The State of States: A Probit Approach

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Acknowledgement: Initial draft of this paper was presented at the *2012 Annual Meeting of the American Economic Association, January 6-8, 2012 in Chicago, Illinois.* Special thanks to Natalie Cohen and Michael A. Brown. The views expressed in this study are those of the authors.

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Abstract

The 2007-2009 recession inflicted a great deal of damage across the country, including severe strains on state budgets as tax revenues collapsed. While many states continue to grapple with deficits, budget shortfalls alone cannot foretell a state's probability of default or bankruptcy. Rather than forecasting a state's probability of default, which remains fairly rare, economic activity is a far more useful measure in predicting the health of a state's economy in the near term. In this paper, we have taken a quantitative approach to analyze the relative risks of economic stagnation and protracted budget issues in each U.S. state. Because each state is at least in part driven by its own unique economic base, we developed a Probit model for all 50 states which assigns a probability of whether a state's economic activity will decline in the next two quarters. We also characterize a state's economic condition relative to other states. We find that state economies which experienced the most severe downturns in the 2007-2009 recession and have a growth model heavily skewed toward the sectors hardest hit during the recession will likely face the weakest and most protracted recoveries. In contrast, states with more diversified economies are relatively healthier since their economic activity typically did not decline sharply, and many currently have near-zero probability of weak economic fundamentals over the next two quarters.

Key Words: States; Probit: Budget Deficit; Default.
JEL Classification: H7; H72; R11.

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1. Introduction

This paper takes a quantitative approach to analyze the relative risks of economic stagnation and protracted budget issues for all U.S. states. We forecast economic activity two quarters ahead using state-specific variables like employment, tax revenue, home prices, and wages and salaries. Based on our analysis, it appears the states that experienced a significant economic downturn and have a growth model heavily weighted toward sectors hardest hit during the Great Recession will likely face the most protracted recoveries.[1]

Much attention has been paid to the ongoing fiscal struggles of state and local governments. The end of assistance through the American Recovery Act came before most states had reached their prerecession tax revenue levels. More recently, the debt ceiling debate and inability of Congress to significantly reduce the deficit have led to at least one rating agency giving some states' bond ratings a negative outlook due to their economic ties to federal government spending.[2] That said, many states experienced several key challenges (some of which are still present at the time of this writing), including sharp reductions in tax revenue, employment and economic activity, along with a rising pattern of unemployment during 2008-2010. These issues have created or exacerbated state budget gaps (the difference between revenue and spending) and have forced states to cut spending, leading to possible further losses in employment and slower economic activity. For example, the average peak-to-trough decline in state economic activity is 9.4 percent, using the Federal Reserve Bank of Philadelphia's state coincident

[1] For the purpose of this study, we define a "significant" state downturn as a decline in state economic activity that exceeds the average peak-to-trough decline of all states, which is 9.4 percent.

[2] On August 4, 2011 Moody's Investors Service assigned a negative outlook to the states of Maryland, New Mexico, South Carolina, Tennessee and Virginia due to economic links with the U.S. federal government spending.

index as a proxy for state economic activity. In addition, all states experienced job losses, along with a decline in state tax revenue.

Now the question arises, why do many states have budget issues? A simple answer to the question is that states usually make fiscal plans based on the assumption of a healthy, positive rate of economic growth, which in turn leads to healthy, positive rates of tax revenue growth. However, during the Great Recession, many states faced a sharp decline in tax revenues as well as economic activity. This may have helped widen state budget gaps and forced states to cut spending and/or increase taxes.

Economic recovery for a state may be a good sign for policymakers, investors and consumers. It may reduce a state's fiscal problems (or at least reduce the severity of the problem), because a state's economic recovery would generate better tax revenues to meet fiscal obligations. Therefore, forecasting a state's economic activity would help officials analyze whether their state is going to see a recovery or not, which will better help them align spending with revenues and reduce potential budget gaps (see next section for more detail).

One well-known way of predicting future turning points in economic activity is to utilize a logistic framework. For example, Estrella and Mishkin (1998) used a Probit model and forecasted the recession probability of the U.S. economy. Since then this approach has been employed by a number of researchers, including Filardo (1999), Chauvet and Potter (2005) and many more (see Wright (2006) for more detail).[3] Typically, a researcher would generate a dummy variable, which would be equal to one (1) if the U.S. economy is in a recession and zero (0) otherwise. Moreover, almost all the studies have used the recession dates defined by the National Bureau of Economic Research (NBER) in order to generate the dummy variable. To the best of our knowledge, our study is the first which develops a state-specific Probit model and uses that framework to build Probit models for all 50 states. Building a state Probit model is not an easy task, given that (1) there is no standard definition and there are no specific

[3] Some researchers have employed the Probit approach on economies other than the U.S. See Passaro (2007) for more detail.

dates for a state recession; (2) there is a limited number of time series data available at the state level; and (3) available state-level data do not typically have a long history (see section 4.1 for more detail on the data).

Our study generates a state-specific dummy variable, which is equal to one (1) if the year-over-year percent change in a state's coincident index is negative, and zero (0) otherwise. Following this approach we build 50 state-specific Probit models and use these models to forecast the two-quarter ahead probability of a state's weak fundamentals (see section 3 for more detail).[4]

Another major contribution of our study is to characterize a state's economic condition relative to other states. The Great Recession hit some states harder than others. For instance, the average peak-to-trough decline of a state's coincident index from the Great Recession was 9.4 percent, but Texas and Minnesota experienced declines of around 5.5 percent. On the other hand, some states, such as Ohio and Florida, experienced declines in economic activity of over 13 percent. In addition, several states, including California and New Jersey, have faced larger budget gaps than other states. Therefore, a state's relative position and future outlook depends on several factors, including the severity of the recession (the peak-to-trough decline in economic activity), the probability of future economic activity, and the state's fiscal health.

Our analysis shows that states which experienced a significant economic downturn and have a growth model heavily skewed toward the sectors hardest hit during the recession will likely face the weakest and most protracted recoveries. States identified as facing protracted recoveries include Nevada, Florida and Michigan. These states have a narrowly focused economic base and have seen little improvement so far in the recovery. In contrast, many states that were less affected by the recession and have a more diversified economy began to recover more quickly. Included in this group is North Dakota, Texas and New York, which were all less affected by the recession and are now seeing improving economic fundamentals. Moreover, some hard hit areas with more

[4] In this paper, we use "weak economic fundamentals," "negative economic activity" and "recession probability" interchangeably.

diversified economic bases, including Oregon and North Carolina, are now seeing their underlying fundamentals improve and our Probit model suggests these states are at little risk of backsliding during the next two quarters. The most encouraging aspect of our analysis is the large and likely growing concentration of states showing a declining two-quarter ahead probability or a probability close to zero of weak economic fundamentals.

The rest of the paper is organized as follows: Section 2 introduces a theoretical review of the economic state of states; Section 3 discusses our econometric methodology in creating a Probit model for measuring state economic activity two-quarters out; and Section 4 reviews the data we used and how it is implemented within the Probit models. In the following section, we discuss our results, including the outlook for a number of states with elevated risk or a recent increase in weak fundamentals two quarters out. Finally, in Section 6, we summarize our findings and suggest future research for the field.

2. The State of States: A Theoretical Review

Our study contributes to the current literature by taking two approaches. First, we developed a state-specific Probit model for all 50 states. Second, we characterize a state's economic position relative to other states. The state-specific Probit model could help a state to predict its near-term (two-quarter ahead) economic outlook. In this section we discuss the theory and implications of a state-Probit model.

Many researchers have employed a Probit framework and predicted future economic activity and turning points in the economy, but most of these studies have predicted economic activity either for the U.S. economy (see Wright (2006) for more detail) or for other national economies (see Passaro (2007)). Our study is the first, to the best of our knowledge, to develop a state-specific Probit model for all 50 states. As mentioned earlier and discussed in the Data section (4.1) in more detail, there is no single standard definition or specific dates for a state's recessions, such as the NBER dates, for the U.S. economy. There are very few options available to an empirical study at the state level as Crone and Clayton-Matthews (2005) suggested. The more prominent measures of economic activity, such as real gross state product, real personal income and employment

are not necessarily good options either because they often lack a long history, are only available at a lower frequency or are not a true representation of a state's economic activity (see Crone and Clayton-Matthews (2005) for more detail). Currently, the best available option is the state coincident index. Using Stock and Watson's (1989) methodology, Crone and Clayton-Matthews (2005) constructed a consistent state coincident index for all 50 states. These indexes are a useful option to compare business cycle properties at the state level. In addition, Crone and Clayton-Matthews (2005) suggested that these indexes can be useful for a time series analysis, such as our study, because they are a better proxy for a state's current economic activity and are comparable to other states. Therefore, we generate a state-specific dummy variable based on a state's coincident index, which is our dependent variable.

By utilizing a Probit model along with a state-specific set of predictors, we generate the two-quarter ahead probability of weak economic fundamentals for each of the 50 states. That said, state officials can make policy decisions based on assumptions about the future economic outlook, and our Probit framework could help analyze the near-term economic outlook. See the Results section (5) for more detail.

2.1 Characterizing a State's Relative Position: A Quadrant Approach

The 2007-2009 recession was more severe in some states than others. For instance, the average peak-to-trough decline in economic activity (using the state coincident index as a proxy for economic activity), was 9.4 percent, but Michigan and Nevada saw peak-to-trough declines greater than 19 percent. On the other hand, Arkansas, New York and North Dakota showed a smaller decline (less than 5 percent). In addition, several states, such as California and New Jersey, have struggled with larger budget gaps than other states, but have seen below-average declines in their economic activity. Therefore, a state's relative position and future outlook depends on several factors, including the severity of the recession (the depth of decline in economic activity), the probability of future economic activity, and annual budget gaps. For example, based on the results of the second quarter of 2011, the two-quarter ahead probability of weak

economic activity is less than one percent for both Michigan and New York. Although both states have a similar probability of weak economic fundamentals in two quarters, their outlooks vary. The most recent recession started for each state at different time periods, and economic activity contracted over a longer time horizon in Michigan. Between the first quarter of 2007 and third quarter of 2009, Michigan experienced a severe and prolonged recession, with economic activity dropping 20 percent, and continues to suffer from well-known structural challenges. In contrast, New York had a mild recession, with state economic activity falling 4 percent between the second quarter of 2008 and fourth quarter of 2009. With a more mild recession, New York's similar probability of weak economic fundamentals ahead suggests it is closer to recapturing its prerecession level of economic activity or returning to expansion more quickly than Michigan.

Another issue which needs to be incorporated into a state's economic outlook is a state's budget situation. For instance, Nebraska and Connecticut both experienced smaller-than-average declines in economic activity and each state's two-quarter ahead probability is currently zero. However, Connecticut has had persistently larger budget gaps compared to Nebraska (both in nominal and percentage terms) which means government spending will likely be a drag on growth as the state cuts its budget and/or increases taxes to align with revenues, which will further dampen economic activity. This puts Nebraska in a better position for near-term economic growth than Connecticut. Therefore, a true measure of a state's economic outlook should consider the depth of a recession, along with the probability of future economic activity and a state's structural fiscal issues.

3. The Econometric Setup

3.1 The Probit Model

A state-specific Probit model is utilized to generate the two-quarter ahead probability of weak economic fundamentals. Furthermore, a state-specific dummy variable is created for all 50 states. The dummy is equal to one (1) if a state's economic

fundamentals are weak, and the dummy is equal to zero (0) otherwise. We define weak economic fundamentals as a quarterly growth rate less than zero for a state's coincident index (year-over-year percent change (YoY) is a negative number). In other words, if a state's coincident index value (YoY) is a negative number (< 0) for a quarter, then economic fundamentals are weak and the dummy variable is equal to one (1) for that state. We followed that procedure and created a state-specific dummy variable for each of the 50 states.

Our target is to predict a negative growth rate of the state coincident index, what we refer to as weak economic fundamentals, within the next two quarters—the two-quarter ahead forecast. Following that approach, we build individual Probit models for all 50 states. The estimation process is the same for all 50 states' Probit models; however, not all 50 Probit models share the same predictors. Therefore, we explain the procedure to estimate a Probit model.

We begin by assuming a Probit model of the form:

$$y^*_{st+h|t} = \beta'_s \; z_{st} + \varepsilon_{st} \qquad (1)$$

$$y_{st+h|t} = 1(\text{if } y^*_{st+h|t} > 0) \qquad (2)$$

where $y^*_{st+h|t}$ is an unobserved variable that determines, at time *t*, if a state *s* experiences weak economic fundamentals (a negative growth rate of state coincident index) within the next *h* (in this case *h*=2 because we are interested in two-quarter ahead probability) periods i.e. $y_{st+h|t} = 1$. z_{st} is a vector that includes the values of the independent variables at time *t* for state *s*; β_s is a vector of coefficients including an intercept; and ε_{st} is a normally distributed error term. Given historical data on the occurrence of weak economic fundamentals of a state, *s* is captured in y_s and a set of predictor variables represented by z_s. We estimate a parameter vector $\hat{\beta}_s$ and forecast the probability of weak economic fundamentals falling in the next *h* periods for state *s*:

$$\mathrm{P}(y_{st+h|t} = 1) = \Phi(\hat{\beta}'_s z_{st}) \qquad (3)$$

where function $\Phi(\square)$ represents the cumulative density function of the standard normal distribution.

If the error term ε_{st} is serially uncorrelated, parameter vector β_s and its variance-covariance matrix can be estimated readily using maximum likelihood. For multi-period ahead forecasting, there is an overlapping data problem in that the forecast horizon is longer than the observation interval, which will cause serially correlated forecast errors (see Estrella and Mishkin (1998)). For instance, our dataset is quarterly, but we are interested in the two-quarter ahead probability of weak economic fundamentals. Under this situation, the standard estimation of parameter vector β is still consistent, but its variance-covariance matrix estimate needs a Newey-West type adjustment, so we assume ε_{st} can be serially correlated.[5]

4. The Data and Implementation Strategy

4.1 The Data

We start with the definition of our dependant variable, which is not a traditional one. As such, it was a challenge to create a new dependent variable which is consistent among 50 states. Typically, if a researcher wants to predict the probability of a recession for a future time period (two-quarters ahead in our case) for the U.S. economy, then he/she can follow the standard practice, which is to use a dummy dependent variable equal to one (1) if the U.S. economy is in recession and zero (0) otherwise. Furthermore, the most commonly used dates to mark a recession's beginning and end are those provided by the NBER. Almost every study in the past has used a dummy variable equal to one (1) if the NBER has declared a recession and zero (0) otherwise to predict the recession probability for a given forecast horizon (for our purposes, two quarters ahead).[6]

For the 50 states, on the other hand, there is no standard definition of specific recession dates, as states do not have a specific peak (beginning of a recession) and

[5] For more technical details, see Wright (2006)
[6] Ibid.

trough (end of a recession). In other words, there are no explicit dates for when a recession began and a recovery started within a state. Therefore, it is a very difficult task to produce a recession definition for a given state when that definition must be consistent across 50 states. One option may be to use state GSP (gross state product) and generate a dummy dependant variable equal to one (1), if, for example, the quarterly growth rate (quarter-over-quarter percent change) of a state's GSP is negative, and zero (0) otherwise. However, a problem arises as state GSP data dates back only to 1997, which is a very short history for our analysis, and is available only on an annual basis.

The most practical option is to employ a state's coincident index and generate a dummy dependant variable based on it. The Federal Reserve Bank of Philadelphia produces a state coincident index for all 50 states which extends back to 1979. The coincident indexes combine four state-level indicators to summarize current economic conditions in a single statistic. The four state-level variables are: (1) nonfarm payroll employment; (2) average hours worked in manufacturing; (3) the unemployment rate; and (4) wage and salary disbursements deflated by the CPI (U.S. city average). The coincident index is consistent across all 50 states and represents the current economic conditions of a state.[7] Therefore, we generate a dummy variable with a value equal to one (1) if state economic fundamentals are weak and zero (0) otherwise. Weak fundamentals are defined as a negative quarterly growth rate (year-over-year percent change) for the state's coincident index. Using that approach, we generated dummy variables for all 50 states. We use the dummy as the dependent variable and produce the probability of weak economic fundamentals within the next two quarters.[8]

Another option to define weak economic fundamentals (and perhaps a recession) within a state is to identify two consecutive quarters of negative growth for a state's coincident index. This technique can be similarly applied as a simple way to identify a national recession when looking at gross domestic product. This definition of weak

[7] See the Federal Reserve Bank of Philadelphia's website for more detail.
[8] Note that the Federal Reserve Bank of Philadelphia produces a state coincident index every month, but we convert that monthly series into a quarterly time series by using the 3-month average of the index.

economic fundamentals may be a suitable option, but it suffers from a relatively short time series. The state coincident indexes date back to 1979 and as a result, there are not many quarters of negative growth rates and the number of quarters with negative growth rates vary widely across states with a range from 16 (New Mexico) to 48 (Michigan). Using the two consecutive quarters of negative growth as a rule of thumb for a recession reduces the number of periods the dummy is equal to one (1), which creates other issues that may reduce the reliability of the results (see next section for detail). As a result, our prescribed definition of weak economic fundamentals—a negative quarterly rate of growth—is more practical compared to other available options.

Once we have defined our dependent variable, we need to determine predictors for a Probit model. In the first step, we collect all available state level variables, of which there are not too many. We end up with approximately 20 variables. The next step is to eliminate those variables which either have a short history or release with a longer lag time. Since our target variable goes back to 1979, we have eliminated the variables with a series history beginning after 1980. For example, population and net migration data are released with at least a one-year lag, while retail sales data is estimated rather than being based on a survey (provided by Economy.com), so we drop these variables. At the end of this step, there are only nine state level variables remaining in the dataset. We add two national level variables, which are the S&P 500 Index and the price for WTI crude oil. The major reason to include national level variables as potential predictors is that states do share some common factors with these national economy measures. The S&P 500 index is a forward-looking indicator, as it is a component of the U.S. index of leading indicators (most widely known as the LEI by the Conference Board). It represents current economic conditions as well as expectations for the near-term prospects of the U.S. economy. The price of crude oil is also important for many states which rely heavily on oil or oil-related industries, i.e., Texas and Louisiana, to name a few. Therefore, we have a data set of 11 variables as potential predictors. We are interested in a 4-6 variable Probit model for a state, as we do not want to include too many (or too few) variables in a

model, which may create an over-fitting (or under-fitting) problem. A 4-6 variable model is a reasonable size, in our view.

To finalize a model, we utilize both theoretical rationale as well as statistical support. First, we run a logistic regression for each of the 50 states between the dummy dependent variable and each of 11 potential predictors. We retain the variables which have a higher association with the dummy dependent variable based on a chi-squared test. Based on theoretical rationale, we identify four variables for each of the 50 states as predictors. In addition to these four predictors, we also include further predictor(s) based on statistical support and/or state specific conditions. The four common predictors for all states are: (1) employment; (2) tax revenues; (3) home prices; and (4) wages and salaries. Many states' models include additional predictors. For instance, New York's model includes the S&P 500 Index as an additional predictor, as the financial sector is a key source of income and employment for New York. Similarly, oil is very important for Texas. A complete list of predictors for each state is available in Appendix A.

4.1.1 Employment

State employment is one of the broadest and most timely economic indicators available. The monthly employment numbers from the U.S. Department of Labor are typically reported only a few weeks after the end of the month. The indication as to whether or not a recession has begun would take place well after any initial drop in the monthly figures. Another distinguishing characteristic about nonfarm employment in recent business cycles is that once employment accelerates, the momentum is typically not deterred unless the economy begins to stall (Figure 1).

4.1.2 Tax Revenue

State tax revenue is another variable that is a useful predicator of state economic activity.[9] Revenue, as reported by the U.S. Census Bureau, fell significantly due to the 2007-2009 downturn from every revenue source and while state tax revenue lags the national recovery, some improvement in state finances foretells stability as economic

[9] Annual tax revenue data published from 1980-1994 by the U.S. Census Bureau was combined with the quarterly tax revenue data series which began in 1995, also published by the U.S. Census Bureau.

drivers strengthen. In fact, an increase in employment, a key economic driver, may lead to a rise in income tax (if the state has one) and/or an increase in sales tax (if the state imposes one). Indeed, economic drivers may vary, as states have very different revenue streams. For example, Florida has no state income tax and depends heavily on sales tax, while Oregon does not have a sales tax but depends heavily on income tax (such a delineation further illustrates the need for distinct models for each state). Moreover, while many states face cyclical budget shortfalls, structural deficits (budget deficits that persist for some time) will weigh on state economic activity well into the recovery (Figure 2).

4.1.3 House Prices

As the housing downturn was the main catalyst for the 2007-2009 recession, any state economic recovery will depend on a turnaround in the housing market. According to the FHFA home price index, home prices fell 16 percent peak to trough (Figure 3). In select markets such as California, Arizona, Nevada and Florida, home prices fell by more than 35 percent from their peak. Moreover, the ever increasing number of foreclosures, short sales and REOs continue to put downward pressure on home prices. As a result, many households continue to grapple with sharp declines in net worth, which further impedes growth in consumer spending and economic activity. Due to declines in home prices, many borrowers are also finding they have negative home equity, meaning that they owe more on their home than it is worth. Negative equity constrains geographic mobility and makes it nearly impossible for borrowers to refinance.

4.1.4 Wages and Salaries

Wages and salaries, the largest component of income, also provides important insight, as they can presage state-level consumer spending. A rise in wages and salaries may indicate a state's economy is healthier, which could potentially lead to higher spending and tax revenues. In our model, we use the quarterly wages and salaries data available from the Bureau of Economic Analysis (Figure 4).

4.2 Implementation Strategy

We use a binary dummy: $y_{st+2|t}$ as a dependent variable for each the 50 states' Probit models. That is, at time *t*, whether weak economic fundamentals (a negative quarterly growth rate of a state coincident index) will occur between the next one and two quarters. Our starting point is a correct estimation of a Probit model with autocorrelated errors. Using the approach of Wright (2006), we estimate the parameters of a Probit model by the Newey-West type adjustment.

We follow a time series Probit model approach instead of using a panel Probit model for all 50 states. Typically, panel data techniques are more powerful compared to time series or cross-section estimate techniques.[10] However, we do not follow a panel Probit or any other panel data estimation techniques because not all 50 states share the same set of predictors. We include state-specific predictors for many states. For instance, Texas is heavily dependent on oil and therefore we include the price of crude oil along with the other predictors in the Texas Probit model, and we include the S&P 500 index in the New York model as New York derives a major source of income and employment from the financial sector.

We transform monthly data series into a quarterly frequency and our final model estimation is based on a quarterly dataset. To avoid potential non-stationary and cointegration issues we transform the data into year-over-year growth rates (first-difference). Another potential issue is the so called "thin tail"[11] property in the Probit model which can potentially cause a forecasted probability too close to one (1) or zero (0) under certain circumstances. That is, $\Phi(\hat{\beta}_s' z_{st}) \geq 0.998$ if $\hat{\beta}_s' z_{st} \geq 3$ and $\Phi(\hat{\beta}_s' z_{st}) \leq 0.002$ if $\hat{\beta}_s' z_{st} \leq$ -3, where Φ is the cumulative standard normal distribution as appeared in

[10] A common perception is that since panel data contains both time series and cross-section dynamics, it may have more power than time series and/or cross-section data estimation techniques. See Baltagi (2008) for more detail.

[11] This refers to the underlying normal distribution of the error term in a Probit model. Due to the fact that most density is distributed close to mean 0, the areas under, say three standard errors away from 0, is very small.

equation (3). According to Greene (2011), this typically could happen when (1) there are very few responses, $(y_{st+h|t}=1)$, like in the case of New Mexico which has only 16 negative quarters of coincident index; and (2) there is very wide variation in an important independent variable, particularly if (1) is also true. Furthermore, we observe this phenomenon for many states (see the Results section for more detail) where forecasted probabilities are often very close to zero (0), or very close to one (1). Alternative assumptions on the error term may help to generate less extreme probabilities. One logical alternative is the logistic distribution that has considerably fatter tails. We will implement this approach in our future research. Keeping these issues in mind, we only need to rescale the magnitude accordingly when interpreting a probability. Instead of interpreting a probability closer to one (1) as outright weak economic fundamentals, we would qualitatively suggest that there exists significant risk of a future slowdown or a moderation in growth. With the above caveats in mind, we should translate the forecasted probability of each model qualitatively rather than quantitatively.

5. Results

Our study covers the 1980:Q1-2011:Q2 time span, and the results for the second quarter of 2011 show that the fundamentals in most states have improved markedly in recent quarters. The majority of states show little probability of weak fundamentals two quarters ahead, with the models showing that 34 states have a probability of less than five percent as of the second quarter.[12] Among states showing a high probability, it is important to note the direction of the quarterly change and whether the probability is increasing or decreasing over the quarter. A state may provide a high reading, but if that probability is lower than the previous quarter, it suggests conditions are generally improving in the state, which will likely continue over the next quarter as the year-over-year change in quarterly data is not prone to as large swings as monthly year-over-year changes or quarter-over-quarter changes. That said, a number of states have seen their probability rise over the last quarter.

[12] See Appendix B for a time-series graph of each state's two-quarter ahead probability

We find that the quarterly change to the two-quarter ahead probability—our dependent variable—moves in accordance with three characteristics of the changes in the models' independent variables. First, a *directional* change in the growth rate of the independent variable, i.e. from positive to negative, can lead to a large quarterly change in a state's two-quarter ahead probability. A directional change from a strong reading to a weak reading (for example, positive employment growth to negative employment growth) can cause a large increase in the probability that a state will have weak fundamentals two quarters ahead. Second, the *magnitude* of the change relative to historic changes can affect the two-quarter ahead probability. Third, whether or not the growth rate is *favorable or unfavorable* (positive or negative depending on the series), can have a bearing on a state's two-quarter ahead probability. While the direction of change may not shift over the quarter, or the year-ago rate of change may not shift much on a quarterly basis, whether or not a state is experiencing unfavorable growth (for example, a decline in house prices) will weigh on the state's outlook.

While the majority of states show little probability of weak fundamentals two quarters ahead or have seen a decline in their two-quarter ahead probability over the most recent quarter of our analysis, a number of states have shown that fundamentals may be weakening (Figure 5). In the next section, we look at a number of states that have shown a recent increase in their two-quarter ahead probability or continue to display a strong probability of weak fundamentals in the coming quarters.

5.1 State Results

Nevada's outlook remains the dimmest among states. Using the Federal Reserve Bank of Philadelphia's recession measurement methodology, the state has been in a recession since the beginning of 2008 and is projected to remain so at least through the end of 2011. The state's Probit model has shown a probability of 100 since the first quarter of 2008. Fundamentals remain weak in the Silver State, with second-quarter employment continuing to fall on a year-ago basis compared to a 0.8 percent increase nationwide. House prices remain under severe pressure as well. Prices fell 14.8 percent

from a year earlier in the second quarter of 2011, the steepest four-quarter decline of any state. Wage growth remains tepid at only 1.7 percent year over year, compared to a 4.0 increase nationally. Tax revenues, however, are showing some improvement, as growth accelerated to 17.6 percent year over year in the second quarter from 4.1 percent the previous period.

Fundamentals in Arizona looked to be improving in the first quarter of 2011, but the two-quarter ahead probability ticked up in the second quarter from zero to 11.1 percent. House prices appear to be driving the modest pick up as price declines accelerated to 13.8 percent in the second quarter from 11.2 percent in the first quarter. Tax revenues may also be a contributor as the pace of revenue collections slowed 5.9 percentage points in the second quarter, although growth remained positive. Employment growth, on the other hand, turned positive in the second quarter, while the rate of wage growth increased 0.1 percentage point compared to a slowdown across the nation.

Fundamentals in Washington showed a mild, across-the-board weakening in the second quarter, causing the two-quarter ahead probability to edge up slightly in the second quarter to 9.4 percent from 2.0 percent the previous quarter. Included as independent variables in the Washington model are the year-over-year changes in employment, wages and salaries, house prices, tax revenues and food stamp recipients. Year-over-year growth in employment, wages and salaries, and tax revenues all decelerated over the quarter, but remained positive. House prices continue to decline and did so at a steeper rate in the second quarter (7.3 percent in Q2:2011 versus 5.7 percent in Q1:2011). Relieving some upward pressure within the model, however, was a slowdown in growth of food stamp usage, which is above the national average in Washington.

Between the first and second quarter of 2011, Maryland saw the largest increase in the probability of a recession. The state's two-quarter ahead probability jumped nearly 70 percentage points to 78.9 percent over the second quarter. Independent variables in the Maryland model include employment, wages and salaries, house prices and tax collections. Driving the second-quarter increase was a year-over-year decline in employment, which bears a strong association to the state's coincident economic activity

index with a chi-square test score of 51.2. After three quarters of gains, Maryland payrolls declined 0.4 percent compared to a 0.7 gain the previous quarter, a large directional change compared to an average slowing of 0.2 percentage points among all states. Losses were concentrated in government employment, particularly at the federal and local level. House prices also weighed on the state's second quarter outlook. The year-ago rate of home prices declines accelerated in the second quarter. Maryland's home prices were down 5.2 percent on a year-over-year basis in the second quarter compared to an average decline of 3.9 percent among all states or 4.4 percent nationally (allowing for variation in size of states' housing markets). State tax revenues and wages and salaries increased at nearly the same rate in the first and second quarters of 2011.

The probability of a recession kicked up in Virginia in the second quarter. Virginia's recession probability rose from 0.0 to 21.5 percent amid a sharp slowdown in employment growth. Similar to Maryland, federal and local employment fell sharply over the quarter. Growth in wages and salaries and tax revenues also moderated over the quarter. Wages and salaries increased at a 3.2 percent rate in the second quarter compared to a 3.6 percent rate a quarter earlier, while tax revenues increased at a 10.2 percent rate in the second quarter compared to a 14.7 percent rate a quarter earlier. House prices also contributed to the state's bleaker outlook as year-over-year declines accelerated by 1.1 percentage point in the second quarter.

Conditions in Illinois still raise some cause for concern in the near-term, but are generally improving. The two-quarter ahead probability remained near the five percent mark in the second quarter. Payroll employment rose on a year-ago basis for the third consecutive quarter, although the rate of growth slowed from a nearly five-year high by 0.2 percentage points to 1.1 percent. Wage growth, which has the strongest association with the state's coincident index, also decelerated, declining 1.0 percentage point compared to an average decline of 0.2 percentage points across all states. Further weighing on the Illinois outlook is that the housing market has yet to turn around. House prices declined at a more rapid pace in the second quarter, falling 4.8 percent on a year-ago basis compared to 3.9 percent in the first quarter. Better tax revenues, however,

limited the uptick in recession probability, and tax revenues rose 27.1 percent on a year-ago basis on the heels of an increase in personal income tax rates.[13]

Looking at California, the probability of a recession has declined steadily in recent quarters, but has not fallen to zero. The two-quarter ahead probability for California remained nearly unchanged at 4.9 percent in the second quarter of 2011. Wage and salary growth remains strong, increasing 5.6 percent year over year in the second quarter, roughly in line with the first quarter's increase of 5.5 percent. Tax revenue growth improved in the second quarter with the series accelerating 1.4 percentage points. Also putting downward pressure on the probability of a recession in the Golden State was the 28 percent year-over-year increase in the S&P 500 index, which we found to be statistically significant with the activity of California's economy. Employment growth has been positive over the previous three quarters, though the pace of job additions slowed a touch in the second quarter. The housing market, however, has yet to fully recover and continues to keep California's probability of recession from falling to zero. House prices in the second quarter slipped 5.6 percent over the previous four quarters, which is the state's fastest rate of decline in over a year.

5.2 Characterizing a State's Relative Position

In this section, we explain our results based on our quadrant approach. As mentioned earlier, a state's outlook depends on both the current two-quarter ahead probability and the severity of the downturn. With this in mind, we plot the two-quarter ahead probability of weak economic fundamentals (negative economic activity) on the x-axis of a scatter plot and the peak-to-trough decline in a state's coincident index (the severity of recession) on the y-axis (Figure 6). We then divide the plot into four sections. The x-axis is bisected at the 50-percent probability mark and the y-axis is bisected at the average peak-to-trough decline in economic activity for all states (9.4 percent). We also mark the ten states with the largest average budget shortfalls (on a percentage basis) for the fiscal years of 2009-2012 in red, while other states are marked in black. According to

[13] Dadayan, Lucy. "Robust revenue gains continue in first quarter and early second quarter." Rockefeller Institute State Revenue Report No. 84, July 2011.

data from the Center on Policy and Budget Priorities, these states experienced an average budget shortfall of more than 20 percent for fiscal years 2009-2012.

Quadrant A shows states which did not experience a severe recession and whose probability of weak economic fundamentals two quarters ahead is less than 50 percent. These states are in the best relative condition as their downturns were relatively mild and their economies are poised for growth over the next two quarters. A commonality of these states is either a diversified economic base or an economy skewed toward sectors that were relatively resilient throughout the downturn. However, some states in this quadrant, such as California and New York, face structural budget issues, which could weigh on their future outlook if they are not addressed. Examples of states in this quadrant include are North Dakota, Texas, Pennsylvania and Minnesota.

Quadrant B represents states which did not experience severe recessions, but have a probability of weak economic fundamentals two quarters ahead greater than 50 percent. Currently there are no states in this quadrant.

Quadrant C captures states that experienced severe recessions, but whose current two-quarter ahead probability is less than 50 percent. States in this quadrant are projected to grow over the coming quarters, but their recoveries will be protracted. Many of the states in Quadrant C have a less diversified economic base and saw severe downturns, meaning it will likely take some time until activity reaches its prerecession levels. Examples of states in this quadrant include Michigan, Arizona, Ohio and South Carolina.

Our last quadrant, Quadrant D, shows the states in the worst economic condition. These states not only have seen above-average declines in economic activity, but their outlook for the next two quarters show a greater than 50 percent probability of recession. Within this quadrant is Nevada, where economic activity has declined 26.6 percent over the last recession and has had a probability of weak fundamentals over 99.9 percent for the past 14 quarters. Nevada's reliance on housing during the last economic expansion and economy heavily skewed towards tourism has made for a difficult recovery given that the housing market is still severely depressed and consumer spending remains

constrained. Also in this quadrant are New Mexico, Maryland and Montana, all of which experienced slightly more severe downturns than the average among states.

We find that state economies which experienced the most severe downturns in the 2007-2009 recession and have a growth model heavily skewed toward the sectors hardest hit during the recession will likely face the weakest and most protracted recoveries. In contrast, many states that were less affected by the recession have a more diversified economic base. These states, for the most part, were the first to see improvement in their two-quarter ahead probability. Moreover, some hard hit areas with more diversified economic bases, including Oregon and North Carolina, are now seeing their underlying fundamentals improve and our Probit model suggests these states are at little risk of backsliding during the next two quarters.

6. Caveats and Future Research

For future research, our study points toward two directions. First, as previously discussed, the state coincident index (SCI) is currently the best available option to measure state economic activity, but there is still room for improvement. For instance, the SCI is heavily weighted toward the labor market, which is an important element of the economy, but still only one indicator. Indeed, three of four variables—nonfarm employment, the unemployment rate and average weekly manufacturing hours—are labor market indicators. It would be useful to construct a SCI which includes more variables such as house prices, building permits, and consumer credit. These variables are very important and date back to at least 1979, which is the start date of the current SCI. Including more variables into the current SCI would increase the index's accuracy.

Second, we believe future research could improve upon the estimation process. Technically, we ran an out-of-sample Probit model as the dependent variable, is a two-quarter ahead economic activity vs. current level (growth rate) of predictors. An alternative approach is to run a pseudo out-of-sample Probit model by ending the sample period, let us say at 2005, and then generating the two-quarter ahead probability, moving one quarter forward and again generating the two quarter ahead probability. In theory, this recursive method may be better, but it is not good in practice. As mentioned

previously, many states have a small number of quarters with a negative SCI rate of growth and may have a "thin tail" issue. If we limit the sample size, the problem may worsen. For example, New Mexico has only 16 (out of 126) quarters of negative growth and if we limit the sample size to the end of 2005, then the series has only five quarters of negative growth (out of 104). This would lead to less reliable results, which is why we believe our estimation process is currently the best available and most practical method. However, in the future, when a longer history of data is available, a recursive method could be appropriate to employ.

6. Summary and Implications

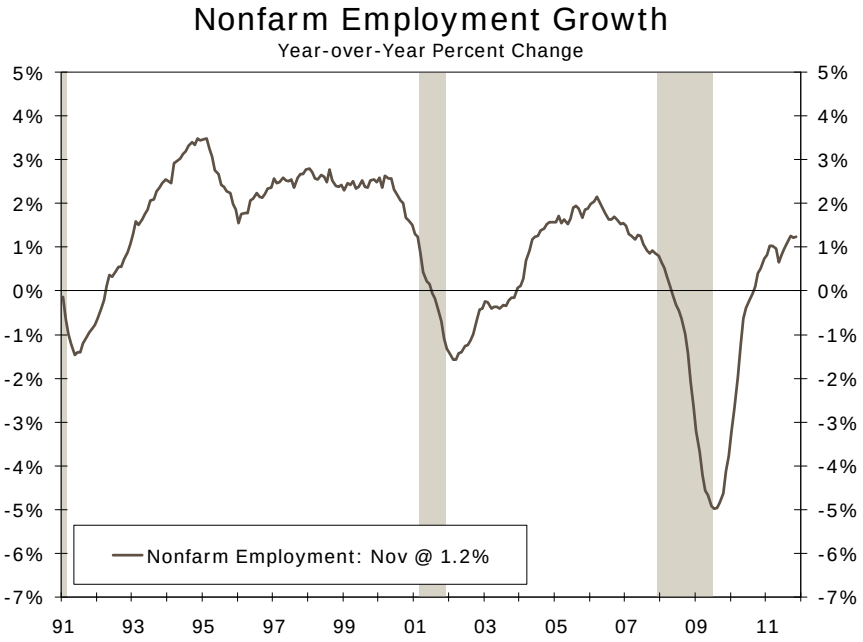
States facing protracted recoveries are also likely to continue to endure significant budget battles. The problem for these states is that the economy is not as large as thought when budgets and spending commitments were made years ago, nor is the economy growing as rapidly as was previously considered. In short, the tax base is too small and not generating as much revenue as had been counted on. States have responded by raising taxes and cutting spending, which has often meant sending some of the hardest decisions down the line to local governments. For these states, reducing the size of government is imperative to bring the budget under control as the tax base simply is not growing fast enough to support dramatically higher taxes.

States with structural budget challenges are at an additional risk of having weak economic fundamentals in the quarters ahead. Most states are seeing improvement in tax revenues, but for some the growth is not enough to close persistent budget gaps caused by a mismatch of policies and revenues amid legislative gridlock. While many states counted on federal funds through programs like the American Recovery Act or drew on rainy day accounts to patch budget gaps, these sources have largely dried up. Furthermore, temporary and one-time fixes, such as skipping pension fund payments and selling state-owned buildings can only last so long. The long-term inability of these states' governments to align spending with revenues may force legislators into a position to cut spending and/or raise taxes at a time when a state's economy may not be able to

withstand the shock of such policy changes. This poses a political economy challenge, which is difficult to model.

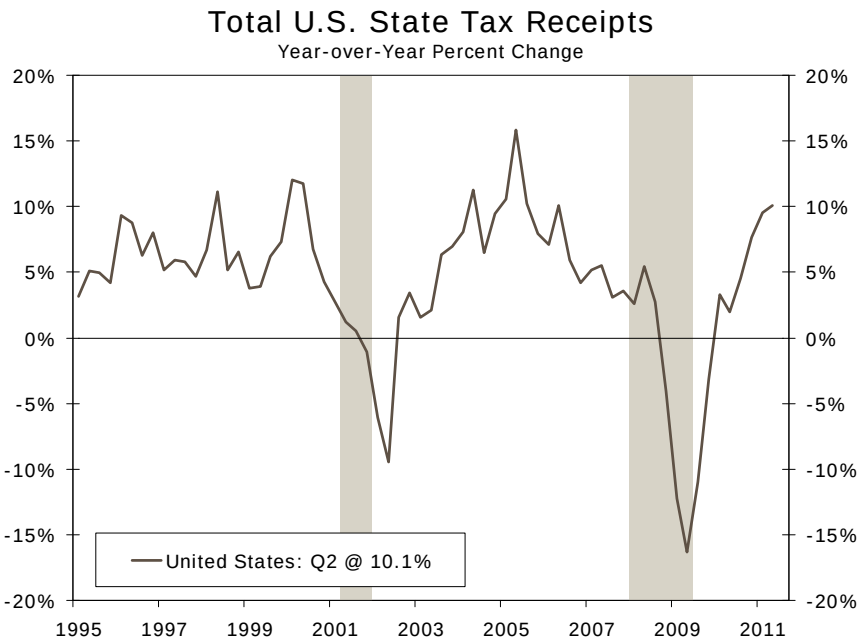
The most encouraging aspect of our analysis is the large and likely growing concentration of states showing a declining two-quarter ahead probability or a probability close to zero (0). Many states, even those severely affected by the recession, are seeing improving economic fundamentals and show little chance of weak fundamentals in the quarters ahead. As many states with large budget gaps in recent years are in relatively good shape, we offer evidence that concerns about state finances have to some extent been overblown.

Figure 1



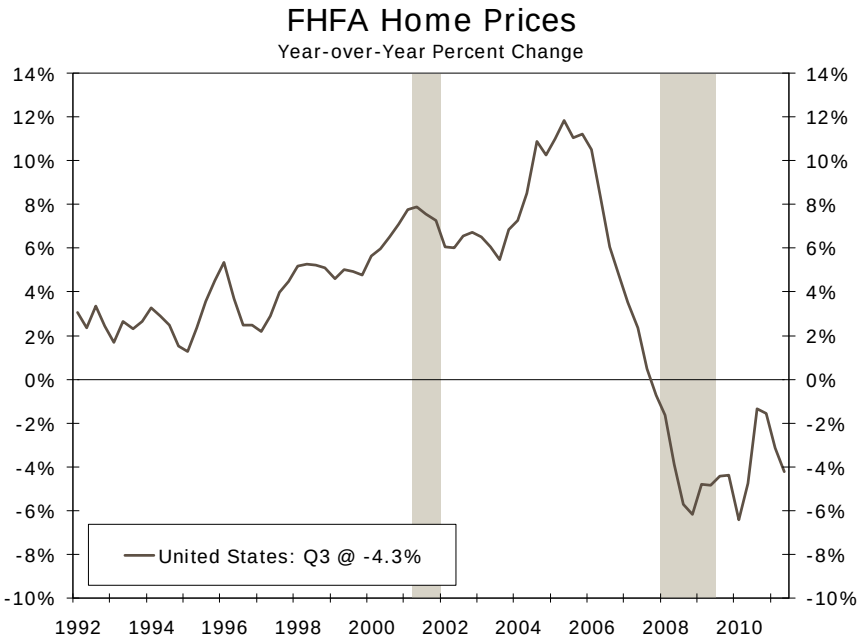
Source: U.S. Bureau of Labor Statistics and Wells Fargo Securities, LLC

Figure 2



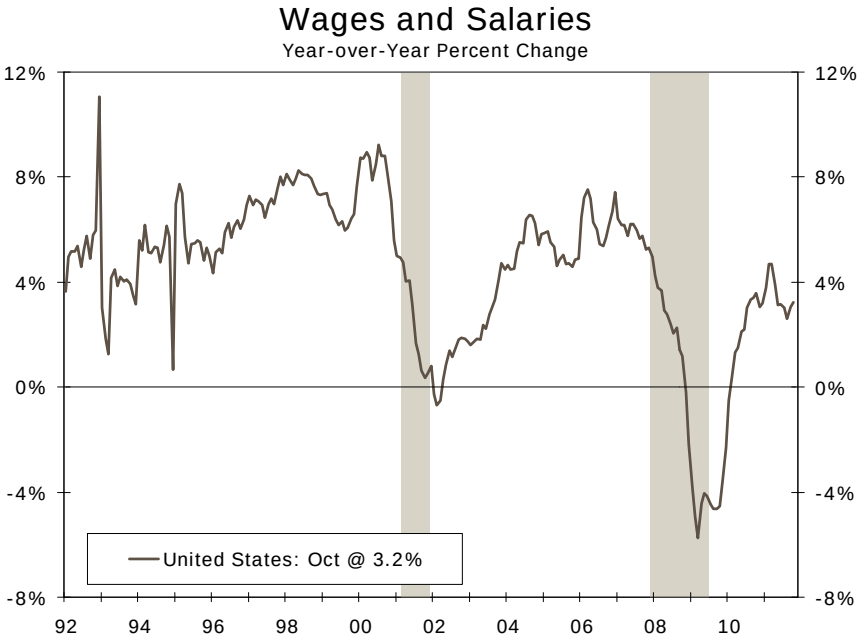
Source: U.S. Census Bureau and Wells Fargo Securities, LLC

Figure 3



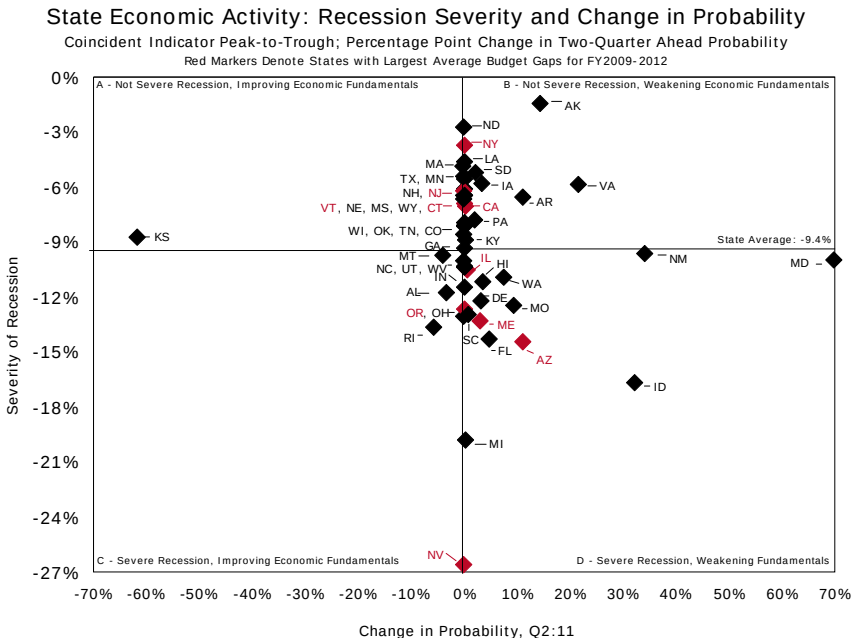
Source: Federal Housing Finance Administration and Wells Fargo Securities, LLC

Figure 4



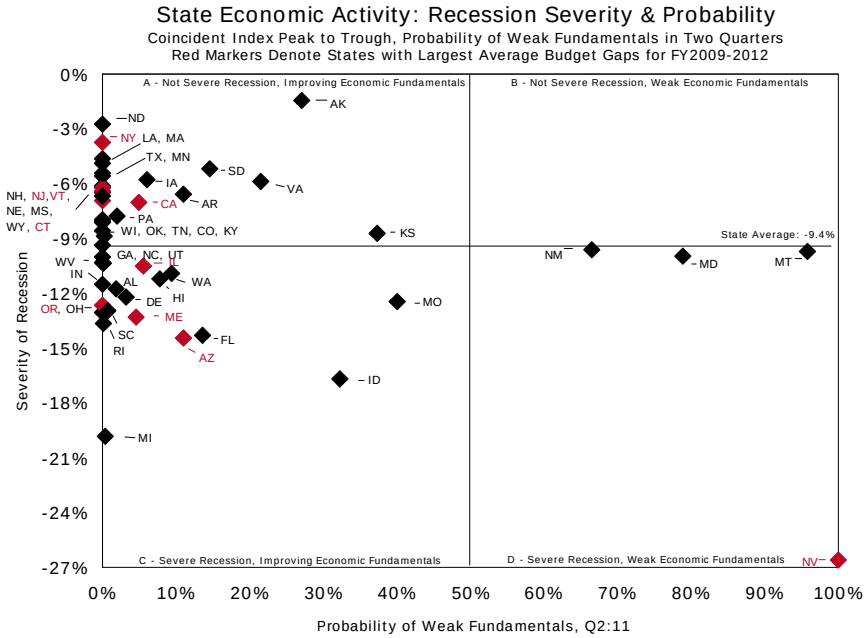
Source: U.S. Bureau of Economic Analysis and Wells Fargo Securities, LLC

Figure 5



Source: Wells Fargo Securities, LLC

Figure 6



Source: Wells Fargo Securities, LLC

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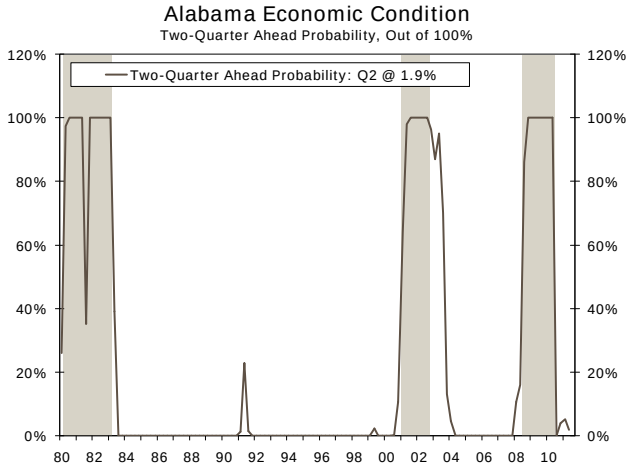
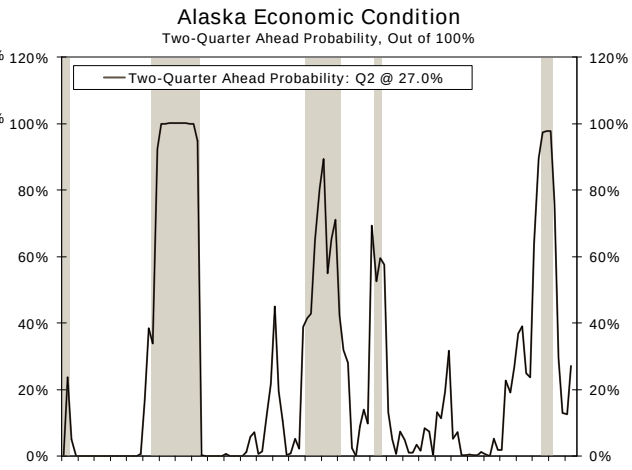
Appendix A: State Predictors for Probit Models

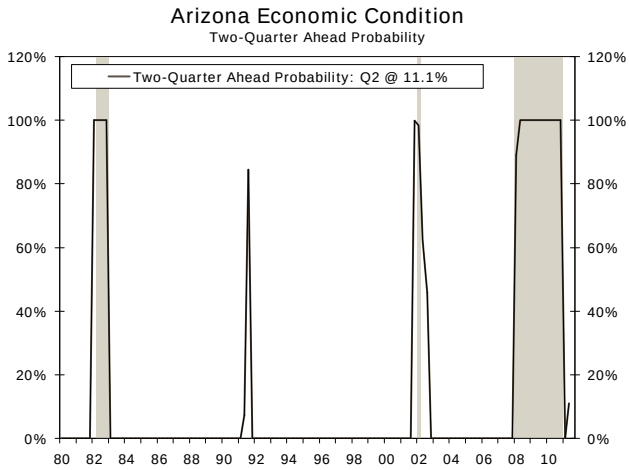
All state Probit models include nonfarm employment, tax revenues, FHFA house prices and wages and salaries income. The table below shows additional variables included in each state's model.

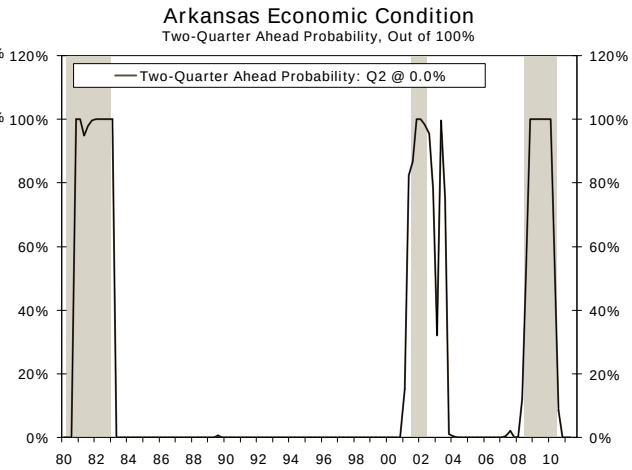
State	# of Variables	Variable 5	Variable 6	State	# of Variables	Variable 5	Variable 6
AK	4	---	---	MT	5	Crude Oil	---
AL	4	---	---	NC	4	---	---
AR	5	Food Stamps	---	ND	5	Food Stamps	---
AZ	5	Crude Oil	---	NE	5	Food Stamps	---
CA	6	Crude Oil	S&P	NH	4	---	---
CO	5	S&P	---	NJ	4	---	---
CT	5	S&P	---	NM	5	Crude Oil	---
DE	5	S&P	---	NV	5	Crude Oil	---
FL	6	Food Stamps	Crude Oil	NY	5	S&P	---
GA	5	S&P	---	OH	4	---	---
HI	5	Food Stamps	---	OK	5	Crude Oil	---
IA	5	Food Stamps	---	OR	5	Food Stamps	---
ID	5	Crude Oil	---	PA	4	---	---
IL	5	Crude Oil	---	RI	4	---	---
IN	4	---	---	SC	5	Food Stamps	---
KS	5	Crude Oil	---	SD	5	Food Stamps	---
KY	4	---	---	TN	4	---	---
LA	5	Crude Oil	---	TX	5	Crude Oil	---
MA	4	---	---	UT	4	---	---
MD	4	---	---	VA	4	---	---
ME	5	Food Stamps	---	VT	4	---	---
MI	5	Crude Oil	---	WA	5	Food Stamps	---
MN	4	---	---	WI	5	Food Stamps	---
MO	4	---	---	WV	5	Food Stamps	---
MS	5	Food Stamps	---	WY	4	---	---

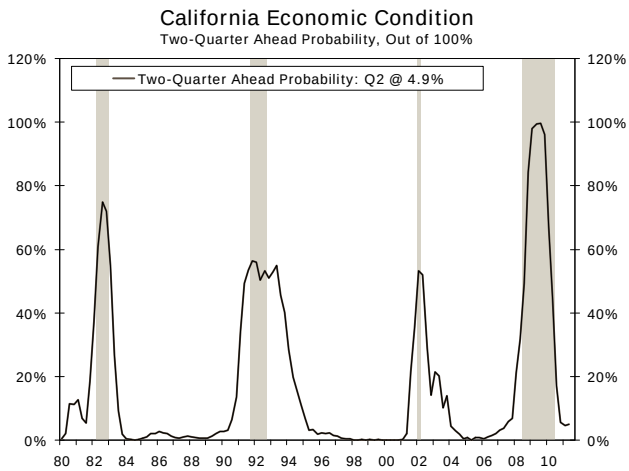
Appendix B: State Probit Models

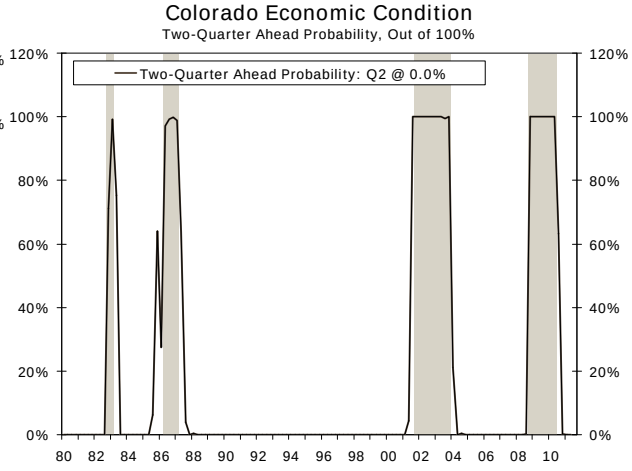


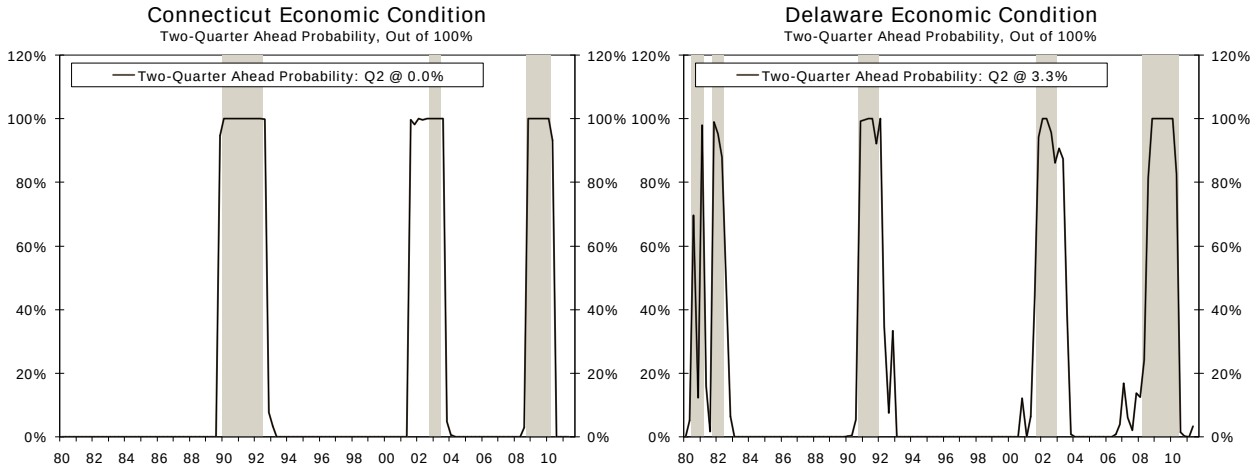


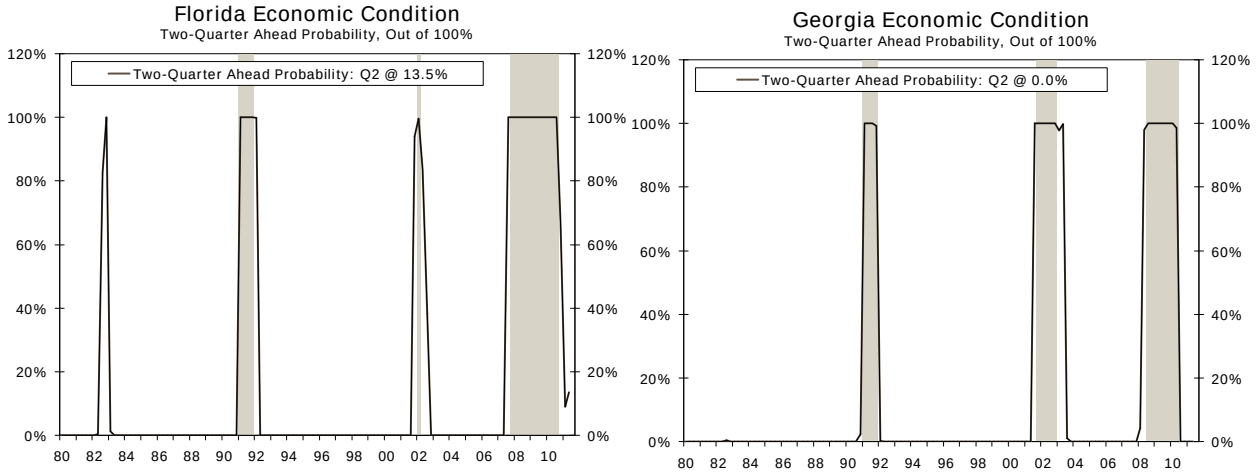


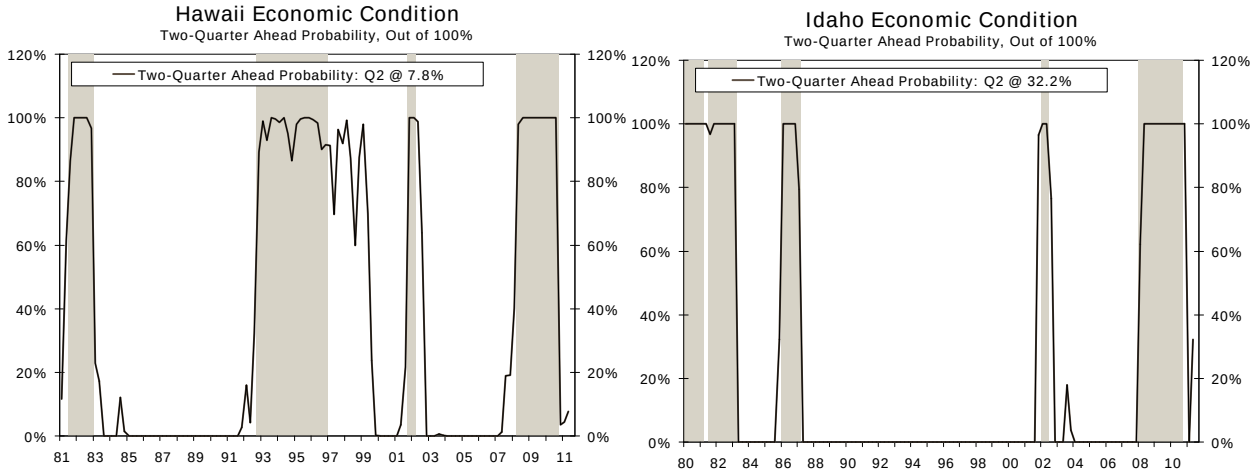


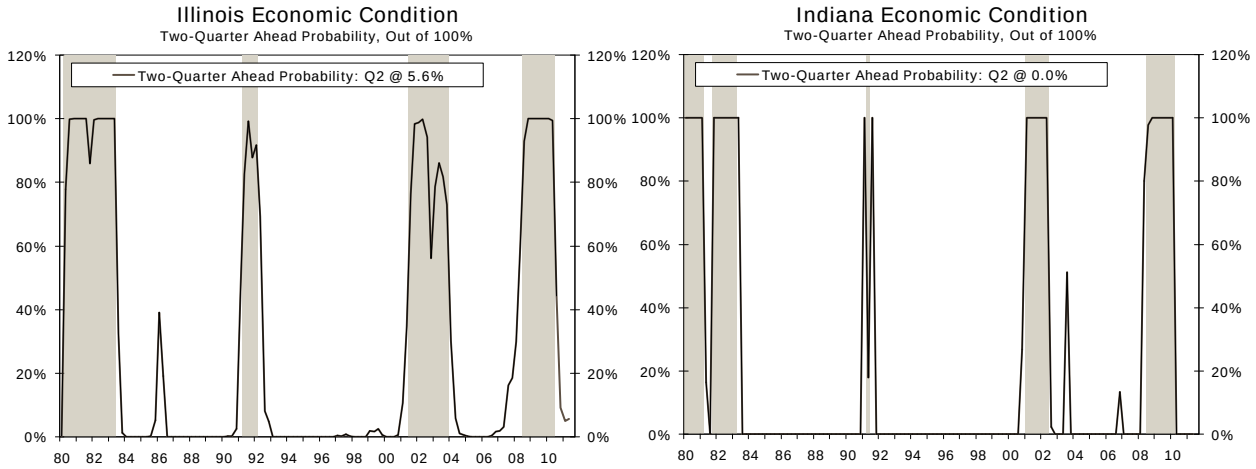




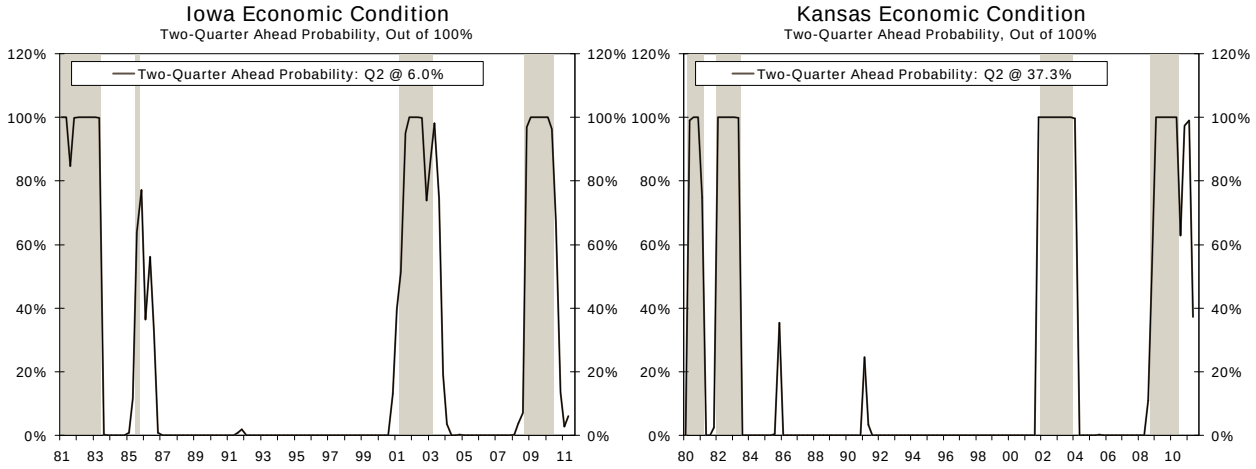

Connecticut Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.0%
Delaware Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 3.3%


Florida Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 13.5%
Georgia Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.0%

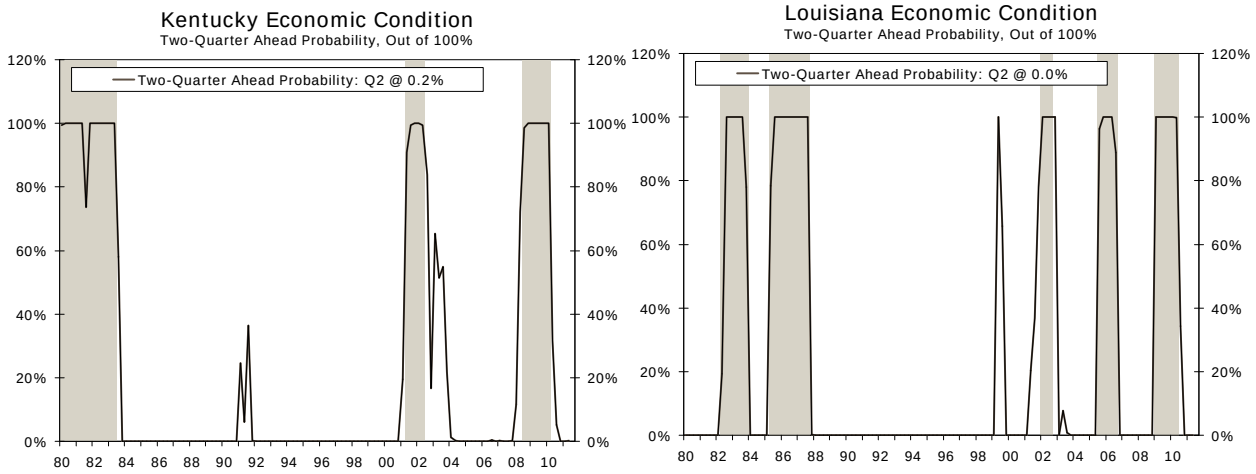

Hawaii Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 7.8%
Idaho Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 32.2%


Illinois Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 5.6%
120%
100%
80%
60%
40%
20%
0%
80 82 84 86 88 90 92 94 96 98 00 02 04 06 08 10

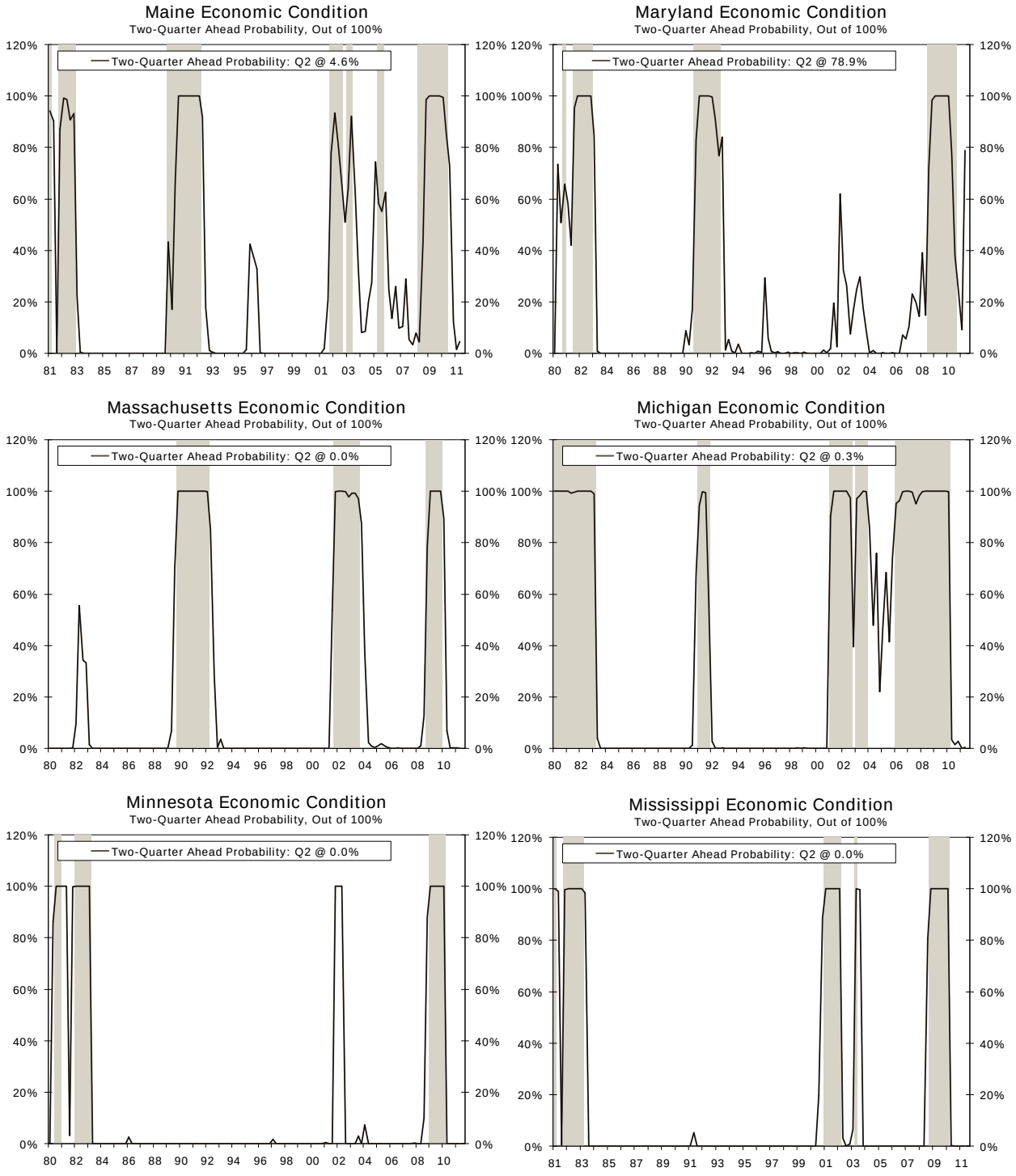
Indiana Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.0%
120%
100%
80%
60%
40%
20%
0%
80 82 84 86 88 90 92 94 96 98 00 02 04 06 08 10

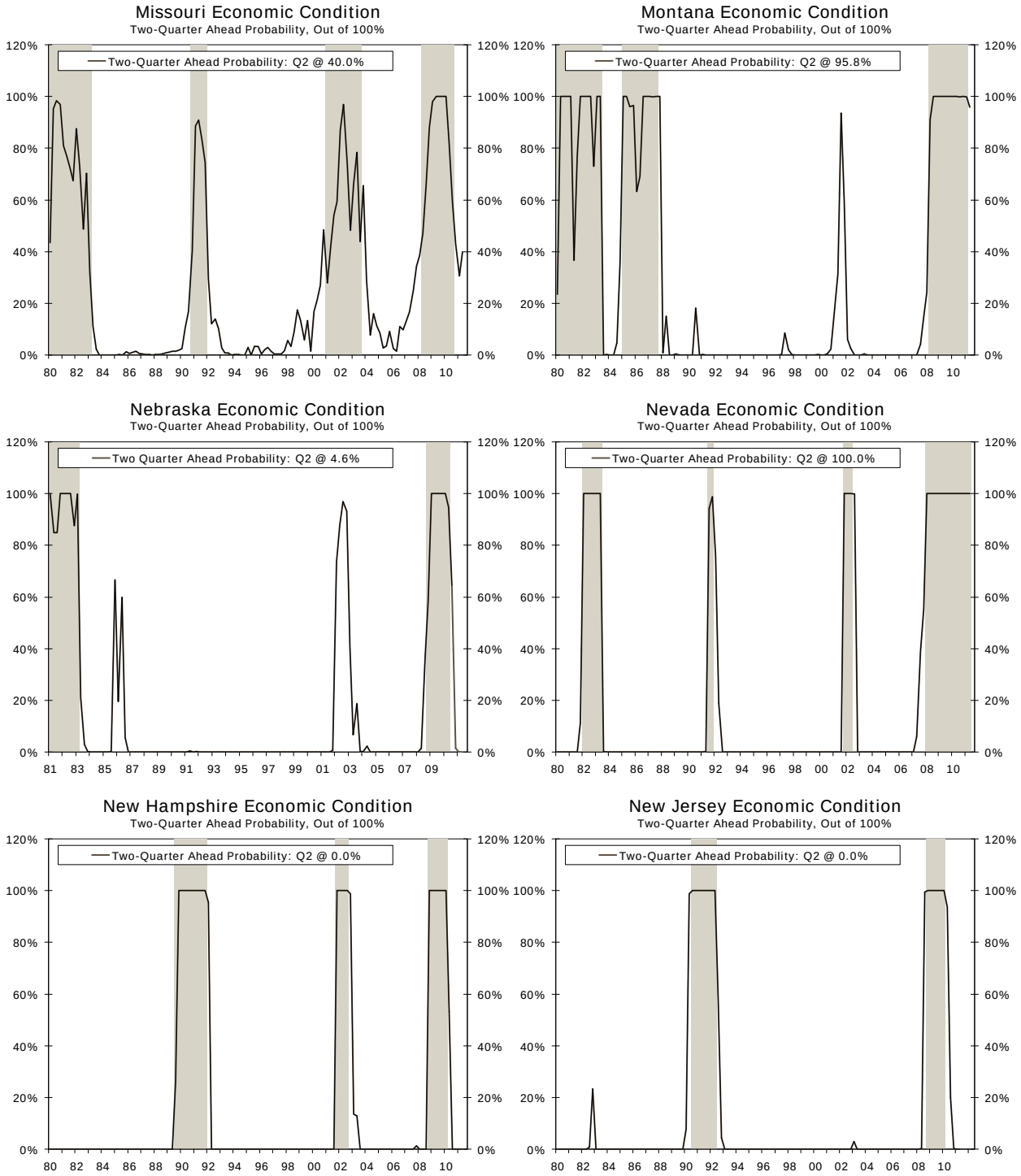

Iowa Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 6.0%
120%
100%
80%
60%
40%
20%
0%
81 83 85 87 89 91 93 95 97 99 01 03 05 07 09 11

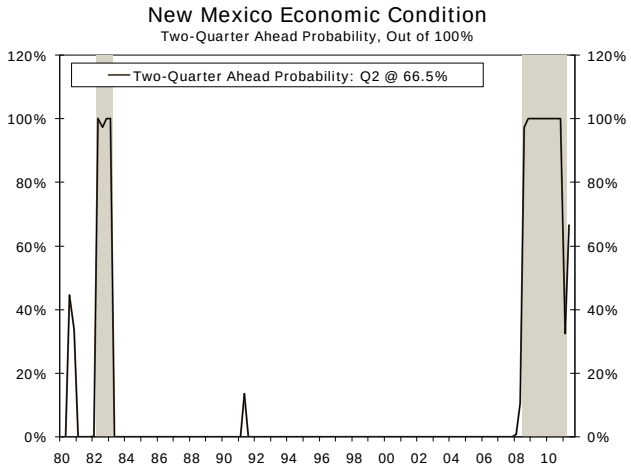
Kansas Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 37.3%
120%
100%
80%
60%
40%
20%
0%
80 82 84 86 88 90 92 94 96 98 00 02 04 06 08 10

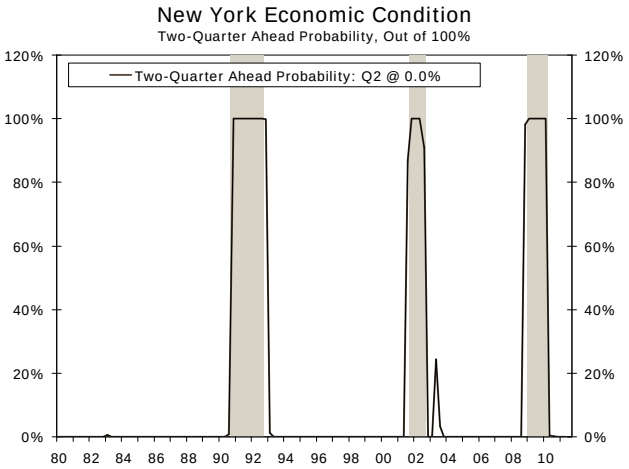

Kentucky Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.2%
120%
100%
80%
60%
40%
20%
0%
80 82 84 86 88 90 92 94 96 98 00 02 04 06 08 10

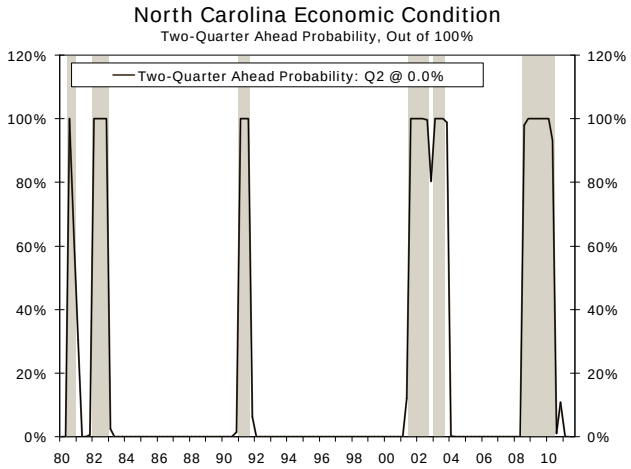
Louisiana Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.0%
120%
100%
80%
60%
40%
20%
0%
80 82 84 86 88 90 92 94 96 98 00 02 04 06 08 10

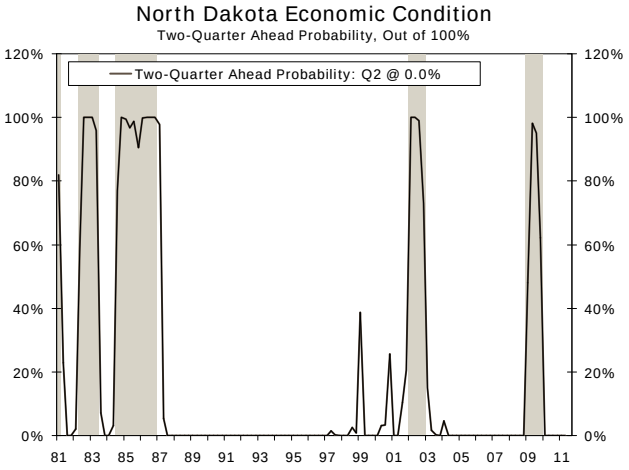

Maine Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 4.6%
Maryland Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 78.9%
Massachusetts Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.0%
Michigan Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.3%
Minnesota Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.0%
Mississippi Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.0%

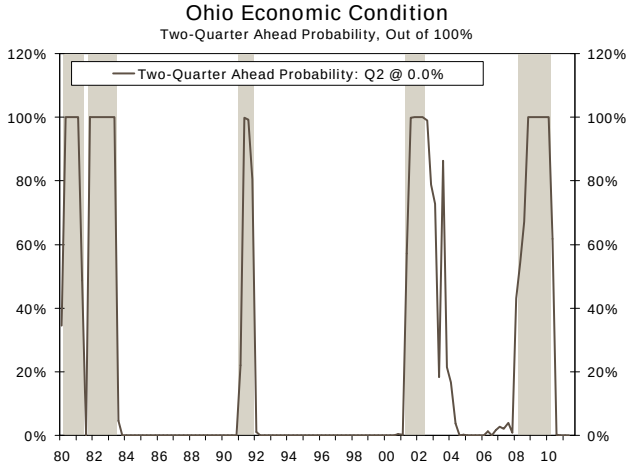

Missouri Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 40.0%
Montana Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 95.8%
Nebraska Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two Quarter Ahead Probability: Q2 @ 4.6%
Nevada Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 100.0%
New Hampshire Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.0%
New Jersey Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.0%

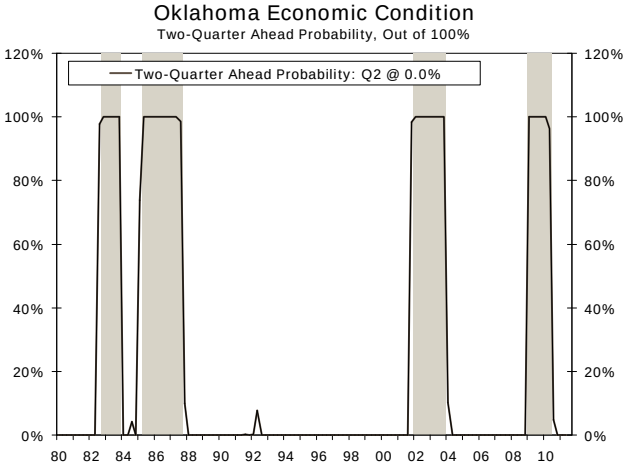

New Mexico Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 66.5%

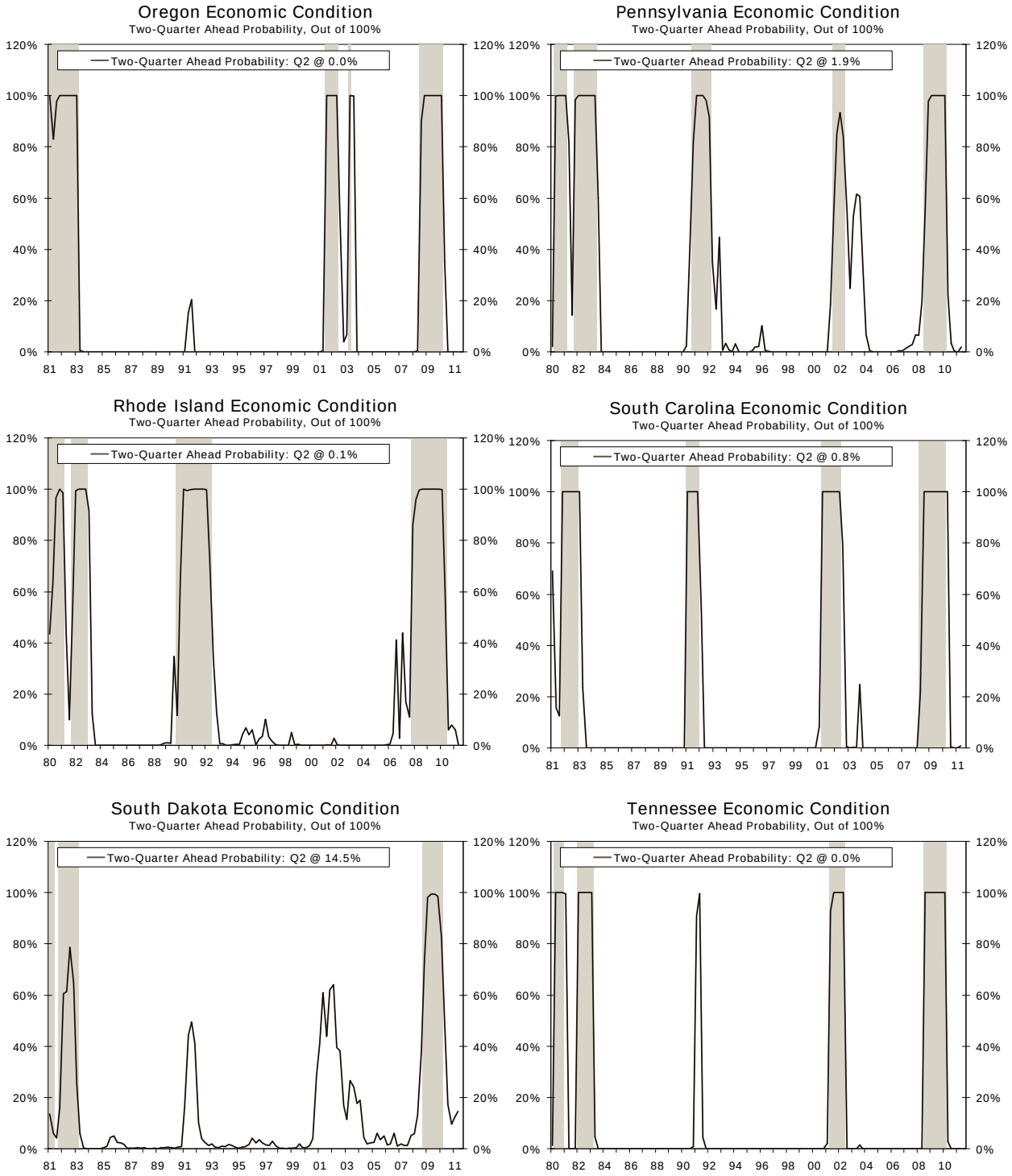

New York Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.0%

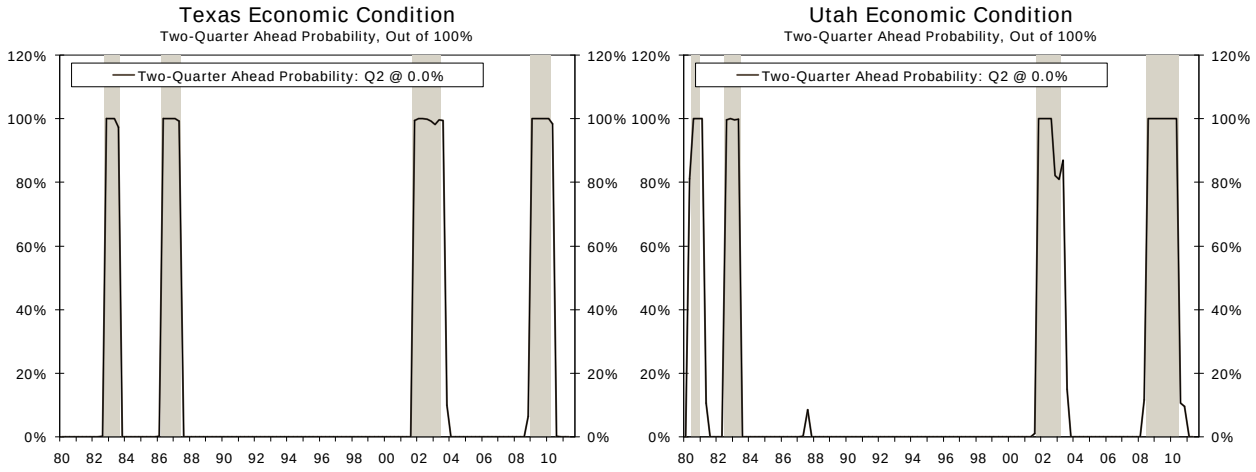

North Carolina Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.0%


North Dakota Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.0%

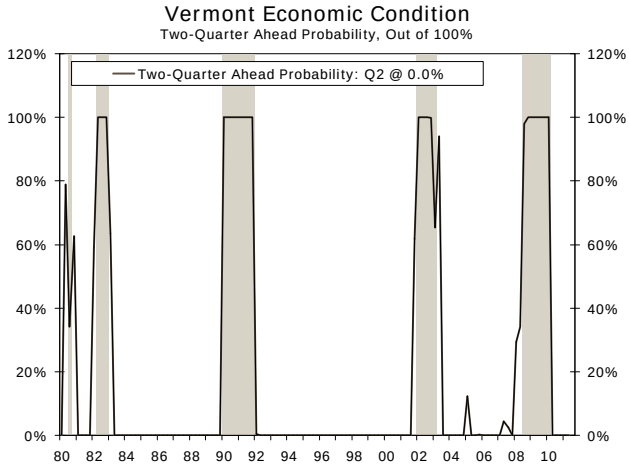

Ohio Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.0%

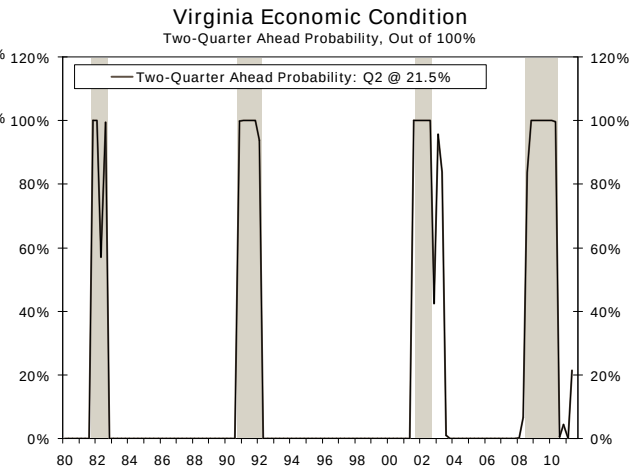

Oklahoma Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.0%

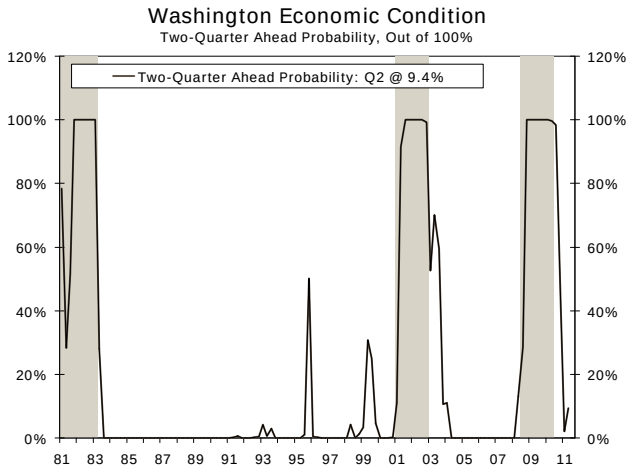

Oregon Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.0%
Pennsylvania Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 1.9%
Rhode Island Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.1%
South Carolina Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.8%
South Dakota Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 14.5%
Tennessee Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.0%

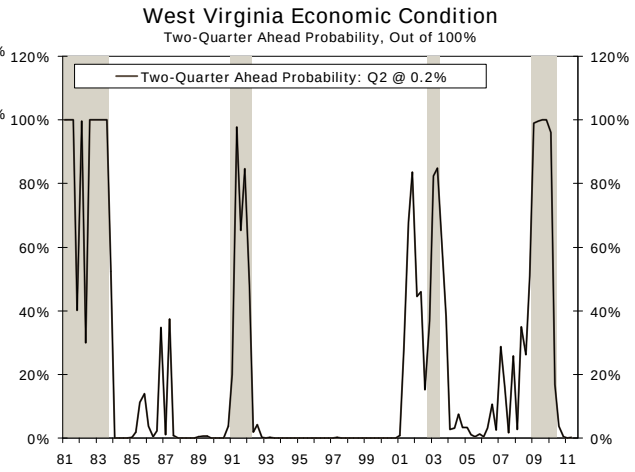

Texas Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.0%
120%
100%
80%
60%
40%
20%
0%
80 82 84 86 88 90 92 94 96 98 00 02 04 06 08 10

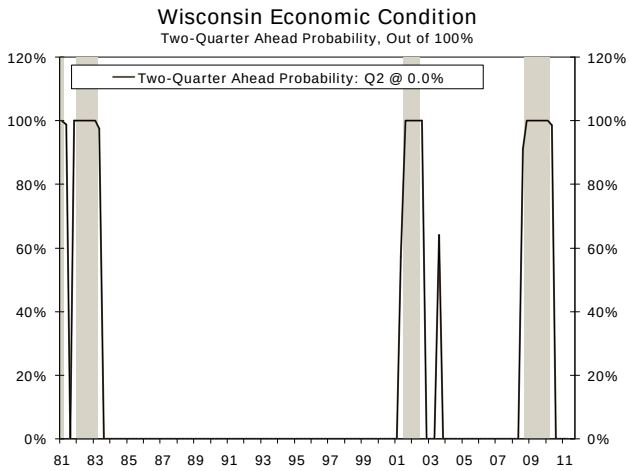
Utah Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.0%
120%
100%
80%
60%
40%
20%
0%
80 82 84 86 88 90 92 94 96 98 00 02 04 06 08 10

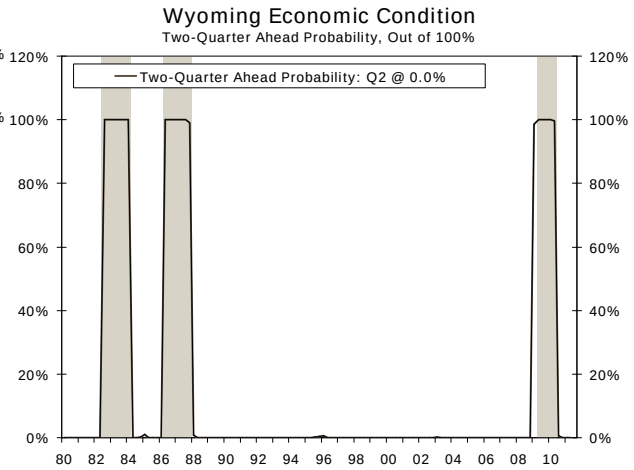

Vermont Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.0%
120%
100%
80%
60%
40%
20%
0%
80 82 84 86 88 90 92 94 96 98 00 02 04 06 08 10


Virginia Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 21.5%
120%
100%
80%
60%
40%
20%
0%
80 82 84 86 88 90 92 94 96 98 00 02 04 06 08 10


Washington Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 9.4%
120%
100%
80%
60%
40%
20%
0%
81 83 85 87 89 91 93 95 97 99 01 03 05 07 09 11


West Virginia Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.2%
120%
100%
80%
60%
40%
20%
0%
81 83 85 87 89 91 93 95 97 99 01 03 05 07 09 11


Wisconsin Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.0%
120%
100%
80%
60%
40%
20%
0%
81 83 85 87 89 91 93 95 97 99 01 03 05 07 09 11


Wyoming Economic Condition
Two-Quarter Ahead Probability, Out of 100%
Two-Quarter Ahead Probability: Q2 @ 0.0%
120%
100%
80%
60%
40%
20%
0%
80 82 84 86 88 90 92 94 96 98 00 02 04 06 08 10