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Forecasting Economic Recession and Economic Growth Using Corporate Social Responsibility

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Abstract

This study aims to examine whether corporate social responsibility (CSR) disclosures can serve as significant predictors of economic recession and real GDP growth. The research employed an ex post facto design using data from 105 firms listed on the Tehran Stock Exchange between 2012 and 2023. CSR disclosure was measured through a text-mining approach applied to board of directors' reports, covering 24 CSR indicators grouped into six dimensions. Economic recession was identified using the Hodrick–Prescott filter on non-oil GDP, and economic growth was measured as the annual change in real GDP obtained from the Central Bank of Iran. Logistic regression was used to test the predictive power of CSR for recession likelihood, while panel regression was applied to examine CSR's effect on GDP growth. Control variables included market return, stock return volatility, investor sentiment, exchange rate, consumer price index, earnings growth, firm size, and firm age. The logistic regression results showed that CSR was negatively and significantly associated with the probability of economic recession, confirming its predictive role in identifying downturns. The panel regression model demonstrated that CSR was positively and significantly related to subsequent GDP growth, even after controlling for financial and macroeconomic variables. These results indicate that CSR disclosures contain incremental predictive information about macroeconomic outcomes beyond traditional indicators. The findings provide strong evidence that CSR disclosures are not merely symbolic but embed valuable information regarding firms' expectations and resilience, making them useful leading indicators of both recession and economic growth. Incorporating CSR into macroeconomic forecasting frameworks can enhance the accuracy and timeliness of predictions, particularly in emerging markets with evolving reporting standards.

Keywords: Corporate Social Responsibility, Economic Recession, Economic Growth, Logistic Regression, Panel Regression, Predictive Indicators

1. Introduction

Forecasting macroeconomic turning points has long been a central concern of policymakers, investors, and scholars, yet traditional indicator sets built on monetary aggregates, industrial production, and sentiment indices still face timeliness and reliability constraints—especially during regime shifts and atypical shocks (Henderson et al., 2012; Leamer, 2009). A growing stream of interdisciplinary research suggests that firm-level disclosures and behaviors—once viewed as "micro"—can aggregate into informative signals about the "macro," improving real-time inference about recessions and growth (Hann et al., 2017; Laurion & Patatoukas, 2016; Nallareddy & Ogneva, 2017). Within this agenda, corporate social responsibility

(CSR) has moved from a peripheral reporting theme to a potentially material, economy-wide barometer: when firms systematically adjust environmental, social, and governance (ESG) investments, community programs, and stakeholder communications, these shifts may carry information about financing conditions, demand expectations, and risk perceptions that matter for business cycles (Dobers & Halme, 2009; Lee-Davis, 2017; Sen, 2017).

The conceptual bridge from CSR to macroeconomic dynamics rests on two related premises. First, CSR is not merely philanthropic; it is a strategic response to stakeholder pressures, regulatory expectations, and risk management needs, all of which intensify around cyclical transitions (Haw et al., 2015; Tang et al., 2012). Second, CSR disclosures co-move with firms' investment, employment, and innovation choices—real decisions that aggregate to output and income—thereby embedding early signals of expansion or contraction (Badu & Appiah, 2018; Barth et al., 2019). As ESG practices diffuse across industries with heterogeneous capital intensity and exposure to commodity or credit cycles, their aggregate footprint can illuminate where the economy sits relative to trend (Vintro & Comajuncosa, 2010; Zainuddin Rela et al., 2020). These ideas align with modern views of macro-micro linkages in accounting and finance, which document how firm-level reporting properties scale to national indicators and labor market outcomes (Laurion & Patatoukas, 2016; Nallareddy & Ogneva, 2017; Rouxelin & Yehuda, 2018).

Empirically, recent studies have demonstrated that accounting-based aggregates predict recessions and GDP growth with economically meaningful accuracy, often rivaling traditional macro series in timeliness. Aggregate financial misreporting and accrual quality, for example, have been shown to anticipate U.S. business cycle turning points and real activity (Beneish et al., 2023). Special items embedded in financial statements also provide information about the state of the economy, indicating that firms' recognition of exceptional charges scales up to macro assessments (Abdalla & Carabias, 2022). Cost behavior measured in GAAP statements, including "cost stickiness," has predictive content for future unemployment, highlighting the labor market channel that links micro cost adjustments to macro slack (Rouxelin & Yehuda, 2018). Collectively, these findings motivate an expanded search for disclosure domains—such as CSR—that may similarly encode expectations about economic conditions.

CSR is a particularly promising candidate for three reasons. First, CSR engagement strategies and disclosures are sensitive to financing constraints and market competition, which tighten in downturns and loosen in upswings (Haw et al., 2015; Tang et al., 2012). Second, CSR can proxy for firms' long-run investment horizons and innovation posture; green transformation and technology upgrading initiatives often scale when credit is abundant and policy support is credible, and retreat when cash flows and risk tolerance deteriorate (Barth et al., 2019; Feng, 2025). Third, CSR programs are embedded in firms' community relations and supply chains; firms tend to intensify resilience-oriented activities and risk communication when they perceive elevated tail risks or stakeholder vulnerability, which are cyclical (Sisto et al., 2020; Zainuddin Rela et al., 2020). Thus, observed changes in the intensity, content, and tone of CSR reporting may lead the real economy.

Sectoral evidence from extractive and heavy industries illustrates the macro relevance of CSR. In mining, CSR commitments shape community resilience, labor stability, and environmental risk management, all of which affect local employment and incomes with potential spillovers to regional growth (Vintro & Comajuncosa, 2010; Yousefian et al., 2023; Zainuddin Rela et al., 2020). Yet, CSR in extractives can also be "inherited" through acquisitions or licensing arrangements, posing complex implementation challenges that determine whether programs stabilize or destabilize local economies (Abuya & Odongo, 2020; Mzembe & Downs, 2014). These sectoral dynamics emphasize that CSR is not noise but an economically meaningful set of commitments and capabilities that respond to macro and policy signals (Dobers & Halme, 2009; Sen, 2017). When aggregated across firms and industries, such responses can become informative about national cycles.

At the same time, scholarship cautions that the value-relevance of accounting and disclosure information evolves across time, jurisdictions, and institutional settings, which has implications for any CSR-macro link (Barth et al., 2019; El-Diftar & Elkalla, 2019). In emerging and MENA markets, accounting information's association with market values varies with legal enforcement, investor protection, and reporting quality (Badu & Appiah, 2018; El-Diftar & Elkalla, 2019). If CSR disclosure quality co-varies with these institutions, its macro predictability should likewise be context-dependent. For instance, auditor

fee pressures and audit errors increase in recessions, potentially affecting the reliability of both financial and CSR disclosures (Serlak et al., 2020). Understanding CSR's macro significance therefore requires careful measurement design tailored to local reporting systems, governance structures, and regulatory priorities (Haw et al., 2015; Kim & Zhang, 2016).

Microfoundations further support the CSR-cycle linkage. Corporate conservatism and managers' financing decisions reflect expectations about aggregate demand and risk, and they shape disclosure choices and stakeholder engagement (Hann et al., 2017; Kim & Zhang, 2016). Conditional conservatism and its aggregation into national accounts suggest that firm-level recognition thresholds can accumulate into macro signals (Laurion & Patatoukas, 2016). Likewise, restatement risks in macro indicators can be anticipated using accounting information, demonstrating a general pathway from firm data to macro data integrity (Nallareddy & Ogneva, 2017). In this light, CSR—when systematically coded from standardized sources such as board reports—can be combined with established accounting aggregates to enhance forecasting of recessions and growth (Abdalla & Carabias, 2022; Beneish et al., 2023).

From a policy and institutional perspective, CSR has become entwined with public-sector objectives, including the Sustainable Development Goals (SDGs), green transition targets, and inclusive growth agendas (Feng, 2025; Sisto et al., 2020; Vastradmath, 2015). Budget allocations and indicator frameworks now explicitly incorporate private-sector contributions to social and environmental outcomes, which means changes in CSR activity could precede adjustments in public investment, regulation, and social protection—each with macroeconomic consequences (Sisto et al., 2020). At the same time, scholars debate whether CSR leadership is normative-ethical or instrumental-strategic; this debate matters because ethical leadership might sustain CSR through downturns, whereas purely instrumental approaches may be pro-cyclical and thus more predictive of cycles (Lee-Davis, 2017; Sen, 2017). Cross-country evidence also shows that CSR's impact on community resilience and local economic stabilization varies with governance quality and stakeholder participation (Navarro Espigares & Lopez, 2006; Zainuddin Rela et al., 2020).

Tax planning, capital intensity, and financing constraints add further nuance. CSR has been linked to investment sensitivity to internal funds and political connections, indicating interactions between social commitments and real investment under frictions (Morani et al., 2021). CSR can also co-evolve with corporate tax avoidance and leverage decisions, with firm size moderating these relationships (Sulaeman, 2024). If CSR responds to balance sheet stress, credit spreads, or tax policy uncertainty, then CSR fluctuations may accompany or precede macro shifts in investment and output. Complementing these channels, consumer durables and housing cycles remain core propagation mechanisms in macroeconomics; if CSR intensity aligns with household demand expectations for durables or with construction-related environmental initiatives, it could carry additional predictive content (Leamer, 2009). Moreover, novel measurement approaches—such as using satellite imagery to proxy for economic activity—encourage triangulating traditional indicators with alternative datasets; CSR-based textual indices can naturally join this toolbox of high-frequency, real-economy proxies (Henderson et al., 2012).

Notably, prior studies that explicitly tie CSR to macroeconomic growth report mixed but informative results across contexts. Evidence from the Indian banking sector suggests that CSR activities can be associated with national growth, though identification remains challenging (Sharma & Sathish, 2022). In the mining industry, CSR has been connected to economic growth and resilience, but impacts depend on program design, local governance, and community engagement (Abuya & Odongo, 2020; Vintro & Comajuncosa, 2010; Yousefian et al., 2023). Earlier macro-development perspectives posit that CSR can foster inclusive growth when embedded in local needs and institutions, reinforcing the plausibility of an aggregate CSR–growth link (Vastradmath, 2015; Verma & Chauhan, 2007). Conversely, poorly governed or purely symbolic CSR may dilute signals or even confound forecasts if disclosures become decoupled from real operations (Dobers & Halme, 2009). These lessons underscore the importance of rigorous CSR measurement and careful econometric design.

From an accounting perspective, CSR-based macro forecasting should be situated within the broader "value relevance" and information quality literature. The evolving association between accounting numbers and market outcomes reveals how investors update beliefs as standards, enforcement, and technology change (Barth et al., 2019; El-Diftar & Elkalla, 2019). In emerging markets, where reporting heterogeneity and enforcement gaps can be material, robust text-mining-based CSR indices

derived from audited board reports may enhance comparability and mitigate noise (Badu & Appiah, 2018; El-Diftar & Elkalla, 2019). Complementary indicators—such as misreporting propensities, special items, and cost behavior—can serve as controls or alternative predictors, improving out-of-sample performance and stability (Abdalla & Carabias, 2022; Beneish et al., 2023; Rouxelin & Yehuda, 2018). Attention to audit market conditions is also warranted, because fee pressure and error rates rise in downturns, potentially affecting disclosure reliability—and thus the fidelity of CSR signals (Serlak et al., 2020).

Theoretically, stakeholder and institutional perspectives frame CSR as a negotiated outcome among firms, communities, regulators, and investors (Dobers & Halme, 2009; Sen, 2017). When the macro environment weakens, firms may reallocate from long-horizon social investments to liquidity preservation, or conversely, they may intensify CSR to manage legitimacy and risk—two opposite yet testable predictions. Strategic CSR can also complement innovation and green transformation, linking environmental upgrading to growth through productivity and risk channels (Feng, 2025). Where public policy actively measures and incentivizes SDG-consistent activities, CSR can become a quasi-policy instrument whose aggregate fluctuations acquire macro significance (Sisto et al., 2020). Historical experience in resource-intensive settings reinforces that CSR's community interface can stabilize or destabilize local economic conditions during shocks, shaping the amplitude and persistence of regional cycles (Abuya & Odongo, 2020; Vintro & Comajuncosa, 2010; Yousefian et al., 2023).

Methodologically, this study builds on the notion that carefully constructed firm-level indicators can forecast national outcomes when appropriately aggregated and modeled (Laurion & Patatoukas, 2016; Nallareddy & Ogneva, 2017). Following the macro-prediction literature using accounting information, we incorporate controls for market return, volatility, investor sentiment, exchange rate, price level, profitability growth, firm size, and firm age to isolate the incremental predictive content of CSR (Abdalla & Carabias, 2022; Beneish et al., 2023). We also recognize institutional and sectoral heterogeneity documented in emerging markets, adjusting our measurement to audited sources and standardized categories to enhance comparability (Badu & Appiah, 2018; El-Diftar & Elkalla, 2019). Finally, we situate our tests within the ethical and strategic debates on CSR leadership, acknowledging that the persistence and cyclicality of CSR may hinge on whether firms view CSR as passion-driven purpose or as fashion-driven signaling (Lee-Davis, 2017).

In sum, the literature provides converging reasons to investigate whether CSR carries independent, incremental predictive power for economic recession and growth. Prior work shows that aggregate accounting properties and special items anticipate macro outcomes (Abdalla & Carabias, 2022; Beneish et al., 2023), that sectoral CSR influences local resilience and economic activity (Vintro & Comajuncosa, 2010; Yousefian et al., 2023; Zainuddin Rela et al., 2020), and that disclosure value-relevance evolves with institutions (Barth et al., 2019; El-Diftar & Elkalla, 2019). Building on these insights, we directly test whether a text-mined CSR disclosure index predicts subsequent recession likelihood and real GDP growth after controlling for established financial and macro variables, and we evaluate this predictive relation in a setting characterized by active capital markets and evolving CSR practice (Haung, 2015; Henderson et al., 2012; Kim & Zhang, 2016; Morani et al., 2021; Navarro Espigares & Lopez, 2006; Sharma & Sathish, 2022; Sulaeman, 2024; Ziari & Ashrafi, 2024). The objective of this study is to examine whether corporate social responsibility disclosures provide statistically and economically significant forecasts of (i) recession probability and (ii) real GDP growth at the national level, conditional on standard controls and institutional features of the reporting environment.

2. Methods and Materials

Since this study seeks to discover scientific laws and principles and attempts to develop knowledge and theories in both general and specific terms, the type of research is considered fundamental-applied. As historical financial statements are used in the data collection process, the research design is ex post facto. Given that a systematic elimination sampling method was employed, descriptive methods were used to report results related to the sample, while inductive inference methods were applied to generalize findings to the statistical population. Therefore, in terms of its nature, this study belongs to descriptive-correlational research. The spatial scope of this research is the companies listed on the Tehran Stock Exchange. The temporal

scope spans from 2012 to 2023. The subject scope lies within accounting and focuses on forecasting economic recession and economic growth using corporate social responsibility.

The statistical population of this study consists of companies listed on the Tehran Stock Exchange during the period 2012 to 2023. The systematic elimination sampling method was applied according to the following criteria:

1. To ensure data homogeneity, companies in the banking, financial, insurance, and leasing sectors were excluded.
2. To maintain comparability of data, companies whose fiscal year did not end in March were excluded.
3. Companies that changed their fiscal year during the study period were excluded.
4. Companies whose shares were not traded at least once every three months during the study period were excluded.
5. Companies with unavailable data regarding the selected variables were excluded.

Table 1. Process of Sample Selection

Description	Number
Total number of companies listed on the Tehran Stock Exchange at the beginning of 2012	348
Minus:	
Number of investment or financial intermediation companies	(68)
Number of companies whose fiscal year did not end in March	(49)
Number of companies whose shares were not traded at least once every three months	(72)
Number of companies with unavailable data	(29)
Number of companies that changed fiscal year during the study period	(25)
Final number of companies studied	105

In collecting the required data to calculate the research variables, the document analysis method was used. Accordingly, information published by the Tehran Stock Exchange, such as audited financial statements and accompanying notes, was applied. Data were also gathered from the Rahavard Novin information system. In other words, the instruments of this research include audited financial statements, the board of directors' reports to the general assembly of shareholders, and the Rahavard Novin database.

This research includes the dependent variables of economic recession and economic growth, which are calculated as follows:

Economic Recession (RECESSION): Economic recession refers to regular declines in economic activities along the trajectory of gross domestic product (GDP). One of the most important aspects of recession is the study of fluctuations of national gross product around its long-term growth path. Therefore, in this study, using EViews software and the Hodrick-Prescott filter method, years of economic recession and economic growth were identified. Consistent with the research of Benish et al. (2023) and Sarlak et al. (2020), a dummy variable is considered, with 1 representing recession periods and 0 representing growth periods. One of the most common methods to extract economic cycles is the time-trend Hodrick-Prescott filter. The extraction process is as follows: first, the trend size of non-oil GDP is extracted using the Hodrick-Prescott filter and denoted as HPGDPN. Then, economic fluctuations around the natural trend are calculated and denoted as the deviation of non-oil GDP. Based on this, recession and growth are identified. If GDPN exceeds its natural trend, economic growth is assumed; if real GDP falls below its natural trend, recession is assumed. Thus, the deviation from the natural trend of GDP, denoted as SDGDPN, is calculated as follows:

Equation (1):

$$SDGDPN_t = GDPN_t - HPGDP_t$$

$$BOO_t = Max (0, SDGDPN_t)$$

$$REC_t = Min (SDGDPN_t, 0)$$

Where BOO and REC represent the deviation of non-oil GDP from its natural trend in years of growth and recession, respectively. Using EViews software, the non-oil GDP variable was detrended using the Hodrick-Prescott method, and the SDGDPN time series was extracted.

Economic Growth (RGDP): This is calculated as the real GDP in the current year minus real GDP in the previous year, divided by the real GDP in the previous year. Data on GDP growth were obtained directly from the website of the Central Bank of the Islamic Republic of Iran. A positive value indicates economic growth, while a negative value indicates economic recession.

In this study, corporate social responsibility (CSR) was measured using a text-mining technique to obtain CSR disclosure ratings, based on the research of Moradi et al. (2021). To rank companies, board of directors' reports were analyzed under 24 items categorized into 6 groups representing CSR dimensions:

1. **Policy and Society:** (1. Legal environment, 2. Shareholder relations, 3. External cultural activities)
2. **Employee Strategy:** (4. Job-related professional training, 5. General training, 6. Employee insurance and welfare, 7. Supporting employees' family life, 8. Internal cultural activities)
3. **Environment:** (9. Environmental or quality certifications, 10. Green space initiatives, 11. Air and noise pollution management, 12. Recycling and waste management, 13. Energy-saving strategies)
4. **Customers and Suppliers:** (14. Product/service quality improvement, 15. Customer relations and after-sales service, 16. Corporate website, 17. Website updates, 18. Online services such as e-sales and orders)
5. **Social Investment:** (19. Social performance reports, 20. Public donations, 21. CSR and social commitment policies)
6. **Corporate Strategy:** (22. Strategic planning and organizational excellence, 23. Employee satisfaction measurement, job classification, and resource development, 24. Core organizational values emphasizing customers and society).

CSR disclosure was measured using the following CSR reporting index:

Equation (2):

$$CSR = \sum_{i=1}^{nj} X_{ij} / n_j$$

Where:

- n_j = total expected score for each company j in year t, equal to 24 (the 24 items above).
- X_{ij} = actual score obtained by company j in year t. If a company discloses an item, it is assigned a score of 1; otherwise, it is assigned 0.

The control variables of this study are as follows:

- **Market Return (MKTRET):** Portfolio return in the given year (Benish et al., 2023).
- **Stock Return Volatility (MKTVOL):** Standard deviation of monthly stock returns (Benish et al., 2023).
- **Investor Sentiment (SENTIMENT):** Calculated using the Baker and Wurgler (2006) sentiment index, as shown in Equation (3) (Benish et al., 2023).

Equation (3):

$$S = \left(\sum(R_{it} - R_r)(R_{iv} - R_v)\right) / \left[\left(\sum(R_{it} - R_r)^2 \sum(R_{iv} - R_v)^2\right)\right]^{(1/2)} \times 100$$

Where:

- S = investor sentiment
- R_{it} = annual stock return of company i in year t
- R_{iv} = volatility rank of stock returns of company i, based on the average standard deviation of stock returns over the prior two years
- R_r = average rank of annual stock returns of portfolio companies (sample companies are sorted by firm size, measured as the natural logarithm of total assets, and divided into five portfolios, from smallest to largest; portfolio 1 includes companies with the lowest measure, and portfolio 5 includes those with the highest)
- R_v = average historical volatility rank of portfolio companies
- **Exchange Rate (ER):** Natural logarithm of the USD exchange rate at the end of the year.
- **Consumer Price Index (CPI):** Consumer price index (inflation rate) at the end of the year.
- **Net Profit Growth (EARNGROWTH):** Current year's net profit minus last year's net profit, divided by last year's net profit.
- **Firm Size (SIZE):** Natural logarithm of total assets.
- **Firm Age (AGE):** Number of years the company has been active since its establishment.

3. Findings and Results

To test the research hypothesis that corporate social responsibility predicts economic recession, a logistic regression model was employed in accordance with Sharma and Satish (2022), as specified in Model (1). In Model (1), if the regression relationship and the coefficient β_1 are statistically significant, the first research hypothesis is confirmed.

Model (1):

$$RECESSION_{(t+1)} = \beta_0 + \beta_1 CSR_{(i,t)} + \beta_2 MKTRET_{(i,t)} + \beta_3 MKTVOL_{(i,t)} + \beta_4 SENTIMENT_{(i,t)} + \beta_5 ER_t + \beta_6 CPI_t + \beta_7 EARNGROWTH_{(i,t)} + \beta_8 SIZE_{(i,t)} + \beta_9 AGE_{(i,t)} + \varepsilon_{(i,t)}$$

Where:

$CSR_{(i,t)}$: corporate social responsibility of firm i in year t.

To test the research hypothesis that corporate social responsibility predicts economic growth, a panel data regression model was applied following Sharma and Satish (2022), as presented in Model (2). In Model (2), if the regression relationship and the coefficient β_1 are statistically significant, the second research hypothesis is confirmed.

Model (2):

$$RGDP_{(t+1)} = \beta_0 + \beta_1 CSR_{(i,t)} + \beta_2 MKTRET_{(i,t)} + \beta_3 MKTVOL_{(i,t)} + \beta_4 SENTIMENT_{(i,t)} + \beta_5 ER_t + \beta_6 CPI_t + \beta_7 EARNGROWTH_{(i,t)} + \beta_8 SIZE_{(i,t)} + \beta_9 AGE_{(i,t)} + \varepsilon_{(i,t)}$$

First, descriptive statistics for the study data were computed. Table (2) reports the descriptive statistics of the model variables, including the mean, median, maximum and minimum values, standard deviation, skewness, and kurtosis.

Table 2. Descriptive Statistics of Model Variables

Symbol	Name	Mean	Median	Max	Min	Std. Dev.	Skewness	Kurtosis
AGE	Firm age	45.767	47.000	70.00	20.000	10.568	-0.322	2.315
CPI	Consumer price index	0.273	0.305	0.465	0.090	0.131	-0.127	1.606
CSR	Corporate social responsibility	0.545	0.541	0.833	0.291	0.095	-0.146	2.827
EARNGROWTH	Earnings growth	1.342	0.113	19.061	-4.879	14.665	7.383	113.940
ER	Exchange rate	11.326	10.799	13.108	10.314	0.977	0.470	1.667
EVA	Economic value added	11.321	11.239	17.352	5.936	1.607	0.334	3.252
MKTRET	Market return	0.598	0.433	1.870	-0.208	0.636	0.711	2.337
MKTVOL	Stock return volatility	1.441	1.369	3.414	0.430	0.590	0.603	2.966
MSCORE	Financial misreporting score	0.297	0.000	1.000	0.000	0.457	0.884	1.781
RECESSION	Economic recession (dummy)	0.272	0.000	1.000	0.000	0.445	1.020	2.041
RGDP	Economic growth	0.026	0.032	0.141	-0.060	0.051	0.281	3.521
SENTIMENT	Investor sentiment	0.225	0.214	1.974	-1.616	6.041	9.503	437.912
SIZE	Firm size	14.716	14.588	20.583	10.644	1.625	0.446	3.622
TOBIN	Tobin's Q	2.636	1.705	28.102	0.147	2.834	3.829	22.417

The principal measure of central tendency is the mean, which indicates the equilibrium point and the center of gravity of the distribution and is a good index of data centrality. For example, the mean for the economic growth variable (RGDP) equals 0.026, indicating that most observations cluster around this value. The median is another central tendency index that reflects the status of the population. As observed, the median of this variable is 0.032, indicating that half of the observations are below and half are above this value. In general, dispersion parameters gauge the extent to which observations differ from one another or deviate from the mean. Among the most important dispersion parameters is the standard deviation. Among the variables, economic growth (RGDP) has the lowest dispersion, and earnings growth (EARNGROWTH) has the highest dispersion, indicating, respectively, the least and greatest variability. Skewness denotes the asymmetry of the frequency curve. If the skewness coefficient is zero, the distribution is perfectly symmetric; if it is positive, the distribution is skewed to the right; if negative, it is skewed to the left. Kurtosis measures the peakedness or flatness of the frequency curve relative to the standard normal curve. The consumer price index (CPI) exhibits the lowest kurtosis, whereas investor sentiment (SENTIMENT) exhibits the highest kurtosis relative to normality. When kurtosis equals zero, the data distribution is normal, i.e., in a tall, upward shape where observations are relatively close and variance is low. Positive kurtosis indicates a more pronounced peak at the mode. In a flat (platykurtic) distribution with negative kurtosis, observations are more dispersed and variance is high. In this study, before estimating the model, the stationarity of the variables was examined. In these tests, rejecting the null hypothesis H0 of a unit root implies stationarity. The Levin, Lin, and Chu method was used to assess stationarity. Accordingly, Table (3) reports the stationarity results for the model variables.

Table 3. Results of Stationarity Tests for Model Variables (Levin-Lin-Chu)

Symbol	Statistic	Probability
AGE	-3.599	0.0002
CPI	-3.127	0.0009
CSR	-30.069	0.0000

EARNGROWTH	-26.472	0.0000
ER	-9.1200	0.0000
EVA	-2.3980	0.0082
MKTRET	-14.974	0.0000
MKTVOL	-19.057	0.0000
RGDP1	-20.609	0.0000
SENTIMENT	-25.703	0.0000
SIZE	-2.7827	0.0027
TOBIN	-13.289	0.0000

The stationarity results in Table (2), based on the computed test statistics and their associated probabilities, indicate that all variables are stationary at the 5% significance level. Before fitting the model to the data, the model assumptions were examined:

According to the table below, under the first criterion the null hypothesis (homoskedasticity) is not confirmed, indicating the presence of heteroskedasticity in the residuals. Therefore, the Huber–White method was used in the model estimation to correct for heteroskedasticity.

Table 4. Wald Test for Homoskedasticity, Model (1)

Statistic (Wald)	Probability
421.79	0.0000

The results of the variance inflation factor (VIF) test are presented below. As shown, the VIF statistics for all variables are below 5, indicating no multicollinearity among the regressors.

Table 5. Correlation/VIF among Independent Variables, Model (1)

VIF	Variable
2.71	ER
2.56	CPI
1.29	SIZE
1.29	MKTRET
1.12	AGE
1.09	MKTVOL
1.02	CSR
1.01	EARNGROWTH
1.01	SENTIMENT
1.45	Mean VIF

Given the foregoing, the likelihood ratio statistic was used to test the overall significance of the model, and Z-statistics were used to test the significance of the regression coefficients. Additionally, the pseudo R-squared was used to assess the association between the dependent and independent variables. The results of estimating Model (1) are reported in the tables below.

Table 6. Results of Data Analysis for Testing the First Hypothesis (Model (1): $RECESSION_{(t+1)} = \beta_0 + \beta_1 CSR_{(i,t)} + \beta_2 MKTRET_{(i,t)} + \beta_3 MKTVOL_{(i,t)} + \beta_4 SENTIMENT_{(i,t)} + \beta_5 ER_t + \beta_6 CPI_t + \beta_7 EARNGROWTH_{(i,t)} + \beta_8 SIZE_{(i,t)} + \beta_9 AGE_{(i,t)} + \varepsilon_{(i,t)}$)

Name	Symbol	Coefficient	Z-statistic	Probability
Corporate Social Responsibility	CSR	-0.064	-12.495	0.000
Market Return	MKTRET	-0.598	-5.156	0.000
Stock Return Volatility	MKTVOL	-0.242	-1.658	0.097
Investor Sentiment	SENTIMENT	-0.008	-1.413	0.157
Exchange Rate	ER	1.743	10.450	0.000
Consumer Price Index	CPI	-16.952	-15.195	0.000
Earnings Growth	EARNGROWTH	0.0005	0.093	0.925
Firm Size	SIZE	-0.140	-2.403	0.016
Firm Age	AGE	-0.003	-0.485	0.627
Constant	C	-14.511	-8.945	0.000

McFadden R-squared: 0.734; Likelihood Ratio Statistic: 249.359; Log-likelihood (max): -1.059; Probability (LR statistic): 0.000

Given that the probability value for the likelihood ratio statistic is less than 0.05, the null hypothesis of overall model insignificance is rejected, indicating that the research model is significant. The coefficient of the corporate social responsibility

(CSR) variable serves as the indicator for evaluating the first hypothesis; if this coefficient is significant, the hypothesis is confirmed. The probability value for the Z-statistic of this variable equals 0.005 and is less than the 0.05 error level; therefore, the first research hypothesis is accepted at the 5% error level (Sharma & Satish, 2022).

One of the tests used to assess the goodness-of-fit of logistic models is the Hosmer–Lemeshow test. In this test, the overall significance of the regression coefficients is examined by comparing the predicted and actual values of the dependent variable across different groups. A large difference between actual and predicted values indicates poor model fit. Accordingly, in logistic regression, the Hosmer–Lemeshow test is used to evaluate model fit, and its statistical significance is interpreted such that if the test probability exceeds 0.05, the null hypothesis is confirmed, indicating good model fit. As shown in the table below, the test probability exceeds 5%, and thus the model exhibits good fit.

Table 7. Hosmer–Lemeshow Test for Model (1)

Test statistic	Probability
7.234	0.456

A summary of the F-Limer (poolability) test results is presented in Table (7). As observed, the probability value in the F-Limer test is greater than 0.05; therefore, the pooled data method is accepted.

Table 8. F-Limer Test (Model (2))

F-Limer Statistic	Probability	Result
0.891	0.769	Pooled

Before fitting the model to the data, the model's assumptions were examined:

According to the value of the Wooldridge test statistic reported in the table below, the model exhibits autocorrelation. To address this issue, generalized least squares (GLS) was used for estimation.

Table 9. Wooldridge Test for No Autocorrelation (Model (2))

Probability	Test statistic
0.0000	17374.253

According to the table below, the null hypothesis of homoskedasticity is not confirmed, indicating the presence of heteroskedasticity in the residuals. Therefore, GLS was used in model estimation to correct for heteroskedasticity.

Table 10. Wald Test for Homoskedasticity (Model (2))

Statistic (Wald)	Probability
94.98	0.000

The results of the variance inflation factor (VIF) test are presented below. As shown, the VIF statistics for all variables are below 5, indicating no multicollinearity among the independent variables.

Table 11. VIF Test Results (Model (2))

VIF	Variable
2.71	ER
2.56	CPI
1.29	SIZE
1.29	MKTRET
1.12	AGE
1.09	MKTVOL
1.02	CSR
1.01	EARNGROWTH
1.01	SENTIMENT
1.45	Mean VIF

In light of the above, the F-statistic was used to test the overall significance of the model, and t-statistics were used to test the significance of the regression coefficients. Additionally, the adjusted R-squared was used to examine the association between the dependent and independent variables. The results of estimating Model (2) are presented in the table below.

Table 12. Results of Data Analysis for Testing the Second Hypothesis (Model (2): $RGDP_{t+1} = \beta_0 + \beta_1 CSR_{i,t} + \beta_2 MKTRET_{i,t} + \beta_3 MKTVOL_{i,t} + \beta_4 SENTIMENT_{i,t} + \beta_5 ER_t + \beta_6 CPI_t + \beta_7 EARNGROWTH_{i,t} + \beta_8 SIZE_{i,t} + \beta_9 AGE_{i,t} + \varepsilon_{i,t}$)

Name	Symbol	Coefficient	t-statistic	Probability
Corporate Social Responsibility	CSR	0.095	2.322	0.020
Market Return	MKTRET	-0.007	-0.656	0.511
Stock Return Volatility	MKTVOL	0.011	1.227	0.219
Investor Sentiment	SENTIMENT	0.0004	2.812	0.005
Exchange Rate	ER	-0.010	-0.772	0.440
Consumer Price Index	CPI	0.076	0.492	0.622
Earnings Growth	EARNGROWTH	0.00004	0.791	0.428
Firm Size	SIZE	0.002	1.761	0.078
Firm Age	AGE	0.00003	0.706	0.480
Constant	C	0.068	0.665	0.505

R-squared: 0.152; F-statistic: 7.013; Adjusted R-squared: 0.144; Probability (F-statistic): 0.000

Given that the probability value for the F-statistic is less than 0.05, the null hypothesis of overall model insignificance is rejected, indicating that the research model is significant. The coefficient of the corporate social responsibility (CSR) variable serves as the indicator for evaluating the second hypothesis; if this coefficient is significant, the hypothesis is confirmed. The probability value for the t-statistic of this variable equals 0.020 and is less than the 0.05 error level; therefore, the second research hypothesis is accepted at the 5% error level.

4. Discussion and Conclusion

The results of this study provide strong evidence that corporate social responsibility (CSR) has significant predictive power for both economic recession and economic growth, even after controlling for well-established financial and macroeconomic indicators such as market return, volatility, investor sentiment, exchange rate, consumer price index, earnings growth, firm size, and firm age. In particular, CSR demonstrated a negative and statistically significant association with the probability of recession in the logistic regression model, while exhibiting a positive and statistically significant relationship with subsequent real GDP growth in the panel regression model. These findings support the first and second hypotheses of the study, confirming that CSR disclosures are not merely symbolic or reputational but can serve as valuable leading indicators of macroeconomic fluctuations. The evidence suggests that the manner in which firms allocate resources and communicate their CSR engagement embeds information about their expectations of future economic conditions and the resilience of their operational environments.

One key insight from the recession prediction model is that CSR intensity, when aggregated across firms, tends to decline in periods preceding downturns, signaling that firms anticipate tighter financing conditions, reduced consumer demand, and heightened uncertainty. This aligns with earlier research demonstrating that accounting aggregates, such as special items and accrual quality, provide predictive signals about recession probability (Abdalla & Carabias, 2022; Beneish et al., 2023). Just as firms recognize unusual charges or adjust recognition thresholds in ways that capture deteriorating fundamentals (Laurion & Patatoukas, 2016; Nallareddy & Ogneva, 2017), CSR commitments appear to function as a barometer of firms' expectations and adaptive strategies. The finding that CSR serves as a leading indicator of recession resonates with prior evidence on cost stickiness, where asymmetric cost adjustments in financial statements predict rising unemployment (Rouxelin & Yehuda, 2018). Together, these studies highlight the potential of firm-level disclosures, beyond traditional financial data, to enhance the timeliness and accuracy of macroeconomic forecasting.

The positive association between CSR and GDP growth adds another dimension to this narrative. When firms increase CSR activities, they are not only responding to regulatory or reputational pressures but also investing in long-term projects that enhance innovation, stakeholder trust, and sustainability. This is consistent with evidence from India's banking sector, where CSR expenditures were linked to national economic growth (Sharma & Sathish, 2022), and with findings in the mining sector, where CSR practices were found to foster community resilience and contribute to regional economic stability (Yousefian et al., 2023; Zainuddin Rela et al., 2020). In our results, the growth-enhancing role of CSR was evident even after controlling

for profitability, market conditions, and investor sentiment, suggesting that CSR captures incremental dimensions of firms' long-run outlook and resource allocation strategies. These findings align with broader theoretical perspectives that conceptualize CSR as a driver of inclusive growth, particularly in developing economies (Vastradmath, 2015; Verma & Chauhan, 2007).

Our results also demonstrate that CSR disclosures provide incremental information beyond conventional macro predictors such as exchange rates and inflation. While traditional indicators like CPI were significant in predicting recessions, CSR still retained explanatory power, highlighting its complementary role. This finding aligns with the argument that the value relevance of accounting and disclosure evolves with institutional settings, where non-traditional disclosures such as CSR can complement or even substitute for weaker market signals (Barth et al., 2019; El-Diftar & Elkalla, 2019). In contexts where investor protection and enforcement are weaker, CSR disclosures may become particularly valuable as proxies for firms' long-term resilience and stakeholder orientation (Badu & Appiah, 2018; Dobers & Halme, 2009). Our study reinforces the importance of including CSR in macroeconomic monitoring frameworks, particularly in emerging economies with heterogeneous reporting standards.

The evidence that CSR predicts macro outcomes also intersects with debates about whether CSR is driven by passion or fashion. The persistence of its predictive role across our models suggests that CSR reflects substantive strategic adjustments rather than transient symbolic gestures. This supports the perspective that CSR leadership, when integrated into firm strategy, provides meaningful signals about long-term growth prospects (Lee-Davis, 2017; Sen, 2017). At the same time, CSR's predictive role may be amplified by policy frameworks that link CSR to national development goals, such as the Sustainable Development Goals (SDGs). Public policy instruments that incentivize CSR activities through budget allocations and regulatory frameworks could further strengthen the alignment between CSR practices and macroeconomic outcomes (Feng, 2025; Sisto et al., 2020).

The sectoral evidence presented in previous research also aligns with our findings. In mining and extractive industries, CSR has been shown to stabilize community relations and mitigate conflict risks, thereby supporting local economic activity and reducing the likelihood of disruptions (Abuya & Odongo, 2020; Mzembe & Downs, 2014; Vintro & Comajuncosa, 2010). Our results generalize these insights to a broader market-wide setting, suggesting that CSR commitments across diverse industries collectively encode information relevant to national cycles. Similarly, evidence from the MENA region indicates that accounting information's value relevance varies by institutional context (El-Diftar & Elkalla, 2019), suggesting that the predictive role of CSR may be context-dependent but nonetheless significant when measured with standardized tools such as text-mining of board reports (Morani et al., 2021).

Another noteworthy finding from our analysis is the role of investor sentiment as a control variable. Although sentiment did not consistently reach significance in our models, the predictive power of CSR remained intact, suggesting that CSR captures expectations that are not fully reflected in market sentiment. This finding is important because it implies that CSR disclosures are not simply responding to investor mood or short-term fluctuations but reflect deeper strategic adjustments. This aligns with research emphasizing the macro-relevance of financing decisions by large firms, which provide insights into broader economic expectations (Hann et al., 2017). By capturing information beyond market noise, CSR demonstrates its unique predictive contribution to macroeconomic forecasting.

Our findings further contribute to the literature linking CSR to green economic transformation and innovation. The positive association between CSR and GDP growth is consistent with evidence that CSR engagement in environmental and technological domains facilitates long-term productivity gains and supports green transition pathways (Feng, 2025). This connection underscores the role of CSR not only as a predictor but also as a driver of sustainable economic growth, particularly in the context of global policy shifts toward decarbonization and ESG integration.

The robustness of our results, supported by tests addressing heteroskedasticity, autocorrelation, and multicollinearity, strengthens confidence in the validity of the findings. The use of standardized CSR indices derived from text-mining of board reports enhances comparability across firms and mitigates concerns about symbolic reporting. This methodological approach reflects lessons from prior research on restatements and misreporting, which highlight the importance of reliable disclosure in macro forecasting (Beneish et al., 2023; Nallareddy & Ogneva, 2017). By grounding our CSR measurement in audited

board-level disclosures, the study aligns with best practices in financial reporting research and provides a credible foundation for macroeconomic inference.

In sum, the findings of this study confirm that CSR is both a predictor and a reflection of macroeconomic dynamics. By demonstrating significant predictive power for recession and growth, CSR joins the expanding set of firm-level disclosures with macroeconomic implications, alongside special items, cost stickiness, and misreporting indices (Abdalla & Carabias, 2022; Beneish et al., 2023; Rouxelin & Yehuda, 2018). The results support theoretical perspectives that conceptualize CSR as embedded in firms' strategic and operational responses to macroeconomic conditions (Haw et al., 2015; Sen, 2017; Tang et al., 2012). They also provide practical evidence that CSR data should be incorporated into macroeconomic forecasting models to enhance predictive accuracy and timeliness, especially in settings where traditional indicators lag or underperform.

Despite the robust findings, several limitations should be acknowledged. First, the study is context-specific, focusing on firms listed in a single emerging market, which may limit the generalizability of results to other institutional environments with different regulatory frameworks and stakeholder expectations. Second, CSR was measured using text-mining techniques on board reports, which, while systematic, may still be subject to disclosure bias or selective reporting by managers. Third, the study period was constrained by data availability, and structural changes in the economy or regulatory environment during the period could have influenced both CSR reporting and macroeconomic outcomes. Finally, although we controlled for a range of financial and macroeconomic variables, omitted variable bias cannot be entirely ruled out, as unobserved policy interventions or sectoral shocks may also affect the CSR–macro relationship.

Future research could expand the analysis to cross-country settings to examine how institutional quality, enforcement, and cultural norms mediate the predictive role of CSR. Comparative studies across developed and developing economies could illuminate whether CSR's predictive power is stronger where formal institutions are weaker, or whether it scales with the maturity of capital markets. Additionally, researchers could experiment with alternative CSR measurement techniques, such as natural language processing of sustainability reports or ESG ratings from third-party providers, to validate and extend the findings. Future studies could also explore sectoral heterogeneity by testing whether CSR in capital-intensive industries, like mining or manufacturing, has stronger predictive content than CSR in service-oriented sectors. Finally, integrating CSR with alternative big data indicators, such as satellite imagery or social media sentiment, may yield richer forecasting models capable of capturing both firm-level and grassroots signals of macroeconomic conditions.

From a practical standpoint, the findings underscore the importance of integrating CSR metrics into the toolkits of policymakers, investors, and analysts. Policymakers can incorporate CSR indices into macroeconomic monitoring systems to detect early warning signals of downturns and assess the resilience of economic growth. Investors and financial institutions can enhance portfolio risk assessments by tracking CSR disclosures as part of their predictive models for market cycles. Firms themselves can recognize that their CSR commitments are not only reputationally important but also economically meaningful, signaling to stakeholders their outlook on economic conditions. By aligning CSR practices with long-term sustainability and growth objectives, firms can simultaneously contribute to national development goals and strengthen their role as reliable predictors of macroeconomic stability.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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