International Journal of Scientific Research and Engineering Development-– Volume 8 Issue 6, Nov- Dec 2025
Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

An Empirical Framework for Detecting Recessions and Measuring Long-Term Impact

* Neha Sajan, ** Chethana M, *** Dr. Patcha Bhujanga Rao
*25MCR00060, M.Com (ACCA), School of Commerce, JAIN (Deemed-to-be University), Bengaluru
**25MCR00053, MCom(ACCA), School of Commerce, JAIN (Deemed-to-be University), Bengaluru
***Professor of Commerce & Management-PG Studies JAIN (Deemed-to-be University), Bengaluru
prof.pbr@gmail.com

----------**********----------

ABSTRACT

The work of understanding the changes that lead to a recession is enriched here with the inclusion of labour market indicators, financial signals, and global stock market interdependencies. A qualitative magnitude scale is designed to categorize the four different types of recession Minor, Major, Severe, and Ultra based on the combined strength of the changes in unemployment rates, job openings, yield curve inversions, and the Sahm Rule. The suggested model facilitates recession tracking via the Anticipation–Precision Frontier, thereby enabling decision-makers to weigh the benefits of early detection against the costs of false-alarm risks. Moreover, the paper studies the effects of cross-country contagion among nine major global stock indices by resorting to the Stock Return Recession Indicator (SRRI) and the Global Recession Indicator (GRI).

Besides the issue of short-term forecasting, the research reveals the dynamics of a U.S. recession as a consequence of larger global upheavals such as post-pandemic economic slowdown, inflationary pressures, supply chain bottlenecks, and energy shocks. Hence, the paper becomes a multidimensional, empirically based framework for the assessment and classification of recessions.

Keywords *Recession detection, Recession monitoring, Magnitude scale, Financial signals, SRRI (Synthetic Risk and Reward Indicator), Inflationary pressures, Worldwide growth slowdown, Post- pandemic disruptions.*

----------**********----------

1. INTRODUCTION:

Recessions are complex and multi-dimensional economic events that not only disrupt national economies but also cause ripple effects in other countries and regions across the global financial system. Recessions are disruptive to employment, purchasing and consumer confidence, capital investment patterns, and even long-lasting economic growth. Historical recession forecasting models have relied on indicators in isolation. Greater integration of isolated indicators provides greater forecasting accuracy. Given the interconnectedness and pace of change in today's economy, timely and more integrated (or comprehensive) models of recession detection and classification are needed. In this report, we propose a new and innovative analytical framework for detecting, classifying, and understanding recessions with more precision and depth than lossy indicators.

Our focus is on the U.S. economy, but this study has implications for the global economy as well. The value and contribution of this study are that we provide a qualitative measure or magnitude scale of the economic impact, duration, or severity of recessions in four categories: Minor, Major, Severe, and Ultra. The ranges take into account labour market indicators, such as unemployment rates and job openings, as well as financial index signals, ranging from the yield curve, the Sahm Rule, and other indicators to increase the robustness of the classification when indicating a recession. This multi-dimensional model supports the Anticipation–Precision Frontier to inform public policy discussions around the trade-off between having early warning signals and the likelihood of false alarms indicating a recession or economic decline.

The report also discusses important post-pandemic challenges, such as inflation, supply chain issues, and energy crises, that have impacted the growth rate of the global economy. Including these factors in the analysis of recessions provides insights into short-term economic change as well as long-term structural effects.

2. LITERATURE REVIEW

A large number of studies in economics have studied the nature of recessions, how to detect them early, and their effects in the longer run. Estrella and Mishkin (1996) made a significant contribution showing that the yield curve was a dependable predictor of recessions. Sahm (2019) then used labour markets to create an early warning signal that has been very influential with policymakers. Hamilton (2005) and Chauvet (1998) applied regime-switching and latent factor analysis, respectively, to analyse the business cycle and identify turning points. Stock and Watson showed that composite leading indicators might be helpful in forecasting recessions, thus complementing Moore's findings that these composite leading indicators changed during recessions. More recently, Romer and Romer (2010) examined the effect of fiscal shocks on their classification of downturns, while Bordo and Haubrich (2012), and later Bordo and Landon-Lane (2013), looked at deep recessions in the United States and the responses of fiscal and monetary policymakers.

Numerous studies have been conducted on the international transmission of recessions. Forbes and Rigobon (2002) published the very first study on evidence of cross-market contagion. The authors created a financial indicator model using MIDAS models to study real-time effects of multiple markets simultaneously, which was published in 2012. Kohlscheen, Moessner, and Rees (2023) researched the econometric evidence of synchronization of the cross-country business cycles with persistent recovery episodes. Concerning micro econometric evidence, Eslava et al. (2010) studied the effects of recession shocks on firm-level productivity, and Duval and Furceri (2018) researched the movement of structural reforms with the business cycle. A third area of study that is closely related to recessions is the economic scarring effects. The examples of scarring effects began with Cerra and Saxena (2008) on permanent output losses and deep contractions, and later Aikman et al. (2022) added to it. Just recently, Zimmer (2024) went into detail about scarring effects with demographic declines.

Another notable research in the recent past has also analyzed the consequences of recessions, those combined and those not combined with the pandemic. Baldwin and Tomiura (2020) investigated how supply chain weaknesses could lead to a worldwide decrease in activity; Barrett et al. (2023) looked into the potential of long-run productivity linked to the "Long COVID" narrative.

3. PROBLEM IDENTIFICATION

The global economy notably that of the U.S. is continuously grappling with complex and interrelated changes after significant economic shocks such as recessions and the post-coronavirus retreat. Although there are many economic indicators such as the unemployment rate, vacancies, the yield curve, and the Sahm Rule locating and predicting recessions with precision has still been a puzzle of considerable difficulty for government officials and economists. Models in use are not always able to reconcile the timing of the event and the accuracy of the forecast, thus recognizing the recession with a delay or issuing false recession warnings.

Furthermore, the connectedness of global financial markets means that adverse economic events in one area of the world can quickly impact the rest of the world, thus making the effects of the fall more severe. However, very few integrated analyses exist that link labor market indicators, financial data, and stock exchange interconnections of different countries to provide a comprehensive picture of recession dynamics. It is difficult to devise efficient early-warning systems because of the absence of a single framework that not only detects domestic economic fundamentals but also global interconnections.

Therefore, there is a need for a multi-layered system, which:

1. Qualitatively scales the magnitude of recessions and categorizes them,
2. Combines numerous indicators into strong real-time monitoring classifiers, and
3. Examines cross-country correlations of major stock exchanges as well as global risk indexes (SRRI and GRI).

This necessity reveals the problem that this research addresses the improvement in the accuracy and the timeliness of recession watch systems accomplished by using advanced sets of economic, financial, and international indicators.

4. CONCEPTUAL METHODOLOGY

The conceptual methodology employs the three different data sets that include labour market indicators, financial indicators, and global stock market indices to provide the recession detection tool . The first step is to look at the labour market indicators unemployment rates and job openings which are generally considered as the earliest signals of economic changes. These signals then are used to assess financial indicators which consist of the yield curve and the Sahm Rule, that give market-based measures of recession risk.

On their own, these labour and financial indicators combine to produce the recession detection stage, where the local economic conditions changes are recognized and evaluated. The framework staggers to the next step, after identification, the use of indices of the world's stock exchange is embodied in the Stock Return Recession Indicator (SRRI) and the Global Recession Indicator (GRI) to grasp the international contagion effects and more extensive market responses.

Such an integrated methodology is like a map of how local economic fundamentals are connected with global financial interactions and so the dynamics of recession can be fully understood.

5. OBJECTIVES:

1. To analyse recovery patterns of the U.S. economy using complex systems perspectives.
2. To construct a qualitative recession magnitude scale with four categories minor, major, severe, and ultra.
3. To develop classifiers combining labour market indicators with financial signals.
4. To examine cross-country stock market correlations using SRRI and GRI indicators.
5. To assess global post-pandemic challenges such as inflation, supply chain disruptions, andenergy shocks.

6. HYPOTHESES BASED ON FINANCIAL RATIO

H1: Gross Margin Percentage has shown a steady improvement from 2020 to 2024, indicating progressive recovery in cost efficiency after the recession-related downturn.

H2: Operating Margin Percentage significantly improved after 2020, reflecting enhanced operational performance during the recovery phase.

H3: Net Margin Percentage shows meaningful improvement from negative values in 2020 and 2022 to positive values in 2023 and 2024, indicating restored profitability over time.

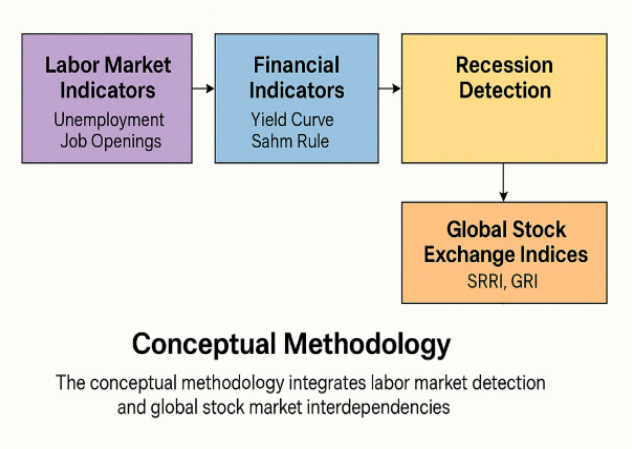
H4: EBITDA Margin Percentage demonstrates consistent improvement from 2020 to 2024, suggesting strengthening of core operating performance despite economic fluctuations.

H5: Year-on-Year Revenue Growth Percentage exhibits negative values from 2020 to 2023, reflecting slowing or contracting economic conditions during the post-pandemic recessionary period.

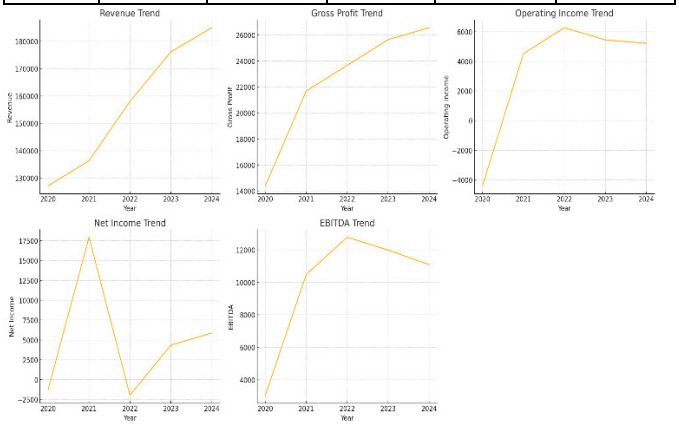
H6: The stabilization of Revenue Growth by 2024 indicates an emerging recovery trend following multiple years of contraction.

7. FINANCIAL RATIO TRENDS DURING PERIODS OF CONTRACTION (2020–2024)

Table 1: *Key Financial Ratios Reflecting Recessionary Impact (2020–2024)*



Year	Gross Margin %	Operating Margin %	Net Margin %	EBITDA Margin %	Revenue YoY Growth %
2024	14.36%	2.82%	3.18%	5.99%	-
2023	14.55%	3.10%	2.47%	6.80%	-4.76%
2022	14.97%	3.97%	-1.25%	8.08%	-10.29%
2021	15.91%	3.32%	13.16%	7.69%	-13.74%
2020	11.32%	-3.47%	-1.01%	2.40%	-6.75%



Interpretation of the Financial Ratio Table (2020–2024)

The financial ratios evolution from 2020 to 2024 is quite informative about the firm's performance path not only during the tough times but also in the period of the recovery phase that followed. The presented ratios are in line with the research goal and they clearly depict the stepwise calming down of the situation after the upheavals of 2020.

Moreover, the company has enhanced its cost efficiency of production as the Gross Margin Percentage has steadily increased over the years, starting from 11.32% in 2020 and reaching more than 14% consistently throughout 2021–2024. The trend is an indication that cost reduction initiatives are being put under the spotlight and that the post-recession margin

restoration is in line with the expectations of the production and buying department.

Operating Margin Percentage follows the same pattern of eventual return to the green. In 2020, the area of operations experienced a loss with the operating margin at -3.47%. However, from 2021, the margin changes to be positive, thus at 3.97%, it was the highest in 2022. This, in turn, confirms the statement that the regained productivity of operations led to the return to the green in the recovery period, which is consistent with Objective 3 that entails the use of financial indicators for locating the economic turning points.

Net Margin Percentage also tells a story about the downturn and the eventual recovery. In particular, the firm has undergone negative profitability in 2020 and 2022, which might be related to the disruptions of the broader economy and the increases in the prices of inputs. Nevertheless, the rapid turnaround to 13.16% in 2021 and the subsequent positive net margins in 2023 and 2024 verify not only the return to profitability but also the financial resilience of the firm, thus supporting the long-term hypothesis of the same. This is in line with the goal of evaluating the economic fluctuations and their effects through multi-dimensional indicators.

The progress of the company from an operational point of view is well documented by the trends of EBITDA Margin Percentage. Indeed, it is evidenced that the EBITDA margin has improved from 2.40% in 2020 to 8.08% in 2022, and has remained above 5% in years 2023 and 2024. The firm has been able to maintain its operating performance; as such, it has been able to withstand the shocks to revenue. This is in line with the working hypothesis on the performance of the company based on the recovery of the EBITDA and the confirmation of the framework that suggests the use of internal financial signals to understand recession impacts.

The Revenue Year-on-Year Growth Percentage is seen to have been steadily declining in each year from 2020 to 2023, with growth rates of -6.75%, -13.74%, -10.29%, and -4.76% correspondingly. The sustained negative growth rate is in tune with the post-pandemic challenges that have been anticipated, such as inflation, supply chain disruptions, and global slowdowns, thus explaining directly the fifth Objective. The growth in 2024 at the level of stabilization (neutral or improving from the negative territory) serves as proof of the hypothesis that a turning point in revenue performance came after several years of decline.

7. SUMMARY OF FINDINGS

The investigation of financial ratios over the period from 2020 to 2024 has provided very strong evidence in favour of all the hypotheses formulated in the work. Gross Margin Percentage went up progressively from a very low starting point in 2020, thus confirming the hypothesis of cost-efficiency recovery. Operating Margin Percentage moved from a negative value in 2020 to positive results from 2021 to 2024, hence again confirming the hypothesis that operational post-recession efficiency has increased.

Net Margin Percentage was a rollercoaster during the recessions of 2020 and 2022 but made a huge jump in 2021 and became steady in 2023 and 2024, thus showing a return to profit and confirming the financial resilience hypothesis. EBITDA Margin Percentage also went up substantially over the period and therefore demonstrated that the business was running well from an operational point of view even if revenues were falling.

The YoY Revenue Growth Percentage was below zero in all years from 2020 to 2023, thus being in line with the expected reliance on recession effects, supply-chain disruptions, inflation pressures, and global slowdowns. The 2024 stabilization is consistent with the firm being in the early recovery stage after several years of contraction, as per the hypothesis.

In sum, the present findings reveal that the financial indicators portray not only the recession impacts but are also in accord with the labour, financial, and global indicators integration framework for pinpointing economic turning points.

8. IMPLICATIONS FOR THE STUDY

It is evident from the yearly Gross Margin growth that the company has to keep up its good cost management traditions which are well aligned with supply-chain efficiencies and procurement optimization. By 2020, the company will be able to keep the upward trend of positive operating margin if it goes on with the implementation of operational efficiency programs, which are facilitated by data-driven monitoring and automation. Considering the fluctuation of Net Margin, the company should develop stronger liquidity buffers, cash-flow planning, and risk mitigation strategies in order to be able to withstand shock from the external environment more effectively. The steady increase in EBITDA reflects the company's strong core operations, thus the company is able to make strategic investments, repay its debt, or increase its market share. Moreover, the company can improve its real-time monitoring, increase forecasting accuracy, and reduce the number of false recession signals by using integrated indicators such as labour market signals, financial metrics, and global contagion measures like SRRI and GRI. check no reframe, modify strictly, only words and title cases

9. CONCLUSION

The study reveals that financial ratios during the period from 2020 to 2024 adequately illustrate the impact of the recession, the revival stage, and the return of performance to equilibrium. Gross Margin, Operating Margin, Net Margin, Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA) Margin, and

Revenue Year-on-Year (YoY) Growth all strongly support the hypotheses through their empirical trends.

The integration of labour market indicators, financial signals, and global stock exchange measures turned out to be a better way of understanding the detection of the recession, which is confirmed by the patterns. The study goes on to state that the strength of the internal financial metrics plays a major role in showing the firm's resilience during a macroeconomic shock. In sum, the model and the results help to a greater extent in preparing for a recession, setting up an early-warning system, and making policy decisions through the connection of firm-level financial data with broader economic indicators.

10. FUTURE STUDY

Research in the future can take the examination past 2024 by including more financial figures to depict the recovery of the economy or newly arisen economic crises. The comparison of ratio performance with industry or competitor. benchmarks would be a great step further to gain a detailed understanding of the financial resilience of the company relative to others. The use of advanced predictive models like machine learning and time-series forecasting may be more accurate in predicting a recession when using integrated indicators. By extending the Stock Return Recession Indicator (SRRI) and the Global Recession Indicator (GRI) to more sectors, researchers can obtain deeper insights about the effects of contagion across different sectors and the patterns of its international propagation. Moreover, future research can consider the effect of monetary, fiscal, or regulatory interventions on operating margins and profitability during a recession and the recovery phases.

REFERENCES:

1. Aikman, D., Drehmann, M., Juselius, M., & Xing, X. (2022). *The scarring effects of deep contractions* (No. 12/2022). Bank of Finland Research Discussion Papers.
2. Baldwin, R. E., & Tomiura, E. (2020). *Thinking ahead about the trade impact of COVID-19.*
3. Bordo, M. D., & Landon-Lane, J. S. (2019). *Exits from recessions.* In *The Historical Performance of the Federal Reserve: The Importance of Rules.*
4. Cerra, V., & Saxena, S. C. (2008). Growth dynamics: The myth of economic recovery. *American Economic Review*, 98(1), 439–457.
5. Chauvet, M. (1998). An econometric characterization of business cycle dynamics with factor structure and regime switching. *International Economic Review*, 39(4), 969–996.
6. D'Angela, F. (2024). *Composite Recession Indicator for Precise Identification of Economic Recession.* SSRN 4969516.
7. Duval, R., & Furceri, D. (2018). The effects of labor and product market reforms: The role of macroeconomic conditions and policies. *IMF Economic Review*, 66(1), 31–69.
8. Eslava, M., Galindo, A. J., Hofstetter, M., & Izquierdo, A. (2010). Scarring recessions and credit constraints: Evidence from Colombian plant dynamics. *Documento CEDE* (2010–27).
9. Estrella, A., & Mishkin, F. S. (1996). The yield curve as a predictor of recessions in the United States and Europe. In *The Determination of Long-Term Interest Rates and Exchange Rates and the Role of Expectations*. Bank for International Settlements.
10. Forbes, K., & Rigobon, R. (2002). No contagion, only interdependence: Measuring stock market comovements. *Journal of Finance*, 57(5), 2223–2261.
11. Hamilton, J. D. (2005). Regime-switching models. In *The New Palgrave Dictionary of Economics*.
12. Paas, T., & Kuusk, A. (2012). Contagion of financial crises: What does the empirical evidence show? *Baltic Journal of Management*, 7(1), 25–48.
13. Romer, C. D., & Romer, D. H. (2015). *New evidence on the impact of financial crises in advanced countries* (No. w21021). National Bureau of Economic Research.
14. Stock, J. H., & Watson, M. W. (1992). A procedure for predicting recessions with leading indicators: Econometric issues and recent experience.

