The Inequality of Recessions

The Application of Turning Point Analysis with Labor Market Disparities[†]

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Abstract

Using novel turning point analysis shows that recessions are often detectable in economically vulnerable groups first and will often present as increases in underemployment. Utilizing roughly 4,000 datasets and optimizing over all parameters, this work offers a method for detection and improved dating of U.S. recessions in real time and offers a theoretical justification for the results. The method improves dating techniques for determining the start and end of a downturn. Modifying labor-based recession indicators utilizing disaggregated unemployment metrics, such as labor utilization, vacancy rates, education, race, etc., yields more responsive indicators. Revealing stylized labor market facts, whereby vulnerable groups often experience economic downturns earlier. Significant disparities in labor market volatility and recovery highlight the need for modified indicators that account for disparate dynamics, offering a more comprehensive approach to recession detection and policy design.

JEL Codes: E32, J15, E24, E66, R23

Keywords: Business cycles, racial disparities, unemployment, labor market, economic indicators, recession, racial economics, employment trends, minority groups, economic inequality

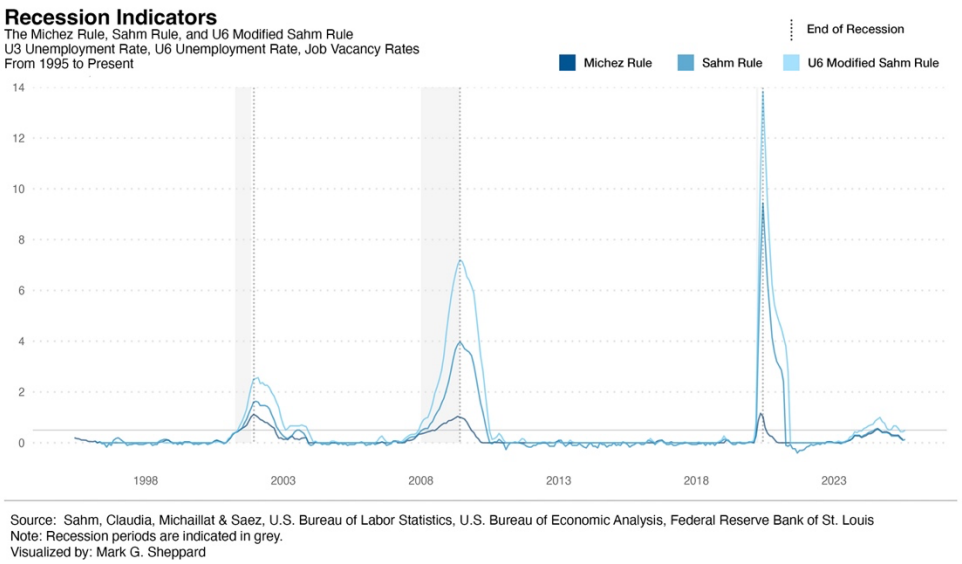
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1 Introduction

This paper further contributes to the literature on recession indications through using turning point analysis, by building on the seminal work of Claudia Sahm (2019), and the more recent contributions of Michaillat and Saez (2025), and validating those results with tools described by Michaillat (2025) and Ash & Nicklesburg (2024). Additionally, this work makes a contribution to the literature on business cycle dating, by utilizing decomposed aggregate measures, in the tradition of Davis (2006), Romer (1989), and Romer (1986).

Utilizing turning point analysis with subcategories of unemployment, such as: labor utilization by U-measure, spatial measures of unemployment by county, racial unemployment measures, gendered unemployment, industry measures, and so on, totaling roughly 4,000 measurements of labor, reveals a persistent trend whereby economically-vulnerable groups, like those racially-marginalized, those with lower education, those who work in more precarious sectors, or more disadvantaged areas, etc., often provide the earliest indication of an economic downturn. The U6 Modified Sahm Rule outperforms the traditional Sahm Rule, most other Modified Sahm Rules with respect to labor utilization, and the Michez Rule, with an interpretation that directly follows from the labor literature on the intensive/extensive margin described in Hicks (1932), with results that coincide with broader empirical work and with an intuitive conclusion: recessions hit vulnerable groups first.



While any specific subgroup will likely have volatile labor market outcomes, resulting in a fairly noisy signal, using the U6 measure of labor utilization[1], which by composition represents an out-sized share of the aforementioned vulnerable groups[2], shown in Nunn, Parsons, and Shambaugh (2019), using U6 in a Modified Sahm Rule indicator yields a signal more in line with the traditional Sahm Rule, but additionally U6 captures movement along the intensive margin, showing that in the lead-up to a downturn, composite estimates of the

labor market outcomes of the most vulnerable groups will show early signs of a recession, specifically with a decline in labor utilization. The differing elasticities in employment add two contributions: more responsive real-time indicators, namely the U6 Modified Sahm Rule, and a clear description of the recessionary implications of the disaggregated labor market — specifically, that by traditional turning point metrics like the Sahm Rule show that vulnerable groups and areas, like the Black and Hispanic community of the de-industrialized Midwest, can often exist in a nearly constant state of relative recession.

1.1 The Sahm Rule

Labor market indicators serve as reliable gauges of economic downturns because employment conditions move closely with the overall business cycle—when the economy contracts, firms reduce hiring and lay off workers, making unemployment a particularly responsive measure of economic stress, described by Stock and Watson (1989).

The Sahm Rule, a widely cited and conventional metric utilized in economic commentary and maintained by the Federal Reserve of St. Louis, offers a straightforward method for detecting recessions by tracking changes in the unemployment rate, y_t. Since monthly unemployment data can be quite volatile due to sampling variability and temporary fluctuations, the rule first smooths the data by taking a three-month moving average, $\bar{y}_t = \frac{1}{3}\sum_{t=1}^{3} y_t$, using an average to smooth data has been a standard practice in time series analysis, dating back to Slutzky (1937). The Sahm Rule then compares this smoothed unemployment rate, $\bar{y}_t$, to its lowest point over the previous year, $\min_{1\le h\le 12} \bar{y}_t$ —essentially asking whether unemployment has risen meaningfully from its recent trough, a technique dating back to Burns & Mitchell (1946). When the smoothed unemployment rate rises by at least half a percentage point, above its twelve-month minimum, the rule signals that the economy has likely entered a recession. The intuition of this approach is that sustained increases in unemployment from recent lows typically reflect broader economic weakness. The half-percentage-point threshold has proven remarkably reliable in real-time recession identification, triggering at or near the onset of every U.S. recession since 1970 without producing excessive false signals, as shown in Michaillat and Saez (2025). Put simply, the Sahm Rule indicates a recession whenever the 3-month average of unemployment rises above a half a percentage point, relative to the low-point of the preceding year, or more formally:

$$R_t = \mathbb{1}\{\bar{y}_t - \min_{1\le h\le 12} \bar{y}_{t-h-12} \ge 0.5\}$$

Now then, while this construction might be ideal for communicating a quick heuristic to policymakers, there are many underlying parameter selections, such as the time window considered, the threshold value, the amount of smoothing, that can be optimized, and moreover input data can be broadened, but it requires a more general formulation.

1.2 The Modified Sahm Rule

The **Modified Sahm Rule** extends the traditional approach primarily by generalizing the parameter choices, like whether to smooth for 3-months or 4-months, and broadening the input data, y_t, that is considered, beyond simply using the baseline U-3 unemployment rate. For example, consider tracking unemployment for college-educated workers versus those with high school education, in an otherwise identical Sahm-Rule-style turning point framework less-educated workers might indicate recession sooner, while college-educated workers might not show labor market weakness until later. However, to identify consistent results the threshold might need to be raised, so the series might need to be smoothed for a longer period of time, and so on. The Modified Sahm Rule allows for exactly such inquisition.

Through multi-dimensional optimization, calculating separate candidate indicators from disaggregated unemployment measures, across demographic subgroups, labor utilization metrics, geographic regions, etc., while simultaneously optimizing over multiple parameters including threshold values, lookback periods, smoothing windows, and indicator combinations to maximize recession detection and accuracy. Modifying the Sahm Rule to simply consider more categories of unemployment data and optimizing over a handful of parameters, creates hundreds of trillions of candidate indicators, those results are drastically culled by business cycle and labor theory, machine learning techniques, and the remaining candidate indicators are validated and evaluated with the anticipation-precision frontier techniques described by Michaillat (2025).

For simplicity, to generalize the Sahm Rule formulation, let's consider a Modified Sahm Rule as consisting of two components: a recent component that measures the labor market, $\bar{y}_{i,t}^{k-month}$, that is smoothed over k-months and a local low-point $\min_{t-11\leq k\leq t} \bar{y}_{i,t}^{k-month}$, that is also smoothed over k-months. For clarity, let's consider the recent component, which is the minuend, $\lambda_{i,t}$, and the local trough, the subtrahend, $\gamma_{i,t}$. In an otherwise identical turning point framework with the present deviation, $\lambda_{i,t}$, and the local extrema, $\gamma_{i,t}$. Therefore the Modified Sahm Rule can be defined as:

$$Sahm_t(\lambda_{i,t}, \gamma_{i,t}) = \lambda_{i,t} - \gamma_{i,t}$$

Where: $\lambda_{i,t} = \bar{y}_{i,t}^{k-month} = \frac{1}{k}\sum_{j=0}^{k} y_{i,t-j}$ and $\gamma_{i,t} = \min_{t-11\leq k\leq t} \bar{y}_{i,t}^{k-month}$

The recession indicator R_t is triggered when the Sahm Rule exceeds a threshold α:

$$R_t^{start} = \begin{cases} 1 & if\ Sahm_t(\cdot) > \alpha \\ \\ 0 & Otherwise \end{cases}$$

Note the following:

- k is typically set to 3 months, in the Sahm Rule, but the function can be smoothed over any k-month average. Generally, subcategories of unemployment with increased volatility require more smoothing.
- α is generally set to 0.5, but this parameter can be set to accomplish upper and lower bounds, such as 0.3 and 0.8 as discussed in Michaillat and Saez (2025).
- Indices i and j allow for comparing different measures (e.g., $i \neq j$, such as comparing Hispanic women unemployment or the unemployment rate in Cocke County, Tennessee against the baseline U-3 as the local extrema, creating a Relative Sahm Rule). This formulation can also be extended to include job vacancy, or any labor utilization measure.

1.3 Discussion of Turning Points, Indicators, and Deviations from Local Extremum

Understanding the connecting thread between Sahm Rule, the Michez Rule, the Modified Sahm Rule and many other metrics in the recession indication field, it is instructive to view many of the techniques—and by extension the turning point methods employed by the Business Cycle Dating Committee—as analyses of **Deviation from Local Extrema**, described in Rockafellar and Wets (1998), whereby recent directionality is compared to a relative peak or trough, generally, with some normalization. Within the field of economics and specifically the Business Cycle Dating Committee, deviations from local extrema would be instead understood as a "turning point" or turning point analysis.

The Sahm Rule is principally a turning point function, that specifically considers U3 unemployment. The function incorporates a smoothing parameter through a moving average and compares relative to a minimum over the preceding year, against a binary threshold. Each parameter choice in the construction matters for the results. Even the utilization of the preceding year, by shifting the window of the minimum by a month, instead of a contemporaneous year has a real effect on the interpretation.

The chief ingenuity of the Michez rule is the function simultaneously considers two signals, U3 unemployment and job vacancies, each measured relative to a recent optimal level, and the function returns the weaker of the two. This functionality filters out random spikes which makes the function defensive against false-positives. The Michez rule then compares the filtered signal to an upper and lower bound cutoff. When the signal falls between those cutoffs, the rule converts its position to a straight-line probability. The overall functionality has many worthwhile features, clear interpretability, and a built-in defense of needless false-positives. The methodology represents a meaningful statistical advancement, and a solid theoretical connection to labor economics, specifically, how recessions manifest as simultaneous increases in unemployment and decreases in vacancies as the economy moves down the Beveridge curve in response to aggregate shocks. This overview is not meant to be an exhaustive explanation, for more technical detail see Michaillat (2025b).

While significant methodological progress has been made in recession detection, opportunities remain for further theoretical development—particularly in incorporating decomposed measures of the labor market. As Michaillat (2025c) highlights, important trade-offs exist between the timing of turning point indicators and their accuracy. The Michez rule, for instance, offers improved accuracy over the Sahm Rule but does so at the cost of earlier signal detection compared to alternatives such as a Modified Sahm Rule using U6 measure of labor utilization.

The practical reason that deviations from local extrema techniques like the Sahm Rule and the Michez Rule, or turning point analysis, are particularly effective at indicating recessions when utilizing labor market data is because labor market conditions are a key variable to many of the systems that the Business Cycle Dating Committee evaluates to determine recessions. And turning point analysis is central to the Committee's determination. So, the focus on labor market turning points parallels many of the indicators that the Committee itself relies upon—such as household employment, payroll employment, and real personal income excluding transfers—making these rules well-aligned with the institutional logic of official recession dating.

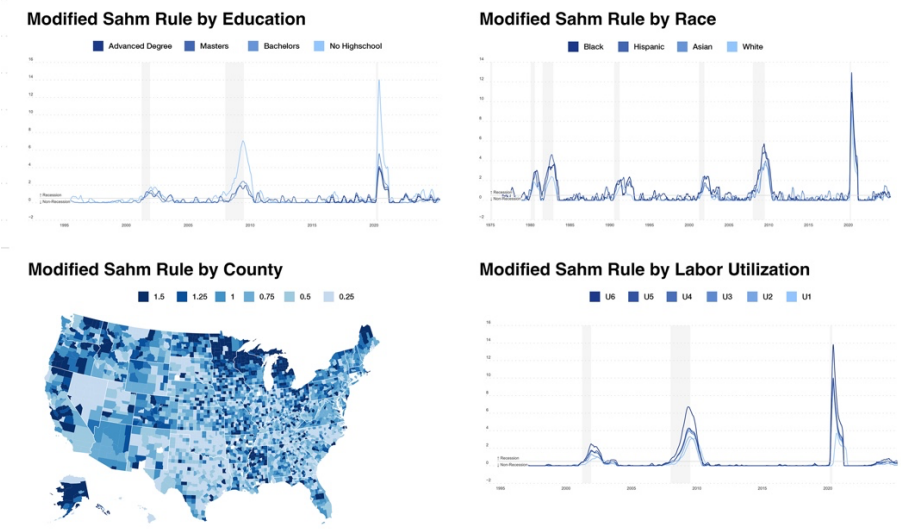
In simple terms, while the Committee examines metrics such as real personal income minus government transfers, employment, real consumer spending, industrial production, real manufacturing and trade sales, household employment, real gross domestic product, and real gross domestic income, etc., to identify recessions, labor market conditions serve as a common outcome variable across these systems. Additionally, labor market measures are released with a much higher frequency and greater dimensionality, therefore employment metrics provide a more-timely and detailed signal of underlying economic trends.

The notation of the Modified Sahm Rule, and by extension the discussion on deviations from local extrema, turning points, normalization and the connection made across the recession indication literature, aims to place the premium on generalizability, making the underlying mechanics and comparisons across various labor market measures and time more intuitive. The original construction of the Sahm Rule placed a very high premium on simplicity, due to the emphasis being on communicability of results to policymakers and the usage as a policy trigger. However, the generalized notation of the Modified Sahm Rule treats the Sahm Rule more as a turning point technique to understand relative labor market measures, while maintaining core functionality and underlying logic.

1.4 The Intensive Margin, Underemployment & The U6 Modified Sahm Rule

Building on the logic of the Sahm Rule and Michez Rule, the Modified Sahm Rule framework applies these turning point methodologies to disaggregated labor market indicators—such as unemployment by race, education, gender, or geographic region. Empirically, economically vulnerable groups tend to exhibit earlier signals of downturns due to their higher sensitivity to macroeconomic shocks. However, this early warning capacity comes at the cost of greater volatility, resulting in noisier signals and reduced reliability. This

embodies the well-documented anticipation–precision tradeoff discussed in Michaillat (2025c), which is rebranded as the advance–accuracy tradeoff in this work for clarity. Notably, the U6 underemployment rate—a broader measure of labor underutilization that encompasses a disproportionate share of less-educated, lower-income, and minority workers—appears to improve responsiveness to downturns while preserving relatively strong signal reliability, offering a favorable balance between lead time and accuracy.



When disaggregating labor market data by education, race, or labor utilization, the U6 Modified Sahm Rule consistently emerges as the most reliable recession indicator. While this analysis finds the U6 Modified Sahm Rule to be the most effective overall turning point function for signaling downturns, alternative Modified Sahm Rule specifications—such as those using county-level unemployment, sector-specific metrics, or other granular indicators—may offer greater insight into the distributional dynamics of labor market stress, even if they sacrifice some degree of aggregate predictive reliability. Additionally, further research could explore integrating the multi-signal, multi-threshold and probabilistic components of the Michez rule into future turning point analyses, and it should also be noted that as a flexible turning point framework, the Modified Sahm Rule can accommodate a wide range of input variables, including measures of economic uncertainty, sentiment indices, or financial indicators such as bond spreads.

The U6 measure can be further isolated, by differencing-out U5, isolating the marginally attached component of labor utilization. The U6-U5 measure isolates the marginally attached component of the labor force—specifically, workers employed part-time for economic reasons—which serves as an early indicator of economic distress because it captures product-market slack rather than traditional labor-market slack. As Michaillat and Saez (2015) demonstrate in their paper on aggregate demand and unemployment, when firms experience declining demand for their products, they initially respond by reducing worker hours rather than eliminating positions entirely, creating this pool of underemployed workers reflected in the U6-U5 gap. This

product-market slack systematically precedes labor-market slack in the recession sequence: firms first struggle to sell their goods and services (leading to hours reductions), and only later stop hiring altogether (leading to traditional unemployment). By incorporating this marginally attached component into a Modified Sahm Rule framework, with a marginal U6, the indicator can detect the earlier phase of economic downturn when firms are cutting hours but have not yet moved to layoffs, providing policymakers with a more anticipatory signal compared to the traditional Sahm Rule that relies on the headline unemployment rate, which only rises after firms have progressed from hours reduction to actual job elimination.

A central mechanism behind the performance of the U6 Modified Sahm Rule or a Marginal U6 Modified Sahm Rule is the sequencing of labor-market adjustment over the business cycle. When aggregate demand weakens, firms typically adjust on the intensive margin—reducing average weekly hours, overtime, and shifting full-time workers into part-time for budgetary reasons—before they adjust on the extensive margin by cutting headcount. This pattern follows from standard models with hiring–firing frictions, search and matching costs, and real/nominal rigidities that make hour-by-hour adjustments less costly than separations. Because U6 explicitly incorporates the marginally attached and those working part-time for economic reasons, a turning-point function applied to U6 will tend to register deterioration earlier than the same function applied to U3 unemployment.

The second reason is compositional. U6 disproportionately reflects outcomes of groups that are more cyclically sensitive—workers with lower education, younger workers, racial and ethnic minorities, and those in lower-wage or more precarious sectors—which experience earlier reductions in hours and underemployment when conditions soften. In a Modified Sahm Rule framework that detects deviations from a rolling local minimum, using U6 effectively aggregates early warning signals from these sub-markets into a single composite. Cross-sectional pooling dampens idiosyncratic noise at the subgroup level, while preserving the timeliness that comes from their higher elasticity to shocks. The result is a signal that leads U3-based triggers without a proportional loss in specificity.

Empirically, the U6 Modified Sahm Rule tends to strike a favorable balance in the advance–accuracy trade-off: it improves responsiveness relative to U3-based specifications and many single-group Modified Sahm Rules, yet avoids the false positives that can arise when relying on a single volatile subgroup. Robustness holds across reasonable choices of smoothing windows and thresholds, though users should remain mindful of structural changes that can affect underemployment (e.g., reclassification of part-time status, shifts in scheduling practices, or sectoral composition). In applications where additional reliability is needed, the U6 Modified Sahm Rule can be complemented with multi-signal features (e.g., uncertainty or financial spreads) or probabilistic layers in the spirit of the Michez Rule, but its theoretical footing in

intensive-margin adjustment and its composite coverage of vulnerable groups explain much of its outperformance on their own.

In short, prior to a downturn firms usually cut hours before they cut jobs, and more importantly, some people are cut first. U6 counts people pushed into involuntary part-time work and those loosely attached to the labor force, so it moves when hours get trimmed—even before layoffs show up. Because U6 also captures workers who feel a downturn first, combining it with a turning-point rule gives an earlier and still reliable recession signal.

2 Data

This study assembles a high-dimensional panel of labor-market indicators to evaluate recession-signal performance across populations, places, and industries. All series are retrieved from the Federal Reserve Bank of St. Louis with the Bureau of Labor Statistics (BLS) as the underlying source. Beyond the headline unemployment rate, U3, the dataset includes underemployment and labor-utilization measures (e.g., U-6 and its components such as part-time for economic reasons and the marginally attached). Disaggregated unemployment rates are compiled by race/ethnicity, education, gender, age, and nativity (foreign-born vs. native), alongside industry/sector unemployment, county-level unemployment, and more. Crossing these dimensions yields roughly 4,000 distinct input series, each documented with its identifier, units (percent), monthly frequency, and seasonal-adjustment status.

To ensure that findings are not an artifact of modeling choices, every input series is paired with a systematic set of parameter variations. Specifically, (i) compare seasonally adjusted versus not seasonally adjusted versions; (ii) vary the alignment of the comparison window used to define local minima (a preceding window versus a contemporaneous window that includes the current month); (iii) apply alternative levels of smoothing to temper month-to-month volatility; (iv) test specifications that incorporate a slow-moving "natural rate" or trend versus raw levels; and (v) rotate the length of the comparison window (e.g., about a year and longer horizons).

The combination of ~4,000 series and this parameter grid produces trillions of potential indicator specifications. The breadth is intentional: some subgroups and geographies are known to respond earlier to cyclical softening but exhibit greater volatility, while broader composites can be more stable yet slower to move. By sweeping systematically across inputs and parameter choices, the analysis makes transparent which results persist across reasonable alternatives and which are sensitive to design decisions. All series carry consistent metadata and versioning (identifier, units, frequency, span, definition, source chain, and update notes) to ensure transparency and reproducibility.

2.1 Sources and Coverage

All labor-market series are retrieved through an API from FRED (Federal Reserve Bank of St. Louis), which serves as a host and distribution platform. The underlying source for the unemployment and underemployment measures is the U.S. Bureau of Labor Statistics (BLS), primarily from the Current Population Survey (Household Survey). Using FRED ensures consistent identifiers, metadata, and update cadence while maintaining the official BLS definitions and revisions.

As a reference point, the headline unemployment rate (FRED series UNRATE; BLS code LNS14000000) is reported monthly, in percent, seasonally adjusted, with a historical span from January 1948 through June 2025 (observed value 4.1 in June 2025). The series was last updated July 3, 2025 with the next scheduled release August 1, 2025. UNRATE corresponds to U-3, defined by BLS as the number of unemployed persons as a share of the labor force (persons 16+ in the 50 states and D.C., excluding those in institutions and active-duty Armed Forces). Throughout, FRED is cited as the retrieval point and BLS as the primary source.

2.2 Scope of Decomposition and Disaggregation

The analysis examines unemployment and labor-utilization across a wide range of subcategories in order to compare the timing and reliability of turning-point signals:

- Demography: race/ethnicity, education, gender, age, nativity (foreign-born vs. native).
- Labor utilization: the broad U-measures, with special attention to U-6 (which includes marginally attached workers and those working part-time for economic reasons).
- Industry/sector: unemployment by major NAICS sectors.
- Geography: county-level unemployment (LAUS).
- Age: age group specific unemployment

Crossing these dimensions produces roughly 4,000 input series. This breadth is essential for characterizing how turning-point behavior varies across economically vulnerable groups, sectors, and places.

2.3 Parameterization and Combinatorics

To evaluate the robustness of turning-point detection, each series is paired with a grid of parameter choices:

1. Seasonality: seasonally adjusted (SA) vs. not seasonally adjusted (NSA), with harmonized seasonal adjustment where needed.

2. Window alignment: using a preceding window for local minima versus a contemporaneous window that includes the current month.
3. Smoothing: moving-average smoothers can be extended to reduce month-to-month noise.
4. Natural-rate adjustment: minimum parameter utilized to limit movements from very low levels, helpful during periods of unusually low unemployment.
5. Window length: alternative lengths for the rolling comparison window (e.g., around one year and longer).

Crossing roughly 4,000 input series with the full parameter grid produces trillions of candidate indicators. To winnow this space, we use systematic search methods (e.g., grid search and related selection routines) to identify a small set of high-performing specifications for the Modified Sahm Rule, and then rely on economic theory to justify the final choice. Throughout, we document how results do—or do not—change when we vary seasonality treatment, window alignment (preceding vs. contemporaneous), smoothing intensity, inclusion of a natural-rate adjustment, and window length. This combinatorial design makes transparent which findings are robust and which are sensitive to modeling choices.

2.4 Preprocessing and Alignment

Series obtained from FRED are aligned to a common monthly calendar. When agency-provided seasonally adjusted versions are available, those are used directly; otherwise, standard seasonal adjustment procedures are applied to ensure comparability. Where isolated gaps occur (e.g., in county panels), minimal forward/backward fills are used solely to maintain continuity for rolling operations; results are inspected to verify that no inference hinges on imputed segments. All unemployment and underemployment measures are treated as percentage rates, facilitating comparability across subgroups and geographies.

2.5 Why Breadth, Theory, & Parameter Searches Matter

Turning-point indicators can be sensitive to how the local minimum is defined, how much short-run volatility is smoothed, whether seasonal effects are harmonized, whether a slow-moving trend is netted out, and how long the comparison window is. Moreover, disaggregated series—by race, education, or county—often move earlier but are noisier than headline aggregates. By systematically sweeping parameters across ~4,000 series, the study directly quantifies the trade-offs between earliness and reliability, and it highlights which indicators (or composites such as U-6) consistently offer earlier yet stable signals. Finally, labor-market theory serves as a crucial filter: specifications that appear attractive on lead time or accuracy but lack clear theoretical grounding are deprioritized despite their statistical performance.

Taken together, the design space is enormous. Even at the low-end, this work considers 24 choices for smoothing durations the recent-deviation component and 24 for smoothing the local-extrema portion; a comparison-window length ranging from 3 to 60; with roughly 4,000 candidate input series for the recent-deviation calculation and similarly roughly 4,000 for the local-extrema calculation; two seasonality treatments (SA vs. NSA); two window alignments (preceding vs. contemporaneous); thresholds spanning 0–3; and seven alternatives for using a natural-rate baseline as the new minimum. Multiplying through yields a specification space on the order of approximately 9.78 trillion combinations in this setup. (The exact count is somewhat irrelevant and will vary with inclusive/exclusive conventions for window lengths and thresholds, and with whether the two components draw from the same or different input series.) The point is that the combinatorics, even with fairly modest parameters, are nearly-infinitely vast.

Even after applying systematic search methods (e.g., grid search and related selection routines with out-of-sample checks) to prune this space, theory remains indispensable for final selection. Many specifications can score well on purely statistical criteria—by capitalizing on noise, revisions, or period-specific quirks—yet lack credible economic justification. Consequently, the screening emphasizes indicators that (i) align with labor-market adjustment theory (e.g., intensive-margin movements preceding layoffs), (ii) are interpretable and implementable in real time, (iii) are robust across cycles and parameter settings, and (iv) cohere with established measurement concepts (e.g., BLS definitions of unemployment and underemployment). This theory-driven filter prevents selection on unjustifiable variation, from crowding out economically meaningful signals.

3 Creation of the Modified Sahm Rule

The Modified Sahm Rule is a flexible generalization of the original Sahm Rule. The Modified Sahm Rule is designed to accommodates diverse labor-market series, but as a turning point function can also be used with almost input data—such as U-measures, subgroup or county unemployment, and vacancies—while allowing separate smoothing of the component that captures current movement and the component that captures the recent low, the recent deviation, $\lambda_{i,t}$, and the local extrema, $\gamma_{i,t}$, respectively. Signals can be computed from seasonally adjusted or not seasonally adjusted data, thresholds can be tuned to the application, and safeguards can be introduced so very low values do not trigger spurious alarms. The two components need not originate from the same series, enabling, for example, a comparison of the present U6 path with the recent minimum of U3 or a subgroup series with a national baseline. In effect, the rule operates as a portable turning-point framework rather than a single fixed indicator.

The Modified Sahm Rule fully parameterizes the choice of inputs, the degree of smoothing applied to each component, the length and alignment of the window used to define local extrema, the treatment of

seasonality, the signaling threshold or band, and the handling of low-level floors associated with the natural rate, while permitting cross-series pairing of the two components. This parameterization enables systematic search and theory-driven selection, maintains transparency over design choices, and facilitates replication across datasets and applications.

3.1 Advanced Indication of Beginning and End of Recessions

The Modified Sahm Rule as a turning point function, can be utilized to indicate both the start of a downturn, and, symmetrically, can date the end of a contraction. Empirically, dating the end of a downturn is straightforward: identify the first month after a local peak when the indicator falls relative to the previous month. A simple binary formulation can be expressed as:

$$R_t^{end} = \mathbb{1}\{Sahm_t < Sahm_{t-1}\}$$

which marks month t as the end of the recession. This approach to dating the end of contractions with turning point functions is related to Phillips & Wang (2025) but employs a distinct formulation; importantly, the results with the Modified Sahm Rule are robust across most labor-utilization measures.

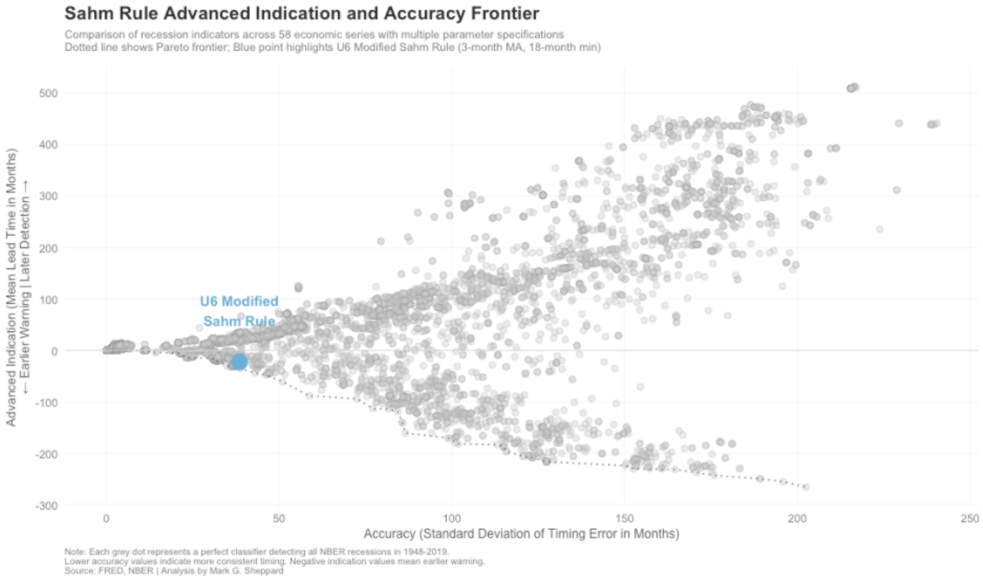
4 Evaluation of the Modified Sahm Rule

This technique represents a systematic, data-driven approach to optimizing recession detection indicators. Rather than relying on fixed parameters chosen through intuition or limited testing (like the traditional Sahm Rule's 3-month moving average and 12-month minimum), this method exhaustively searches through millions of possible parameter combinations to identify optimal recession classifiers.

The analysis works by taking 58 different economic time series and applying various transformations to each: different smoothing windows (1-12 months), different lookback periods for calculating minimums (6-24 months), different data transformations (levels, logs, first differences), and optional seasonal adjustments. For each resulting indicator, the algorithm tests multiple thresholds to find "perfect classifiers" - those that correctly identify all historical recessions in the training period (1948-2019) without any false positives. These perfect classifiers are then evaluated on two key dimensions: accuracy (measured as the standard deviation of timing errors) and indication (the average lead or lag time in detecting recessions).

The most innovative aspect is the construction of the anticipation-precision frontier, analogous to the efficient frontier in portfolio theory. This Pareto frontier identifies classifiers where no improvement in one dimension (earlier detection or more consistent timing) is possible without sacrificing performance in the other dimension. This allows users to select classifiers based on their specific needs - those requiring early warning can choose classifiers with more anticipation but less precision, while those needing reliable timing can choose classifiers with better accuracy but less advance warning. The approach reveals that many

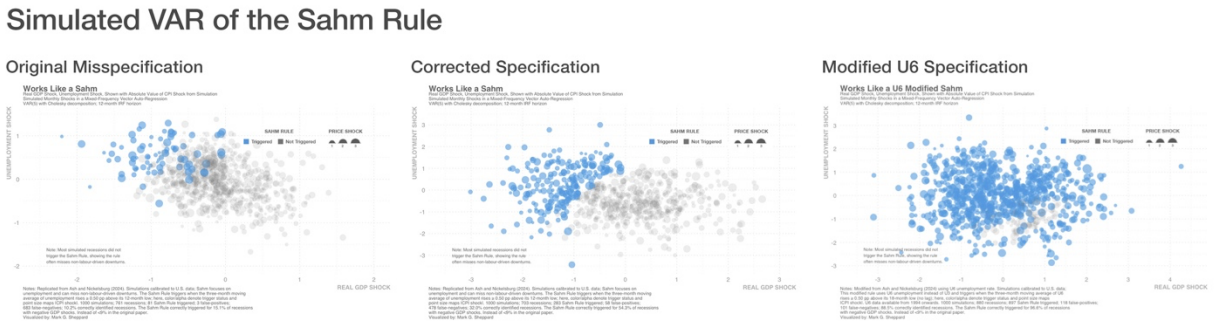
different parameter combinations can achieve perfect classification, but they involve different trade-offs between early detection and timing consistency.



4.1 Works like a Modified Sahm

Recent paper by Ash & Nicklesburg (2024) evaluate the Sahm Rule by computing the index from unemployment and then testing the Sahm Rule on both historical data and macroeconomic paths simulated from small VARs. In these designs, the Sahm Rule is not embedded in the VAR; rather, unemployment is simulated and the rule is applied to those paths.

In implementing the Sahm Rule, Ash & Nicklesburg (2024) use a slightly different specification than the standard formulation, calculating a 4-month moving average rather than the traditional 3-month average, and applying the 0.5 threshold as a constant subtraction rather than as a binary indicator. While this is a significant departure from the original Sahm Rule specification, and materially affects their specific numerical results, their innovative VAR-based framework provides valuable insights. When applying the Ash & Nicklesburg (2024) methodology using the standard Sahm Rule specification (3-month average of unemployment minus the minimum 3-month average over the preceding year, with a 0.5 threshold for recession identification), the results demonstrate that the rule performs remarkably well, including in identifying recessions driven by non-labor market shocks. This reinforces both the robustness of their simulation approach and the reliability of the Sahm Rule across diverse economic conditions.



The central finding is unsurprising given the construction: a rule that keys off realized labor slack is not a one-month-ahead forecaster of recessions, particularly when downturns are initiated by non-labor shocks. Instead, it tends to become informative a few months into an episode. That conclusion is broadly consistent with the original purpose of the turning point function—as a transparent policy trigger—rather than as a forecasting model.

The same limitation would likely apply to the Modified Sahm Rule, and by extension likely any labor market based turning point function. Allowing different inputs and parameter choices can improve timeliness and interpretability, but the object remains a turning point indicator: it signals that conditions have moved materially away from a recent local minimum. As such, the Modified Sahm Rule can help date the onset and end of downturns and provide early confirmation once a recession is underway, and more broadly can be used to characterize the heterogeneity of the labor market, yet it should not be presented as a stand-alone forecast of future recessions. The practical use case is as a high-frequency, real-time monitor—best employed alongside complementary signals when the goal is prediction, and as a clear, rules-based benchmark when the goal is dating and communication.

This pattern likely generalizes, as the result largely reflect propagation: variables closest to the originating shock tend to move first, while variables farther along the adjustment chain move later. Thus, a financial shock is typically visible earliest in financial markets and only later in spending, production, hours, and unemployment; a real-side (demand/supply) shock shows up first in real activity and later in labor indicators; a labor-specific shock (e.g., hiring freezes or hours cuts) appears first in labor utilization and only later in broader aggregates. Hiring–firing frictions, wage/price rigidities, balance-sheet channels, and data-release lags all create these lead–lag patterns. Consequently, Sahm-type and Modified Sahm-type measures—being labor-based turning-point indicators—will tend to react earlier when slack originates in the labor market and later when recessions are triggered by non-labor shocks, reinforcing the view that turning point functions are indicators, not forecasts.

4.2 Validating the Modified Sahm Rule Specification

Using machine learning technique of grid search, random search, and evolutionary strategies, as described by Kwon and Maliar (2024), in addition to the Precision-Anticipation frontier in Pascal Michalliat (2025), the U6 Modified Sahm is consistently a candidate indicator. Using a range of search strategies—grid search, random search, and evolutionary strategies in the spirit of Kwon and Maliar (2024)—the U6-based Modified Sahm Rule repeatedly emerges as a robust candidate indicator. Across hyperparameter sweeps (window lengths, thresholds, smoothing choices) and stochastic explorations of specification space, the criterion that uses U6 (the broad underemployment rate) remains on or near the Pareto set of models that balance early warning with low false alarms. This stability is not an artifact of any one optimizer: exhaustive grids recover it, random draws rediscover it, and evolution-inspired updates retain it. In practice, the result reflects an empirical regularity—U6's inclusion of the marginally attached and involuntary part-time workers makes it more sensitive to incipient labor-market slack than narrower measures, so the smoothed-gap trigger in a Sahm-style construction tends to fire when genuine cyclical deterioration begins rather than on transitory noise.

That empirical robustness is also theoretically defensible. Standard labor-demand reasoning implies firms first cut hours and slow new hiring before large layoffs materialize; search and matching frictions then push workers into part-time for economic reasons or out of the labor force temporarily. Because U6 internalizes these margins of adjustment, a turning-point function built from U6—smoothing the series and comparing it to its recent trough—captures the onset of slack earlier while remaining anchored to real utilization of labor. On Pascal Michaillat's (2025) precision–anticipation frontier, this construction sits at an attractive point: it anticipates recessions sooner than unemployment-only rules (thanks to U6's breadth) yet preserves precision by requiring a sustained deviation from the local minimum rather than reacting to a single-month jump. In short, both the search over model space and the economics of labor-market adjustment argue for the U6 Modified Sahm as a consistently strong, conventional, and defensible candidate indicator.

5 Conclusion of the Modified Sahm Rule

Labor market turning point indicators demonstrate significant value in identifying both the onset and conclusion of economic downturns. However, advancing beyond these heuristic approaches will require substantial theoretical development and empirical research.

The performance of the U6 Modified Sahm Rule compared to other specifications can be attributed to two key factors. First, it captures labor market slack through movements along the intensive margin (hours worked, underemployment) that typically precede movements along the extensive margin (job losses) during downturns. Second, as a composite measure, it reflects underlying labor market inequities—capturing early distress signals from lower-income, less-educated, and racially marginalized workers who are often the first to

experience downward economic pressures. These populations' overrepresentation in marginal employment makes the U6 measure particularly sensitive to emerging economic weakness.

While recessions are conventionally coded as binary events for analytical purposes, this research reveals a more complex reality. Decomposed measures demonstrate substantial heterogeneity in recession experiences across subcategories of labor market data—not only in recession duration and severity, but crucially, in their temporal onset. This finding challenges the implicit assumption of simultaneity in traditional recession indicators.

The frontier of this recession detection literature must evolve beyond single-indicator approaches to embrace multi-signal functions, building upon the framework established by Michaillat and Saez (2025). Future research should incorporate more flexible input data structures that capture the full spectrum of labor market dynamics—not merely unemployment and vacancy or layoffs, but movements along both the extensive and intensive margins of labor utilization. This includes measures of involuntary part-time work, discouraged worker effects, and the complex interplay between labor force attachment and economic vulnerability.

Our findings suggest that the performance of the U6 Modified Sahm Rule stems precisely from its nature as a composite measure that inherently captures multiple dimensions of labor market distress. It aggregates the experiences of marginally attached workers, the underemployed, and those facing structural barriers related to education, race, and income levels, simply by being disproportionally represented by such groups. This compositional advantage points toward a more comprehensive approach: multi-signal functions that systematically incorporate excessive amounts of input data across various economic indicators. By optimizing over parameter spaces that include measures of economic vulnerability alongside traditional labor market metrics, future recession detection systems could provide not only the earliest possible indication of economic downturns but also the most accurate assessment of their depth and distributional impact. The goal is a detection framework that balances timeliness with precision while remaining sensitive to the unequal ways recessions manifest across different segments of the population.

The evidence presented here confirms what disadvantaged communities have long known but economic indicators have failed to capture: recessions do not arrive for everyone at once. Economically marginalized groups, those with less education, lower incomes, racial minorities, and so on, consistently experience economic downturns before recessions register in aggregate statistics. This temporal disparity is not merely a measurement issue; it reflects fundamental inequities in how economic shocks propagate through the labor market. By the time a recession is officially recognized, vulnerable populations have already been experiencing recessionary effects, suggesting that our current approach to recession detection systematically understates

both the duration and human cost of economic downturns. While disparate outcomes of recessions have been long understood, the conclusion of this research is that some groups experience recessions first.

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