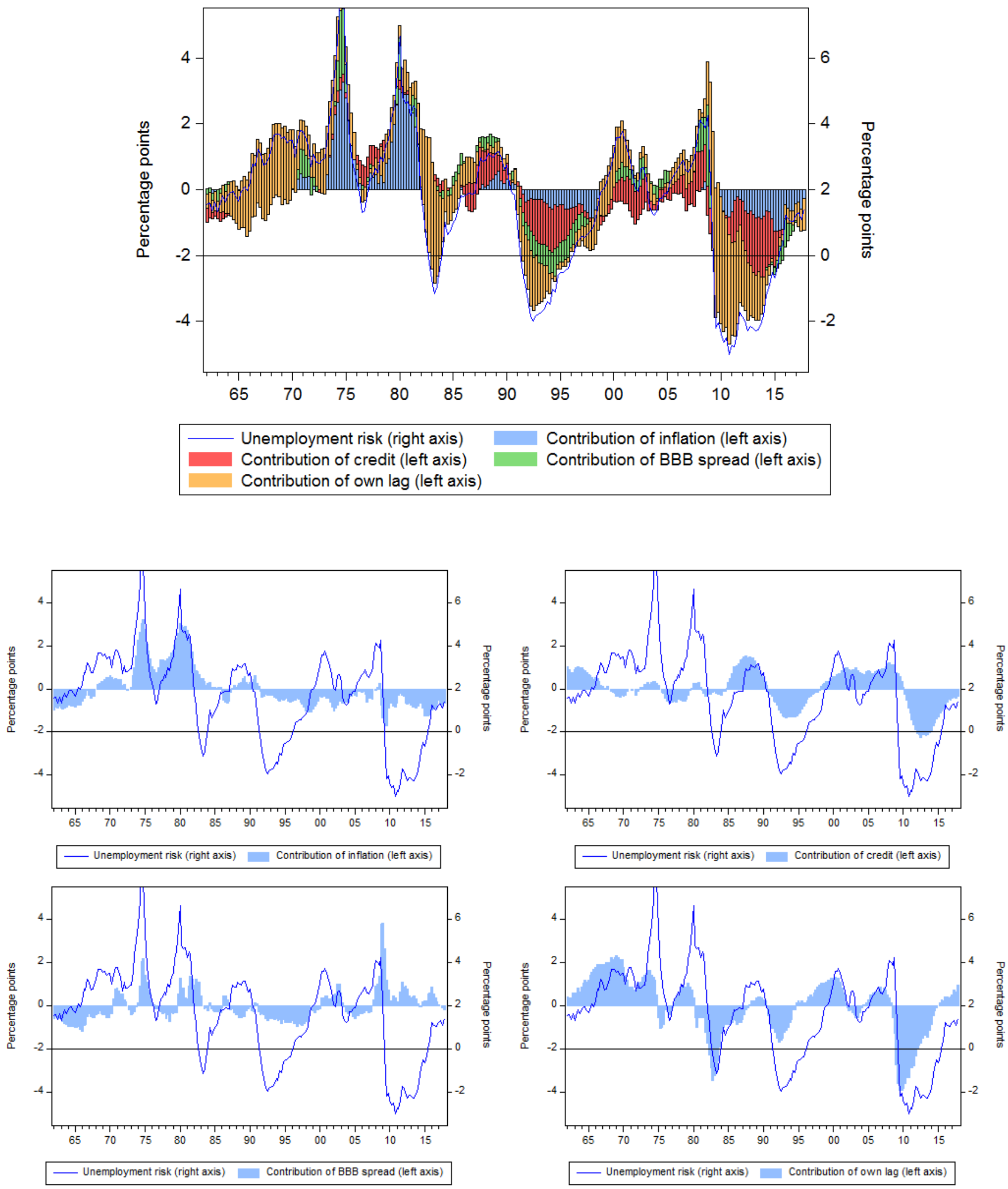


Figure 6: Unemployment Risk and Contributions of Explanatory Variables (90th percentile for change in unemployment rate over subsequent 8 quarter) (Contributions based on equation (1))

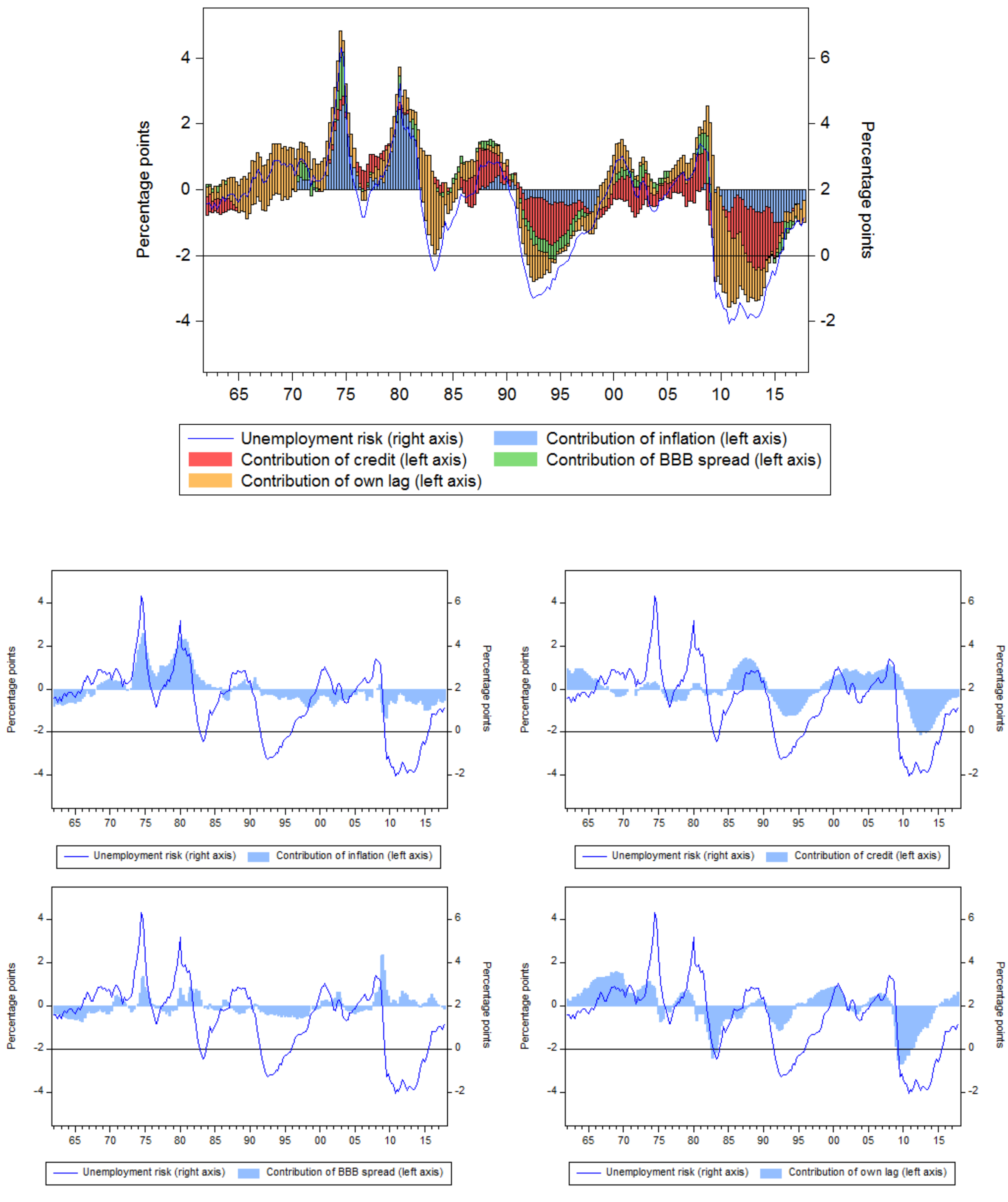


Figure 7: Coefficients for Projections of the Change in Unemployment, 1-year Horizon, for the 1st through 9th Deciles

(Median Estimate and 90-percent Confidence Intervals)

(Quantile Regressions from 10th to 90th Percentile)

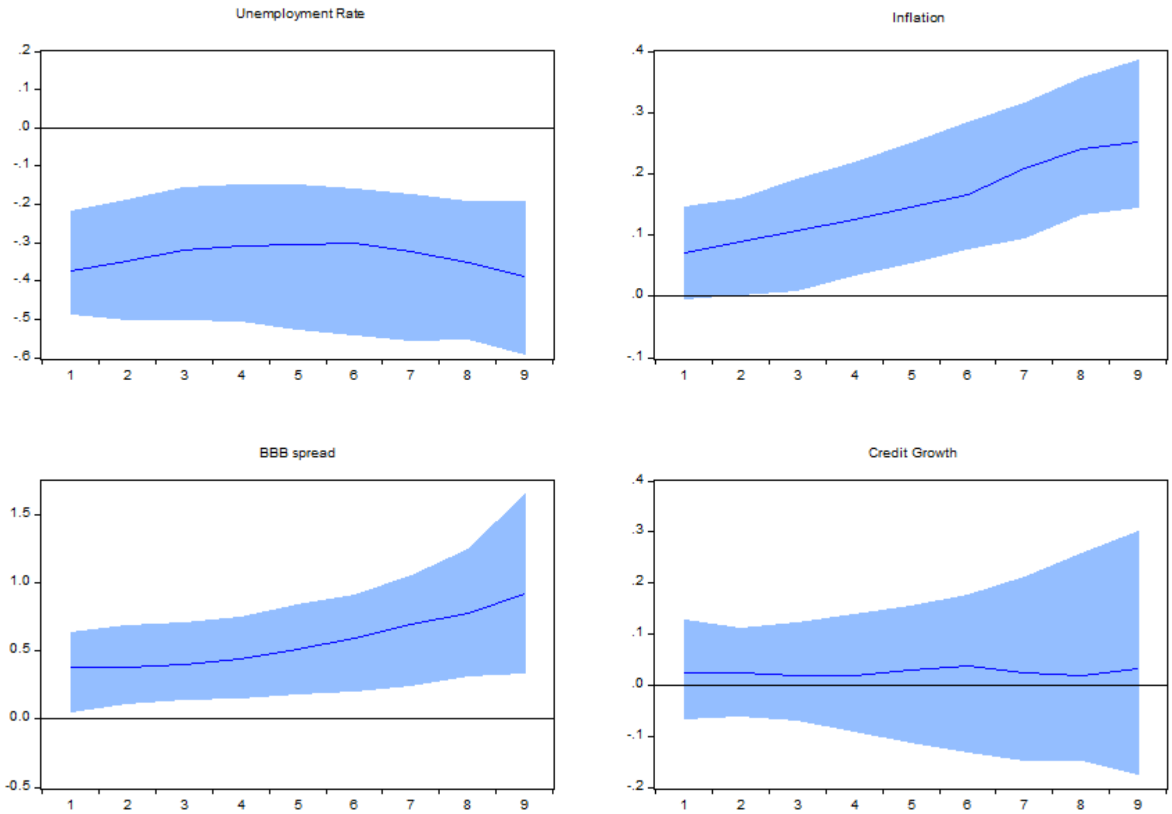


Figure 8: Time-Variation in the Projected Risks to the Level of the Unemployment Rate, 12 quarters ahead

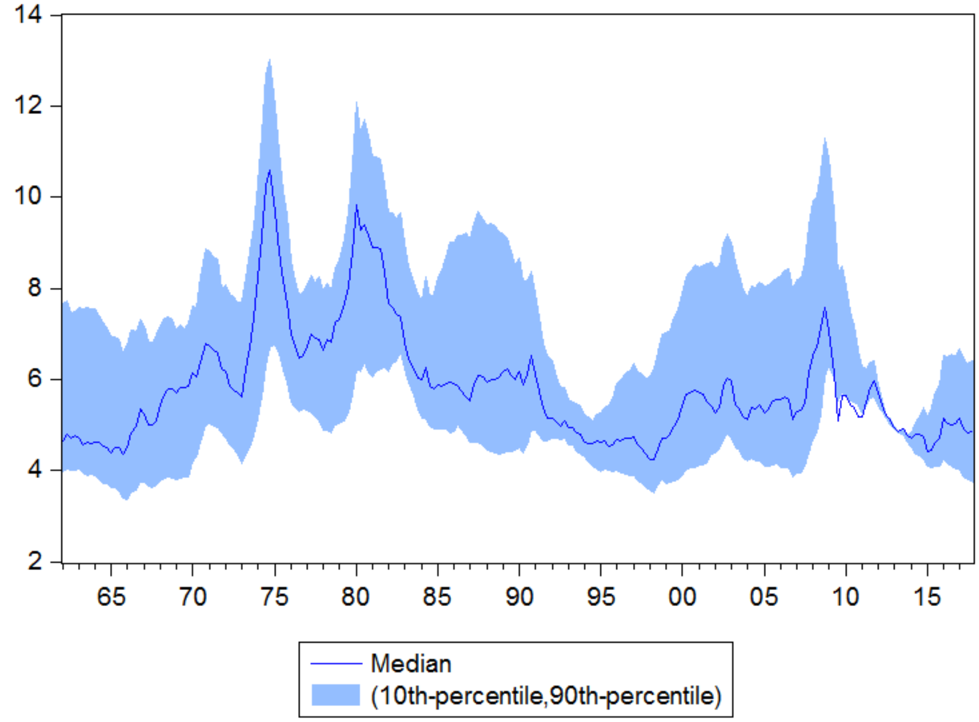


Figure 9: Coefficients on BBB Spread With/Without Business-Cycle Controls for Projections of the Change in Unemployment, 1-year Horizon, for the 1st through 9th Deciles (Median Estimate and 90-percent Confidence Intervals) (Quantile Regressions from 10th to 90th Percentile)