Estimating Regional Recession Probabilities

BY ADAM KAMINS

With fears of a global recession dominating the discourse for more than a year, it is important to remember that not all economies are created equal. Economic history is littered with examples of painful downturns in some areas that barely register in others.

The depth of the past two recessions, stemming from the Financial Crisis in 2007-2009 and the COVID-19 pandemic in 2020, meant that virtually all metro areas contracted meaningfully. But other, less severe, recessions in the U.S. have spared parts of the country; and in other cases, a very specific shock has pushed isolated areas into a somewhat self-contained recession. These include the severe decline in oil prices during the middle of the last decade.[1]

It is therefore important to avoid painting with the same broad brush when assessing recession risks, while also ensuring that the broader context is reflected properly for regional economies. To meet those objectives, Moody's Analytics has overhauled its approach to generating recession probabilities for states and metro areas. The new methodology utilizes a binary dependent variable and near-term shifts in labor market, housing and cost variables to assess the likelihood of a recession taking place within 12 months.

The first part of this paper reviews the methodology underlying the new regional recession probability calculations. It will include a discussion of key drivers and a summary of the equation specifications that are used. The second section discusses some takeaways, including a look at which areas are among the most and least vulnerable to a downturn in the next year.

Key inputs

The first step in modeling regional recession probabilities involves identifying not just the drivers, but what type of transformations to perform. The second question is critical: consider, for example, the unemployment rate. A case could be made to simply look at the level, but structural differences across metro areas would keep the Farm Belt's recession probability low while artificially elevating that of areas with structurally high joblessness such as El Centro CA, which has never fallen below 12%.[2] The change from a year ago might be too lagged, but a month-to-month change would likely introduce too much volatility.

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1   Natural disasters are another prime example of this, driving a regional economy into recession but usually having little impact more broadly. Since those shocks are not economically driven, however, they are not as relevant to a forward-looking discussion.

2   Based on preliminary estimates through July 2023.

In order to ensure that these issues were not overly problematic, a z-score for each series being was used, comparing the current month against history, going back to 1990 or the date of the first historical value. This represents the difference between the current value and the average over time, divided by the standard deviation. Such an approach not only properly contextualizes individual series, but controls for their magnitude, allowing for meaningful inferences about the drivers of increased or decreased probabilities.

While this measure of normalized growth or levels was the standard transformation of the independent variables being used, transformations are of course only as useful as the underlying drivers.

To capture the impact of labor market momentum, two series were used. The first was the **growth rate of payroll employment**; this series is based on a comparison of the most recent 12-month average and the prior 12-month figure. The intuition is that greater evidence of recent momentum in payroll growth corresponds to reduced risk of falling into recession.

The second labor market series is the **change in the unemployment rate**. This involves subtracting the most recent jobless rate from the rate from three months earlier. That time horizon was used in large part because a meaningful increase in the unemployment rate over three months is typically a surefire sign of recession.[3]

House prices are also a critical input into the calculation. Using the Federal Housing Finance Agency All-Transactions Index, two measures are used to capture the impact of the real estate market. This involves the **year-over-year change in house prices** relative to historical averages. Stronger price growth decreases the likelihood of a recession, while backtracking prices represent a red flag.

The other input is based on house price levels compared with historical norms. Instead of looking at the year-over-year change, this measure **compares current prices to their historical averages**. While generally positive for all metro areas, the greater the value for this series, the more likely it is that prices have become somewhat untethered from fundamentals. This can be thought of us as a crude measure of overvaluation across markets. Ultimately, the further removed an economy is from its average from prior decades, the greater its risk of a correction that could spill into the rest of the economy.[4]

Finally, cost pressures are a key determinant of recession risk. This is based on the **year-over-year change in the three-month moving average of the consumer price index**. For metro areas, timely CPI estimates that are produced monthly by Moody's Analytics are used as the starting point. For states, this is complicated somewhat by the lack of a state-level series, so instead published figures for each region are used for their corresponding states.

During the development process, a number of other series were used as potential explanatory variables, but they were deemed less suitable. Among these were labor force participation, industrial production, and the Case-Shiller house price index. Similarly, in most cases more than one transformation was used initially before settling on one that was both economically intuitive and showed a good statistical fit.

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3 See https://www.economy.com/economicview/analysis/353854, among other pieces.

4 Because house prices can be lagged relative to other series, the one-quarter-ahead forecast is typically used to represent a more current snapshot of what we believe the housing market to look like.

Modeling approach

In order to translate these inputs into a meaningful forecast, the Moody's Analytics business cycle status formed the basis for the dependent variable. This is produced each month for every economy in the U.S. and extends back more than two decades. It has traditionally used a combination of timely economic data and analyst judgment to determine where different economies are in their business cycles.

For months in which a state or metro area's status was either "In Recession" or "Moderating Recession," a recession dummy was created and set equal to one. For all other periods, its value was zero.

A traditional ordinary least squares approach, however, is not compatible with a dummy variable. So instead, a probit model was used; this allows for a binary dependent variable and returns a probability of that series being equal to one.

Given the use of data for 50 states and more than 400 metro areas or divisions, panel regression techniques were employed. This allows for a far more robust sample that included more than 10,000 observations for states and more than 80,000 for metro areas and divisions.

Each of the independent variables was expressed as a 12-month lag. This is because the objective is to identify shifts in history that foretold a recession one year later. Therefore, the ultimate outcome of the process is a value for a period roughly one year into the future, which translates to the risk of a recession in the next year.[5]

The state equation includes a constant term along with all but one of the five variables outlined in the prior section. That is because the change in employment is far less predictive of recession than any other series. While the z-statistic produced by the probit model technically indicates weak statistical significance, the large sample may overstate this, and the fact that it is nearly 20 times less powerful a predictor than any other variable justified its removal.

The change in the unemployment rate, house prices relative to their historical norms, and the rate of inflation all show a positive, statistically significant link to a recession one year into the future. The change in house prices, meanwhile, is negatively correlated with recession risk, with upward momentum in the housing market suggesting diminished risk. These results are intuitive, but there is some additional insight derived from the unemployment rate proving especially impactful, likely crowding out the effect of payroll changes.

After running a model based on this equation, a preliminary probability is created; but the process does not end there. First, an adjustment is made to account for the possibility that analysts or the business cycle index may have designated a place as being at elevated risk. For such states, if the recession probability is already above 50%, then no change is made. But if it is below 50%, the series is brought halfway up to even odds. In other words, if the initial model assigns a 30% probability but an area is classified as at risk of falling into recession, then the probability will be adjusted up to 40%.

Based on this set of probabilities, a final step involves "squeezing" to ensure alignment with the U.S. figure. That number is based on a national model and the subjective judgment of Mark Zandi, chief economist of

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5   Note that "next year" may mean around 10 months from the date of publication of the measure, which is a function of the lag in the release of the relevant economic data.

Moody's Analytics. It also takes into consideration a consensus estimate based on a monthly survey of around 60 staff economists, an exercise that began in the fall of 2022 (see Chart 1).

Chart 1: National Recession Probability Is Gradually Falling

Moody's Analytics economists' subjective probability of a U.S. recession in 12 mo, avg, %
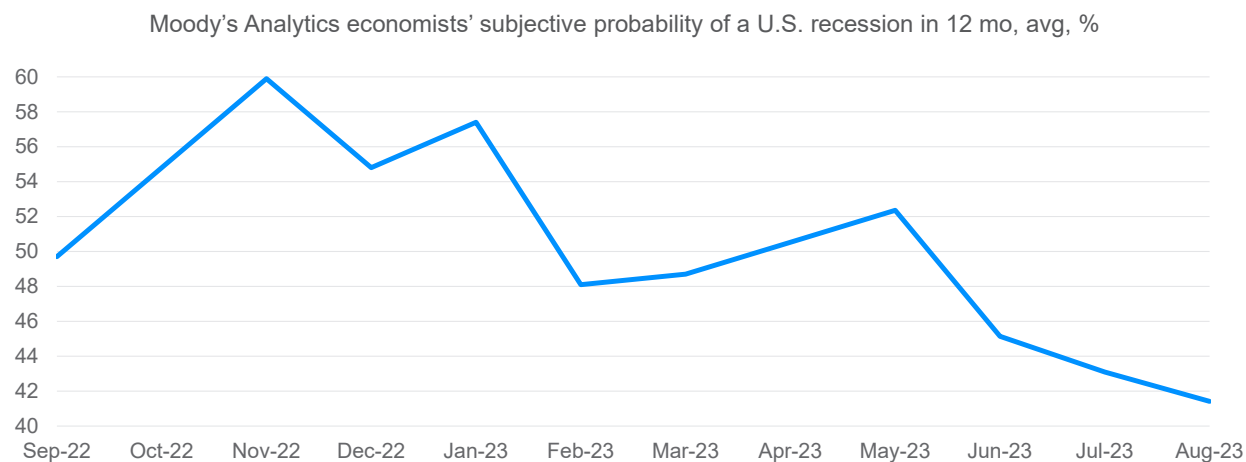
Source: Moody's Analytics

If the U.S. probability differs from the population-weighted average across states, each state-level probability is adjusted accordingly. However, the squeezed value is not allowed to climb higher than 85%, based on the notion that it is all but impossible to predict a year-ahead recession with that much certainty. Controls are also in place to ensure that values do not fall too low and provide a false sense of security, as there is always some risk of a downturn in the near future.

For metro areas, the approach is similar. The regression equation uses the same fundamental construction as is employed for states, although in this case the change in payroll employment is used. That variable is still dwarfed by its peers, but it proves slightly more significant than it is for states and displays the appropriate sign. It should be noted, however, that the decision to make it part of the calculation has minimal impact on the final probabilities. Generally, the relationships and their relative magnitudes are similar when comparing states and metro areas (see Table 1).

As is the case for states, an upward adjustment is made, where necessary, for those places considered more at risk of falling into recession. And a population-weighted average is also used to ensure alignment with the U.S.

Ultimately, this process results in a set of recession probabilities that can differ noticeably across regional economies, but do not vary too wildly. This is by design. It reflects the fact that there are unique factors driving the vulnerability of different places. But at the same time, there is significant correlation between recession risk for one state or metro area compared to that of another. Put another way, one regional economy falling into recession tends to be a strong indicator that others will or perhaps have already begun to experience a downturn of their own.

Table 1: Probit Regression Results

Dependent variable: Probability of recession, 1=recession dummy
All independent variables except the constant term represent a 12-mo lag
Sample period: Nov 2002-Dec 2019

	States	Metro areas
Payroll employment, 12-mo MA, % change yr ago	-	-0.026***
	-	(0.01)
Unemployment rate, change from 3 mo ago	0.965***	0.736***
	(0.03)	(0.01)
FHFA HPI, % change yr ago	1.206***	0.690***
	(0.06)	(0.01)
FHFA HPI, % diff vs. avg	-0.576***	-0.645***
	(0.02)	(0.01)
CPI, 3-mo MA, % change	0.982***	0.522***
	(0.04)	(0.01)
Constant	-1.734***	-1.295***
	(0.06)	(0.01)
n	10,506	83,018
R-squared	0.34	0.28

Note: ***p<0.01, **p<0.05, *p<0.1; standard errors in parentheses

Sources: BEA, BLS, FHFA, Moody's Analytics

Where risks are concentrated

While cooling inflation and slowing job growth in recent months have made the odds of a soft landing more favorable, the U.S. economy is hardly out of the woods. As a result, regional pockets of heightened vulnerability remain. As of June, when the national recession probability was at 40%, about two dozen metro areas faced greater than even odds of falling into recession by mid-2024. Even so, the most vulnerable sat at only slightly above 50%. On the other end of the distribution, all but 17 economies face a 20% probability or higher.

Similar patterns can be observed when comparing state probabilities. For the early part of the year, as the national probability hovered around 50% and most states were moving in a similar direction, the distribution was extremely tight. As the spring went on, the national probability dropped a bit and some differences across states began to grow more pronounced, widening the range. But even after that, the interquartile range remains tight and 39 of 50 states sit between a 35% and 45% probability (see Chart 2).

Yet even within a tight regional distribution, there are clear patterns. Austin TX is the nation's most vulnerable economy, featuring a near-perfect storm of risk factors. Its labor market is slowing, inflation is above average, and house prices endured a more significant recent correction than they did nationally. Further, Austin has experienced some of the most rapid house price increases in the U.S. over the past few decades, consistent with its status as one of the nation's more overvalued markets. Combine that with the impact of tech's recent struggles and the metro area's vulnerability is even more pronounced.

Similar dynamics are playing out in other Texas markets, particularly Dallas-Fort Worth, but they are most widespread in the Mountain West. Boise ID's red-hot job and house price growth has caused rapid price increases, eroding affordability. This has made the metro area especially vulnerable, but it is hardly alone in its region. Denver, Salt Lake City, and Phoenix all rank among the 25 economies with the most foreboding recession odds, and they are joined by a handful of smaller Rocky Mountain economies (see Chart 3).

Chart 2: Range of Probabilities Widens, but Regional Variation Remains Limited

Distribution of state recession probabilities in 2023, by mo

Lines represent overall range across states.
Blue shaded area represents the interquartile range.
Green dot is U.S. probability.

Jan Feb Mar Apr May Jun
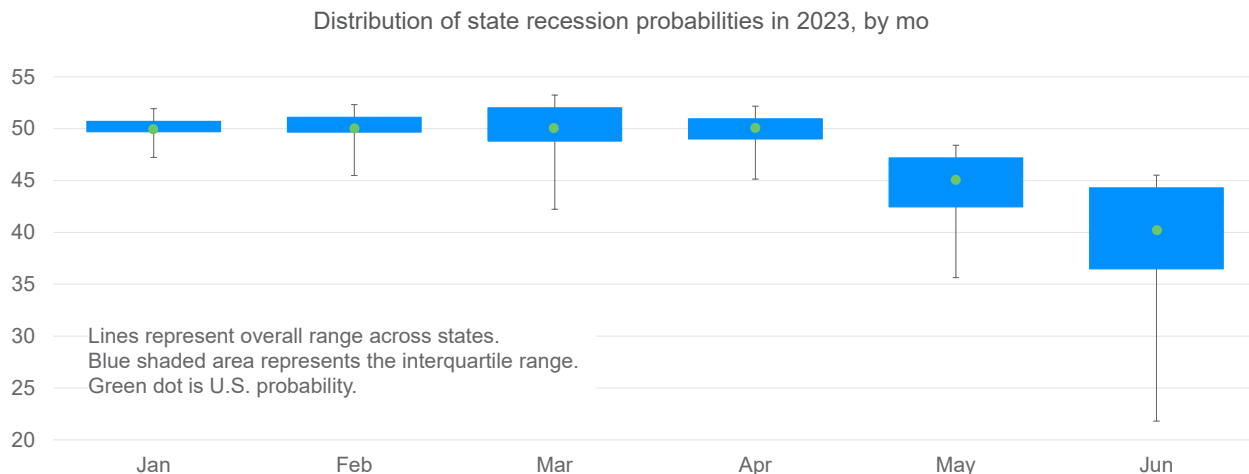
Source: Moody's Analytics

Chart 3: Recession Fears Are More Justified in South and West

Probability of recession in the next 12 mo as of Jun 2023, %

Austin TX
Boise ID
Ogden UT
Tampa FL
Dallas
Colorado Springs CO
Fort Worth TX
Denver
Salt Lake City
Bakersfield CA
Phoenix
Seattle
Raleigh NC

Highest probabilities among the nation's
100 most populous metro areas/divisions

49.0   49.5   50.0   50.5   51.0   51.5   52.0   52.5   53.0
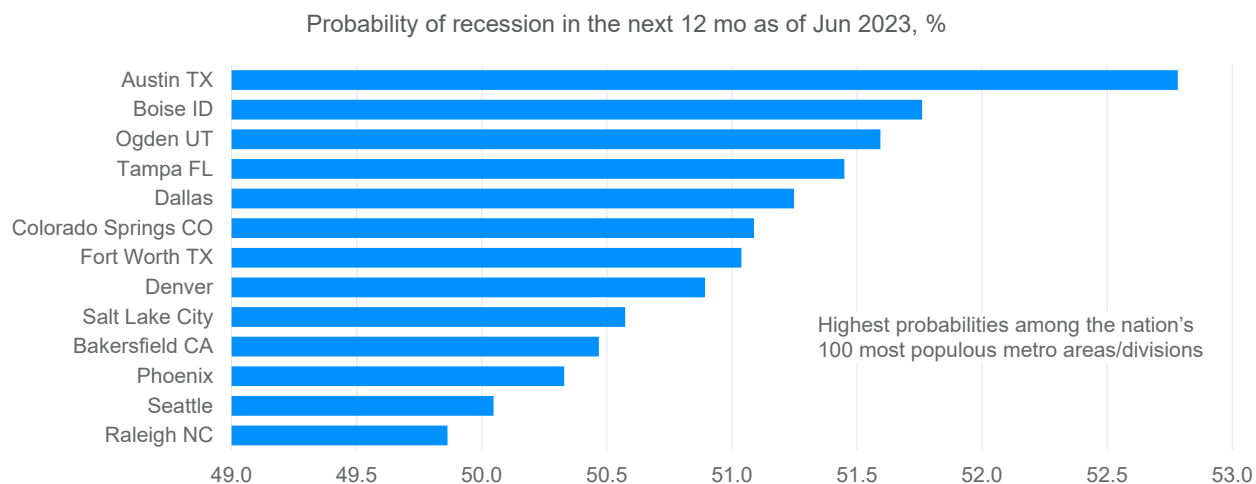
Source: Moody's Analytics

Safe(r) havens

Slower-growing areas, particularly those in the Northeast, are generally less exposed to a potential downturn. That region's struggles in the years following the pandemic have resulted in more modest growth but also help to ensure a degree of stability. Given the importance of recent momentum—either positive or negative—in determining recession risks, this lack of movement is important to keeping risk at bay.

Similarly, the Northeast and, to a lesser extent, the Midwest have not experienced the same degree of house price acceleration in recent years as the rest of the nation. Therefore, markets are not as overvalued, and the recent correction proved more benign. This is part of why of the 10 metro areas with the lowest recession

probabilities as of June, seven are small northeastern economies. They are especially concentrated in rural Pennsylvania and include Williamsport, Erie, Altoona and East Stroudsburg. Among states, Connecticut, Maryland and Vermont rank as the least risky, highlighting the region's relative advantage (see Chart 4).

Chart 4: Northeastern Economies Are Better Insulated

Probability of recession in the next 12 mo as of Jun 2023, %
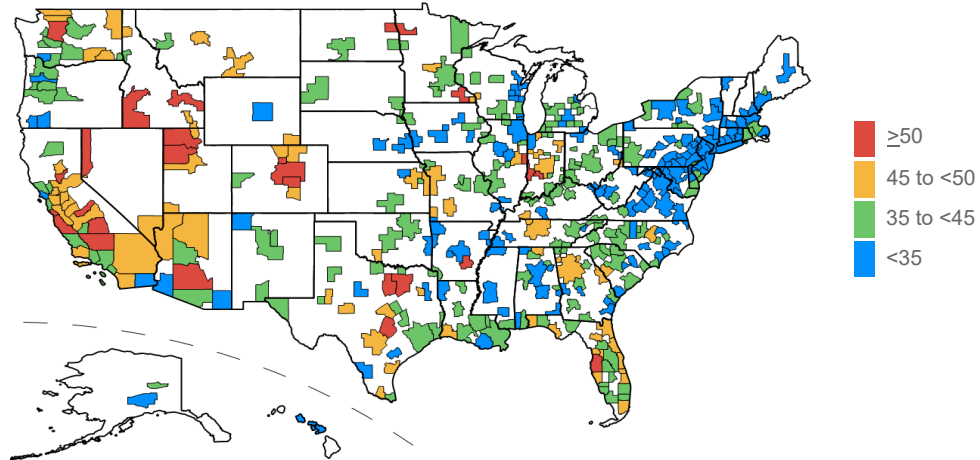
Source: Moody's Analytics

The large cities in the Northeast are not quite as well-positioned, but they too are less vulnerable than the U.S. as a whole. This list includes New York, Boston and Washington DC, all of which have experienced slow but steady progress along with below-average inflation amid tepid aggregate demand. Those same dynamics extend across regions as well. In fact, they are largely responsible for Chicago boasting the lowest probability of falling into recession among gateway areas (see Chart 5).

Chart 5: Lowest Recession Probabilities Are in Slower-Growing Metro Areas

Probability of recession in the next 12 mo as of Jun 2023, %

Lowest probabilities among the 100 most populous metro areas/divisions; note that Honolulu figure does not yet capture spillover from Maui wildfires.
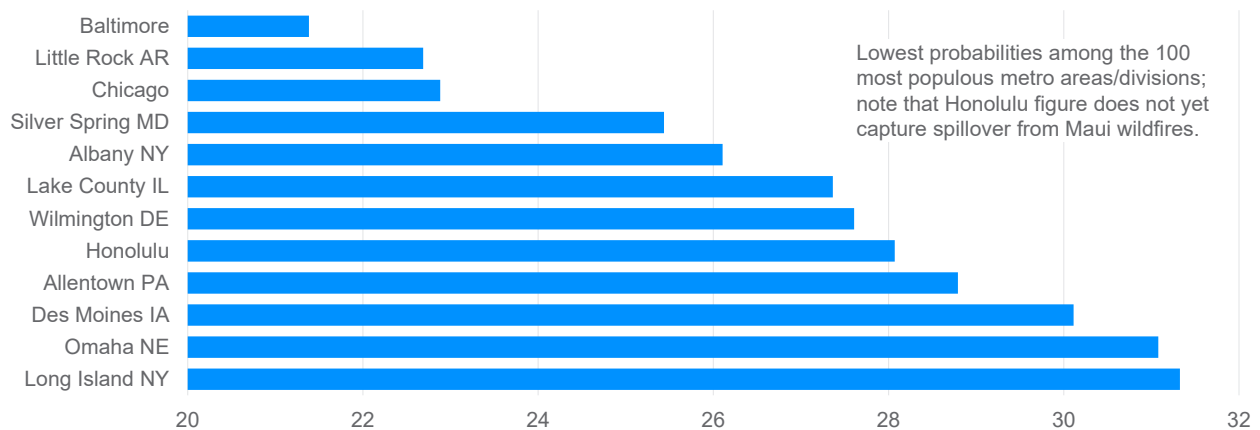
Source: Moody's Analytics

Of course, many caveats apply to the relative safety of certain economies. For one, the events that drive the next global or national recession—whether it occurs in a year or in a decade—will have a lot to say about which places are hit hardest. For example, an especially steep financial market shock would suddenly place the large global markets described above in harm's way. But that requires overlaying a qualitative understanding of an economy's drivers and how they intersect with broader dynamics, which is beyond the scope of a mathematical model like this one.

Additionally, it is worth reinforcing that when a few regional dominoes fall, many others will likely follow. Even if the next recession proves less severe than its two immediate predecessors, it will take some luck and significant structural advantages for certain economies to stay afloat while many of their peers begin to take on water.

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