(Online) ISSN 2712-0554
*Original Research*

**Heritage and Sustainable Development**
Vol. 7, No. 2, 2025, pp.1041-1054
https://doi.org/10.37868/hsd.v7i2.1612

# Asymmetric cost behavior and earnings forecast precision: A cross-country study of Iraq and Jordan

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Received Jan. 2, 2025
Revised Aug. 19, 2025
Accepted Sep. 16, 2025
Online Oct. 14. 2025

**Abstract**

This study explores the impact of cost stickiness and its signaling effect on the accuracy of earnings per share (EPS) forecasts in the capital markets of developing countries, with a focus on Iraq and Jordan. Cost stickiness, defined as the asymmetric response of costs to revenue fluctuations, particularly their slower reduction during sales declines, challenges traditional forecasting models that assume cost symmetry. Drawing on panel data from 30 publicly listed firms between 2014 and 2023, the study tests six regression-based hypotheses. The results indicate that higher levels of total and operational cost stickiness significantly impair EPS forecast accuracy. In Iraq, operational and wage-related stickiness exert the strongest effects, while in Jordan, service and depreciation costs play a more prominent role. These findings are interpreted through agency theory, signaling, and information asymmetry, emphasizing how weaker institutional quality and disclosure, as in Iraq, intensify the adverse effects. The study contributes to the cost behavior literature and offers practical insights for analysts, regulators, and managers in emerging markets.



*Keywords*: Cost stickiness, Earnings forecast accuracy, Asymmetric cost behavior, Financial transparency, Developing economies, Iraq, Jordan

## 1. Introduction

Understanding cost behavior is a central issue in management accounting, as it directly affects financial forecasting and decision-making. Traditional models classify costs as fixed or variable, assuming that changes in activity levels produce proportional cost adjustments regardless of direction. Under this view, costs are expected to rise and fall symmetrically with sales, depending solely on the magnitude of the change [1, 2].

However, evidence from the past two decades challenges this assumption, showing that costs often decrease less during sales downturns than they increase during upturns, a phenomenon known as cost stickiness [3, 4]. This asymmetric behavior reflects managerial and organizational decisions, such as retaining resources in anticipation of future demand. While much of the literature has concentrated on cost behavior during sales declines, less attention has been paid to cost responses during sales growth [5, 6]. Yet, positive cost signals accompanying sales expansion can provide important insights into future performance and forecast reliability.

Banker and Chen [2], for example, demonstrated that forecasting models incorporating both cost stickiness and positive signals outperform those relying solely on segmented earnings information.

Another important dimension is the classification of costs. Aggregated analysis of total costs obscures the heterogeneous behavior of individual categories. Costs may differ substantially by function, such as cost of goods sold versus operating expenses, or by nature, including wages, services, and depreciation. Disaggregating costs, therefore, provides a more accurate picture of how each component responds to revenue changes and how these responses affect earnings predictions [7, 8].

Accurate earnings per share (EPS) forecasts are crucial for investors, analysts, and regulators, particularly in developing capital markets where transparency and institutional quality are limited. Failure to account for cost stickiness and positive cost signals may reduce the reliability of such forecasts. Consequently, this study examines the influence of both aggregate and disaggregated cost behavior by function and by nature on EPS forecast accuracy in firms listed on the Iraq and Jordan stock exchanges [9, 10].

The study addresses the following research question: How does cost behavior, in terms of both function and nature, affect the accuracy of EPS forecasts in developing market contexts such as Iraq and Jordan?

## 2. Theoretical foundations of the study

This study investigates how stickiness costs and its positive signals on the accuracy of earnings per share (EPS) forecasts in developing markets. Several theories provide the conceptual foundation. Agency cost theory links cost stickiness to conflicts between managers and shareholders, as managers may retain resources during downturns to safeguard their control [11, 12]. Information asymmetry theory emphasizes that managers possess superior knowledge of cost structures, while investors face limited disclosure, leading to greater forecast errors.

The cost stickiness theory demonstrates that costs decrease more slowly when sales decline than they increase when sales rise, producing asymmetric behavior that undermines forecasting models that assume symmetry. Signaling theory suggests that managers use cost behavior as a market signal, which may mislead investors if costs are not reduced during downturns [1, 13]. Managerial behavior theory highlights psychological and organizational factors, such as reluctance to cut staff, that reinforce cost stickiness and distort financial information [14, 15].

These theories jointly explain why sticky costs reduce EPS forecast accuracy, especially in weak institutional environments such as Iraq and Jordan. Prior researches [1, 4] confirm that both cost stickiness and positive cost signals increase analyst forecast errors, and that effects differ across cost categories.

Accordingly, the study develops the following hypotheses:

**H1**: The stickiness of costs (the combined total of cost of goods sold and operating expenses) has an inverse effect on the accuracy of earnings per share (EPS) forecasts in the Iraq Stock Exchange.

**H2**: The stickiness of costs (the combined total of cost of goods sold and operating expenses) has an inverse effect on the accuracy of earnings per share (EPS) forecasts in the Jordan Stock Exchange.

**H3**: The stickiness of operating expenses has an inverse effect on the accuracy of earnings per share forecasts in the Iraq Stock Exchange.

**H4**: The stickiness of operating expenses has an inverse effect on the accuracy of earnings per share forecasts in the Jordan Stock Exchange.

**H5**: The stickiness of wage expenses, service costs, and depreciation costs has an inverse effect on the accuracy of earnings per share forecasts in the Iraq Stock Exchange.

**H6**: The stickiness of wage expenses, service costs, and depreciation costs has an inverse effect on the accuracy of earnings per share forecasts in the Jordan Stock Exchange.

## 3. Methodology

This research is applied in terms of its purpose and is analytical (causal) in nature. Philosophically, it belongs to the positive accounting paradigm. From the implementation perspective, it follows a quantitative approach, and in terms of reasoning, it employs a deductive–inductive methodology. Regarding the time dimension, it is classified as a longitudinal and retrospective study, using historical data of sample firms.

The statistical population consists of companies listed on the Iraq and Jordan Stock Exchanges over the period 2014 to 2023.

The final sample size will be determined after the screening process. Companies are selected based on the following criteria:

1. Companies listed on the Iraq and Jordan Stock Exchanges with accessible financial data for the 2014–2023 period;
2. Companies whose shares were actively traded during the 2014–2023 period and were not delisted by the end of the fiscal year 2014;
3. To ensure comparability, companies whose fiscal year ends in December each year;
4. Companies that did not report losses in any of the years under study;
5. Excluding banks, financial institutions, insurance firms, holding companies, investment firms, and similar entities.

## 4. Variables and measurement

Dependent variable: Accuracy of EPS forecasts

The forecast error of EPS ($FE_{it}$) is used, measured using the model proposed by Cheng and Firth (2000):

$$\mathbf{FE}_{i,t} = \frac{(\mathbf{AP}_{i,t} - \mathbf{FP}_{i,t})}{\mathbf{FP}_{i,t}}$$

**FEit**: The absolute value of the earnings per share (EPS) forecast error by the managers of company *i* in year *t*.
**APit**: The actual net earnings per share of the company *i* in year *t*.
**FPit**: The forecasted net earnings per share by the managers (calculated using the weighted moving average method).

The smaller the value of this ratio, the higher the accuracy in estimating the earnings per share.

Independent variable: Cost stickiness

Cost stickiness is measured based on the model developed by Anderson et al.:

$$\text{Cost Signal}^{-} = \frac{\mathbf{COST}_{i,t}}{\mathbf{SALES}_{i,t}} - \frac{\mathbf{COST}_{i,t-1}}{\mathbf{SALES}_{i,t-1}}$$

In periods of declining sales, the value obtained from the above model indicates cost stickiness. Under other conditions, the value of this variable is considered to be zero [16, 17].

This ratio, during periods of declining sales, is referred to as the negative cost stickiness signal. According to this model, when sales decrease, the calculated figure reflects cost stickiness; otherwise (in cases of increasing or unchanged sales), it is assigned a value of zero [18, 19].

Based on this model, during periods of increasing sales, it is expected that the ratio of costs to sales will decrease due to the presence of fixed costs. This change in the cost-to-sales ratio is recognized as a positive cost stickiness signal. The method of calculating the positive cost signal is as follows:

$$\text{Cost Signal}^{+} = \frac{\mathbf{COST}_{i,t}}{\mathbf{SALES}_{i,t}} - \frac{\mathbf{COST}_{i,t-1}}{\mathbf{SALES}_{i,t-1}}$$

In periods of increasing sales, the value obtained from the above model indicates cost stickiness. Otherwise, it is assigned a value of zero.

This ratio, during periods of increasing sales, is referred to as the positive cost stickiness signal. According to this model, when sales increase, the calculated figure reflects the positive cost signal; otherwise (in cases of decreasing or unchanged sales), it is assigned a value of zero.

**$COST_{i,t}$**: Current period costs (including total costs, cost of goods sold, operating expenses, salaries and wages, services, and depreciation)

**$SALES_{i,t}$**: Current period sales
**$COST_{i,t-1}$**: Prior period costs (including total costs, cost of goods sold, operating expenses, salaries and wages, services, and depreciation)
**$SALES_{i,t-1}$**: Prior period sales

## 5. Empirical models

To test the research hypotheses, regression models adapted from [4, 6] are used.

The regression model for Hypotheses 1 & 2 is based on:

$$FE_{i,t}=\beta_0 + \beta_1\ TotalCost\ Signal^{-}_{i,t} + \beta_2\ TotalCost\ Signal^{+}_{i,t} + \beta_3\ MV_{i,t} + \beta_4\ LOSS_{i,t} + \beta_5\ DOWN_{i,t} + \beta_6\ VSALE_{i,t} + \beta_7\ MARGIN_{i,t} + \beta 8\ \Delta NINCOME_{i,t} + \varepsilon_{i,t}$$

If coefficients β1\beta_1β1 and β2\beta_2β2 are statistically significant at the 95% confidence level, the first and second hypotheses will not be rejected.

Regression model for Hypotheses 3 and 4:

$$FE_{i,t}=\beta_0 + \beta_1\ COGS\ Signal^{-}_{i,t} + \beta_2\ SG\&A\ Signal^{-}_{i,t} + \beta_3\ COGS\ Signal^{+}_{i,t} + \beta_4\ SG\&A\ Signal^{+}_{i,t} + \beta_5\ MV_{i,t} + \beta_6\ LOSS_{i,t} + \beta_7\ DOWN_{i,t} + \beta_8\ VSALE_{i,t} + \beta_9\ MARGIN_{i,t} + \beta 10\ \Delta NINCOME_{i,t} + \varepsilon_{i,t} \quad (5)$$

If the coefficients $\beta_1$, $\beta_2$, $\beta_3$, and $\beta_4$ are statistically significant at the 95% confidence level, the third and fourth hypotheses of the research will not be rejected.

The regression model for testing the fifth and sixth hypotheses is presented in:

$$FE_{i,t}=\beta_0 + \beta_1\ Wage\ Signal^{-}_{i,t} + \beta_2\ Serv\ Signal^{-}_{i,t} + \beta_3\ Dep\ Signal^{-}_{i,t} + \beta_4\ Wage\ Signal^{+}_{i,t} + \beta 5\ Serv\ Signal^{+}_{i,t} + \beta_6\ Dep\ Signal^{+}_{i,t} + \beta_7\ MV_{i,t} + \beta_8\ LOSS_{i,t} + \beta_9\ DOWN_{i,t} + \beta_{10}\ VSALE_{i,t} + \beta_{11}\ MARGIN_{i,t} + \beta 12\ \Delta NINCOME_{i,t} + \varepsilon_{i,t}$$

If the coefficients $\beta_1$ through $\beta_6$ are statistically significant at the 95% confidence level, the fifth and sixth hypotheses of the research will not be rejected.

Table 1. Variables

| Variable Name | Description |
|---|---|
| $FE_{i,t}$ | Forecast error of earnings per share (EPS) |
| $MV_{i,t}$ | Natural logarithm of the market value of equity |
| $LOSS_{i,t}$ | Dummy variable: equals 1 if the firm reports a loss in period *t*, 0 otherwise |
| $DOWN_{i,t}$ | Dummy variable: equals 1 if the firm forecasts a loss in period *t*, 0 otherwise |
| $VSALE_{i,t}$ | Percentage change in sales |
| $MARGIN_{i,t}$ | Gross profit margin (gross profit divided by sales) |
| $\Delta INCOME_{i,t}$ | Change in net income compared to the same period of the previous year; equals 1 if positive, 0 otherwise. |
| TotalCost Signal− | Cost stickiness of total costs during periods of sales decrease |
| TotalCost Signal+ | Positive cost signal of total costs during periods of sales increase |

| Variable Name | Description |
|---|---|
| COGS Signal− | Cost stickiness of the cost of goods sold (COGS) during periods of sales decrease |
| SG&A Signal− | Cost stickiness of selling, general, and administrative (SG&A) expenses during periods of sales decrease |
| COGS Signal+ | Positive cost signal of the cost of goods sold during periods of sales increase |
| SG&A Signal+ | Positive cost signal of SG&A expenses during periods of sales increase |
| Wage Signal− | Cost stickiness of wage expenses during periods of sales decrease |
| Serv Signal− | Cost stickiness of service expenses during periods of sales decrease |
| Dep Signal− | Cost stickiness of depreciation expenses during periods of sales decrease |
| Wage Signal+ | Positive cost signal of wage expenses during periods of sales increase |
| Serv Signal+ | Positive cost signal of service expenses during periods of sales increase |
| Dep Signal+ | Positive cost signal of depreciation expenses during periods of sales increase |

## 6. Results and discussion

This study employs a multiple regression model to examine the impact of cost stickiness on earnings forecast accuracy, comparing active firms in Iraq and Jordan. The dataset includes 15 firms from each country between 2014 and 2023. Tables 1 and 2 present descriptive statistics, such as observations, mean, standard deviation, minimum, and maximum, for the research variables.

The dependent variable is the forecast error of earnings per share (FE), with a mean of 0.119, a standard deviation of 0.564, a minimum of -1.143, and a maximum of 1.603. The key explanatory variables are measures of cost stickiness and their positive signals.

Cost stickiness captures expense behavior during sales declines and generally shows a positive mean. Among its indicators, total cost stickiness records the highest mean and dispersion, while service expenses show the lowest. Positive signals reflect sales growth; their means vary, with total costs showing the lowest (-4.242) and service costs the highest (0.116).

Among control variables, the percentage change in sales has the lowest mean, while the logarithm of equity market value has the highest. Dispersion is assessed mainly by standard deviation.

As shown in Table 4-2, total cost stickiness and its positive signal display the greatest variability, while service cost signals show the lowest (2.274). The maximum observed value also appears in total cost stickiness (193.848). Additional descriptive statistics for Iraqi firms are presented in Table 2.

Table 2. Descriptive statistics of research variables in Iraq

| Variable name (English) | Observations | Mean | Std. Dev. | Min | Max | Abbreviation |
|---|---|---|---|---|---|---|
| Earnings Per Share Forecast Error | 150 | 0.119 | 0.564 | -1.143 | 1.603 | FE |
| Total Cost Stickiness | 150 | 11.435 | 41.395 | -0.086 | 193.848 | Totalcosts~1 |
| Positive Signal of Total Costs | 150 | -4.242 | 22.283 | -92.912 | 38.797 | Totalcosts~2 |
| COGS Stickiness | 150 | 0.431 | 1.755 | -1.673 | 8.199 | Cogssignal1 |
| Positive Signal of COGS | 150 | -1.013 | 4.657 | -19.903 | 6.685 | Cogssignal2 |
| SG&A Expense Stickiness | 150 | 1.908 | 6.935 | -0.161 | 33.449 | Sgasignal1 |
| Positive Signal of SG&A Expenses | 150 | -0.504 | 6.877 | -27.165 | 25.434 | Sgasignal2 |
| Wage Expense Stickiness | 150 | 0.362 | 3.578 | -29.634 | 14.114 | Wagesignal1 |
| Positive Signal of Wage Expenses | 150 | -1.405 | 6.828 | -33.854 | 6.805 | Wagesignal2 |
| Service Expense Stickiness | 150 | 0.116 | 0.480 | -0.039 | 2.699 | Servsignal1 |

| Variable name (English) | Observations | Mean | Std. Dev. | Min | Max | Abbreviation |
|---|---|---|---|---|---|---|
| Positive Signal of Service Expenses | 150 | -0.473 | 2.274 | -21.913 | 1.035 | Servsignal2 |
| Depreciation Expense Stickiness | 150 | 1.301 | 4.523 | 0 | 22.712 | Depsignal1 |
| Positive Signal of Depreciation Expenses | 150 | -0.849 | 5.384 | -28.309 | 8.446 | Depsignal2 |
| Log of Market Value of Equity | 150 | 32.691 | 1.703 | 27.391 | 36.201 | MV |
| Loss Indicator | 150 | 0.347 | 0.478 | 0 | 1 | LOSS |
| Forecasted Loss Indicator | 150 | 0.380 | 0.487 | 0 | 1 | DOWN |
| Sales Growth Rate (%) | 150 | 7.428 | 87.875 | -0.997 | 1076.378 | VSALE |
| Gross Profit Margin | 150 | 29.625 | 103.149 | -1.444 | 496.281 | MARGIN |
| Change in Net Income Compared to the Previous Period | 150 | 0.613 | 0.489 | 0 | 1 | ΔNINCOME |

For Jordan, the mean forecast error of earnings per share is -0.247, with a standard deviation of 2.292, ranging from -15.736 to 6.430. Cost stickiness generally shows a positive average, with total cost stickiness recording the highest mean and variation, while wage cost stickiness has the lowest mean and least dispersion.

Positive cost signals display both positive and negative averages. Service costs show the lowest mean (-0.251), whereas depreciation costs have the highest (0.979). Among control variables, the gross profit margin records the lowest mean, while the logarithm of the market value of equity holds the highest. In terms of variability, the positive signal of total costs shows the widest dispersion (SD = 7.438), while wage costs show the narrowest (SD = 0.204). The maximum observed value across variables is total cost stickiness (41.277)

Additional descriptive statistics for Jordan are presented in Table 3.

Table 3. Descriptive statistics of Jordan's data

| Abbreviation | Variable Name | Observations | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|---|---|
| Fe | Forecast Error of Earnings per Share | 150 | -0.247 | 2.292 | -15.736 | 6.430 |
| Totalcosts~1 | Total Cost Stickiness | 150 | 2.922 | 8.592 | -0.148 | 41.277 |
| Totalcosts~2 | Positive Signal of Total Costs | 150 | 0.147 | 7.438 | -27.921 | 38.131 |
| Cogssignal1 | Cost of Goods Sold Stickiness | 150 | 0.011 | 0.592 | -0.579 | 5.487 |
| Cogssignal2 | Positive Signal of Cost of Goods Sold | 150 | -0.121 | 0.578 | -5.358 | 1.103 |
| Sgasignal1 | Operating Cost Stickiness | 150 | 0.141 | 0.644 | -0.041 | 5.915 |
| Sgasignal2 | Positive Signal of Operating Costs | 150 | -0.082 | 0.652 | -5.900 | 3.258 |
| Wagesignal1 | Wage Cost Stickiness | 150 | 0.004 | 0.032 | -0.079 | 0.337 |
| Wagesignal2 | Positive Signal of Wage Costs | 150 | -0.023 | 0.204 | -2.326 | 0.388 |

| Abbreviation | Variable Name | Observations | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|---|---|
| Servsignal1 | Service Cost Stickiness | 150 | 0.167 | 0.974 | -0.391 | 6.933 |
| Servsignal2 | Positive Signal of Service Costs | 150 | -0.251 | 1.329 | -9.303 | 0.249 |
| Depsignal1 | Depreciation Cost Stickiness | 150 | 2.247 | 7.195 | 0 | 38.778 |
| Depsignal2 | Positive Signal of Depreciation Costs | 150 | 0.979 | 5.973 | -8.255 | 38.568 |
| Mv | Logarithm of Market Value of Equity | 150 | 32.643 | 0.464 | 31.252 | 33.166 |
| Loss | Loss Indicator | 150 | 0.627 | 0.485 | 0 | 1 |
| Down | Loss Prediction Indicator | 150 | 0.693 | 0.463 | 0 | 1 |
| Vsale | Percentage Change in Sales | 150 | 0.046 | 0.193 | -0.413 | 0.58 |
| Margin | Gross Profit Margin | 150 | -0.005 | 0.113 | -0.749 | 0.066 |
| Δnincome | Change in Income Compared to the Previous Period | 150 | 0.046 | 0.050 | 0 | 1 |

In order to make the comparisons more substantiated, the means of the two country groups were compared using the t-test, as shown in Table 4. The average earnings per share forecast error for Iraq is positive, while for Jordan, it is negative. Therefore, based on the calculation formula for the earnings per share forecast error presented in the previous chapter, in Iraq, on average, the net profit forecasted by managers is less than the actual net profit per share (AP > FP). In contrast, in Jordan, on average, the net profit forecasted by managers is greater than the actual net profit per share (FP > AP). This discrepancy may arise due to different managerial strategies. For instance, Iraqi companies may, due to high conservatism, refrain from revealing positive news about the company. As a result, the forecasted profit in these companies is lower than the actual value. On the other hand, in Jordan, managers may, in an attempt to attract investors or raise the share price of the company, overstate their profit figures, leading to the forecasted profit being higher than the actual profit. Consequently, the average earnings per share forecast error in the two countries is significantly different at the 99% confidence level.

Table 4. Comparison of means for data from two countries

| Abbreviation | Variable Name | Iraq Mean | Jordan Mean |
|---|---|---|---|
| Fe | Earnings per Share Forecast Error | 0.119*** | -0.247*** |
| Totalcosts~1 | Total Cost Stickiness | 11.435*** | 2.922*** |
| Totalcosts~2 | Positive Total Cost Signal | -4.242*** | 0.147*** |
| Cogssignal1 | Cost of Goods Sold Stickiness | 0.431*** | 0.111*** |
| Cogssignal2 | Positive Cost of Goods Sold Signal | -1.013*** | -0.121*** |
| Sgasignal1 | Operating Expense Stickiness | 1.908*** | 0.141*** |
| Sgasignal2 | Positive Operating Expense Signal | -0.504*** | -0.082*** |
| Wagesignal1 | Wage Expense Stickiness | 0.362*** | 0.004*** |
| Wagesignal2 | Positive Wage Expense Signal | -1.405*** | -0.023*** |
| Servsignal1 | Service Expense Stickiness | 0.116 | 0.157 |
| Servsignal2 | Positive Service Expense Signal | -0.473*** | -0.251*** |

| Abbreviation | Variable Name | Iraq Mean | Jordan Mean |
|---|---|---|---|
| Depsignal1 | Depreciation Expense Stickiness | 1.301*** | 2.247*** |
| Depsignal2 | Positive Depreciation Expense Signal | -0.849*** | 0.979*** |
| Mv | Logarithm of Market Value of Equity | 32.691 | 32.643 |
| Loss | Loss-Making Status | 0.327*** | 0.627*** |
| Down | Predicted Loss-Making Status | 0.38*** | 0.693*** |
| Vsale | Sales Growth Percentage | 0.003 | 0.000 |
| Margin | Non-operating Profit to Sales Ratio | 29.625*** | -0.05*** |
| Δnincome | Income Change Compared to the Previous Period | 0.613*** | 0.46*** |

It must be noted that *** indicates significance at the 99% level. During times of sales decline, the stickiness of total costs, cost of goods sold, operating costs, and wages is significantly higher in Iraq compared to Jordan. This suggests that the reduction in these costs during a downturn in Iraqi companies is less, leading to greater stickiness. Additionally, the stickiness of depreciation costs in Jordan indicates less variation in depreciation costs relative to activity levels in Jordanian companies, which results in greater stickiness. There is no significant difference in the stickiness of service costs between the two countries, meaning that the behavior of these costs during sales decline is similar in both Iraq and Jordan.

All positive stickiness signals in Iraq are lower than those in Jordan at the 99% confidence level, indicating that during sales increases, the changes in costs in Iraq are less than the changes in costs in Jordan. Moreover, the non-operating profit to sales ratio and income changes compared to the previous period are significantly higher in Iraqi companies.

In the present study, the F-Limer test has been used to examine whether the data are panel or pooled. The results indicate that the panel data model should be used for estimating the coefficients in Iraq, while the pooled data model should be used for Jordan. The results indicate that the panel data model should be used for estimating coefficients in Iraq, while the pooled data model is more suitable for Jordan. To determine the appropriate estimation method for panel data, the Hausman test was applied. Since the Hausman test is only applicable to panel data, it was conducted solely for the regression models of Iraq. The result of the Hausman test indicates that the random effects model is a more appropriate model for Iraq.

According to the results of the model merging test, the first regression model for Iraq should be estimated using the panel data method. Furthermore, after conducting the Hausman test, it was determined that for the best regression estimation, the random effects method should be used. This model for Jordan should be estimated using the pooled data method. Additionally, based on the results in Table 5, the first model in both countries exhibits heteroscedasticity of residuals at the 99% confidence level. The test statistics for this test were 6.87 for Iraq and 75.09 for Jordan, indicating that the null hypothesis of homoscedasticity of residuals is rejected. In contrast, the residuals of the first model for Iraq and Jordan do not exhibit serial correlation. The test statistic for this test was 0.963 for Iraq and 3.282 for Jordan, where the null hypothesis of no serial correlation is confirmed. It is confirmed that there is no serial correlation. By applying the model specification test, it was also determined that the specified model based on the data of companies from both countries does not have any important omitted variables. The test statistic for this test was 0.803 for Iraq and 0.178 for Jordan.

Table 5. Results of diagnostic tests for regression models

| Country | Test Name | Chi2 or F | P-Value |
|---|---|---|---|
| Iraq | Breusch-Pagan Test | 6.87 | 0.009 |
| | Wooldridge Test | 0.963 | 0.343 |
| | Ramsey Reset Test | 0.33 | 0.803 |
| Jordan | Breusch-Pagan Test | 75.09 | 0.000 |
| | Wooldridge Test | 3.283 | 0.092 |
| | Ramsey Reset Test | 1.66 | 0.178 |

The null hypotheses for the three tests are as follows: Homoscedasticity, no serial correlation, and no omitted variables. Based on the presence of heteroscedasticity in the first model of panel data for Iraq, the regression for this country was estimated using the generalized method of moments (GMM). Additionally, due to heteroscedasticity in the first model of pooled data for Jordan, the regression for this country was fitted using the feasible generalized least squares (FGLS) method. The estimation results for the first model for both countries are presented in Table 6. The coefficients of the variables for total cost stickiness and positive signals of total costs for Iraq and Jordan were calculated as 0.008, 0.002, and 0.018, 0.032, respectively. Therefore, as the positive signals and total cost stickiness increase in both countries, the earnings forecast error increases, and the accuracy of the forecast decreases. Consequently, the first and second hypotheses of the research, which suggest that higher cost stickiness (total cost and operating costs) reduces the accuracy of earnings per share forecasts in the stock markets of Iraq and Jordan, are accepted at the 95% confidence level [20, 21].

In Iraq, contrary to Jordan, the intensity of the effect of total cost stickiness on the earnings' forecast error is greater than the positive signal of total cost stickiness. However, the intensity and significance level of the effect of both positive signals and total cost stickiness are higher in Jordan than in Iraq. Among the control variables in Iraq, the company's loss-making status significantly increases the earnings forecast error. Conversely, the prediction of the company's loss-making status and the percentage change in sales significantly reduces the earnings forecast error, thereby increasing the prediction accuracy in this country. In Jordan, the prediction of the company's loss-making status also significantly increases the earnings forecast error at the 95% confidence level.

Table 6. Empirical findings related to hypotheses 1 and 2

| Variable Name | Latin Equivalent | Iraq Coefficient | Iraq P-Value | Jordan Coefficient | Jordan P-Value |
|---|---|---|---|---|---|
| Total Cost Stickiness | Totalcostsignal1 | 0.008** | 0.026 | 0.018*** | 0.000 |
| Positive Signal of Total Costs | Totalcostsignal2 | 0.002** | 0.044 | 0.032** | 0.018 |
| Market Value of Equity (Log) | Mv | 0.011 | 0.627 | 0.155 | 0.720 |
| Loss-making Status | Loss | 1.329*** | 0.000 | -0.584 | 0.262 |
| Prediction of Loss-making Status | Down | -1.239*** | 0.000 | 1.209** | 0.032 |
| Percentage of Sales Change | Vsale | -0.002*** | 0.000 | -0.642 | 0.549 |
| Gross Profit Margin to Sales Ratio | Margin | 0.0002 | 0.377 | -0.403 | 0.796 |
| Change in Profit Relative to the Previous Period | Δnincome | -0.012 | 0.895 | -0.121 | 0.747 |
| Constant | Constant | -0.208 | 0.784 | -5.776 | 0.680 |
| Obs | | 150 | | 150 | |
| Adjusted $R^2$ | | 10.24% | | 8.12% | |
| Wald Test | | 77.1491 | 0.000 | 18.36 | 0.000 |
| Normality of Residuals | | 0.750 | | 0.188 | |

The first model in both countries is statistically significant at the 99% confidence level. However, the explanatory power of the first model is higher in Iraq, with an adjusted $R^2$ of 24.10.

Finally, the normality of the regression model residuals in both countries was tested. According to the results of the Kolmogorov–Smirnov test, the normality statistics for the residuals of the first model in Iraq and Jordan

were calculated as 0.75 and 0.188, respectively. Therefore, the residuals of the first model in both countries follow a normal distribution.

Based on the results of the model integration test, the second regression model for Iraq should be estimated using the panel data method. Also, after conducting the Hausman test, it was determined that the best regression estimation method for Iraq is the random effects model. For Jordan, this model should be estimated using the pooled data method. Additionally, according to the results in Table 7, the second model for both countries exhibits heteroscedasticity at the 99% confidence level. The test statistics for this test for the two countries were calculated to be 7.23 and 87.61, respectively, which shows that the null hypothesis of homoscedastic residuals is not confirmed.

Table 7. Results of diagnostic tests for the second regression

| Country | Test Name | Chi2 or F | P-Value |
|---|---|---|---|
| Iraq | Breusch-Pagan Test | 7.23 | 0.007 |
| | Woodridge Test | 1.03 | 0.334 |
| | Ramsey RESET Test | 0.14 | 0.936 |
| Jordan | Breusch-Pagan Test | 87.61 | 0.000 |
| | Woodridge Test | 3.19 | 0.096 |
| | Ramsey RESET Test | 0.25 | 0.859 |

The null hypotheses of the three tests are: homoscedasticity, no serial correlation, and no omitted variables.

For Jordan, the mean forecast error of earnings per share is -0.247. The residuals of the second model for both Iraq and Jordan show no serial correlation, with test statistics of 1.03 and 3.19, confirming the null hypothesis. Model specification tests also indicate no significant omitted variables, with statistics of 0.14 for Iraq and 0.25 for Jordan.

Due to heteroscedasticity, the second model was estimated using GMM for Iraq and FGLS for Jordan. Results (Table 8) show that in Iraq, total cost stickiness and positive cost signals were insignificant, while operating cost stickiness (0.006) and positive operating cost signals (0.002) significantly increased EPS forecast error, confirming Hypothesis 3 at the 95% level.

In Jordan, total cost stickiness (0.028) and positive cost signals (0.012) significantly increased EPS forecast error, while operating cost variables were insignificant, meaning Hypothesis 4 is not supported. The second model is significant at the 99% level in both countries, with Iraq's explanatory power (Adj. $R^2$ = 23.65%) exceeding the first model. Finally, Kolmogorov-Smirnov statistics (0.269 for Iraq, 0.142 for Jordan) confirm residuals follow a normal distribution. Null hypotheses for the three tests: homoscedasticity, no serial correlation, and no omitted variable.

Table 8. Empirical findings related to Hypotheses 3 and 4

| Variable Name | Latin Equivalent | Iraq | P-Value | Jordan | P-Value |
|---|---|---|---|---|---|
| Cost Stickiness | Cogssignal1 | 0.003** | 0.082 | 0.028** | 0.020 |
| Operating Cost Stickiness | Sgasignal1 | 0.006** | 0.028 | 0.550* | 0.056 |
| Positive Cost Signal | Cogssignal2 | 0.009* | 0.080 | 0.012*** | 0.000 |
| Positive Operating Cost Signal | Sgasignal2 | 0.002*** | 0.007 | 0.216* | 0.061 |
| Log Market Value of Equity | Mv | 0.007 | 0.768 | 0.150 | 0.728 |
| Loss | Loss | 1.342*** | 0.000 | -0.430 | 0.403 |
| Forecast of Loss | Down | -1.233*** | 0.000 | 0.996* | 0.077 |
| Sales Change Percentage | Vsale | -0.002*** | 0.000 | -0.833 | 0.422 |

| Variable Name | Latin Equivalent | Iraq | P-Value | Jordan | P-Value |
|---|---|---|---|---|---|
| Profit Margin to Sales Ratio | Margin | 0.000 | 0.596 | -0.301 | 0.845 |
| Earnings Change from Previous Period | Δnincome | -0.003 | 0.975 | -0.065 | 0.860 |
| Intercept | Constant | -0.091 | 0.907 | -5.543 | 0.691 |
| Obs | 150 | | 150 | | |
| Adjusted $R^2$ | 23.65 | | 9.54 | | |
| Wald Test | 142.89 | 0.000 | 115.06 | 0.000 | |
| Norm of Residual | 0.269 | | 0.142 | | |

Based on the results of the model combination test, the third regression model for Iraq should also be estimated using panel data. Furthermore, by performing the Hausman test, it was determined that in order to achieve the best regression estimate, the random effects method should be used. This model for Jordan should be estimated using pooled data. In addition, based on the results in Table 9, the third model in both countries exhibits heteroscedasticity of the residuals at the 99% confidence level. The test statistic for this test for the two countries was calculated as 7.14 and 47.59, respectively, indicating that the null hypothesis of homoscedasticity of the residuals is not confirmed.

In contrast, the residuals of the third model for both countries do not exhibit serial correlation. The test statistic for serial correlation for Iraq and Jordan was calculated as 2.33 and 3.49, respectively, confirming the null hypothesis of no serial correlation. Additionally, by using the model specification test, it was determined that the specified model for both countries does not have any important omitted variables. The test statistic for this test for Iraq and Jordan was calculated as 1.29 and 1.51, respectively.

Table 9. Diagnostic test results of the third regression

| Variable Name | Test Name | $Chi^2$ or F (Iraq) | P-Value (Iraq) | $Chi^2$ or F (Jordan) | P-Value (Jordan) |
|---|---|---|---|---|---|
| Breusch–Pagan Test | Heteroskedasticity | 14.7 | 0.008 | 47.59 | 0.000 |
| Wooldridge Test | Serial Correlation | 2.233 | 0.157 | 3.490 | 0.083 |
| Ramsey RESET Test | Model Specification | 1.29 | 0.280 | 1.51 | 0.213 |

The null hypotheses for the three tests are, respectively: homoskedasticity, no serial correlation, and no omitted variables. Given the heteroscedasticity in the third model for Iraq and Jordan, the regression for Iraq was estimated using the GMM method, while for Jordan it was estimated with the FGLS method. Table 10 reports the results.

In Iraq, wage cost stickiness and its positive signal were significant (0.060 and 0.052 at the 95% and 99% levels). Depreciation cost stickiness and its positive signal were also significant (0.019 and 0.010 at the 99% and 95% levels), while service cost variables were insignificant. Thus, wage and depreciation stickiness, along with their positive signals, increase EPS forecast error, whereas service costs do not, leading to rejection of the fifth hypothesis. In Jordan, wage cost stickiness and its positive signal were highly significant (2.058 and 4.018 at the 99% level). Cost of goods sold stickiness and its positive signal were also significant (0.028 and 0.117 at the 95% level), as were depreciation stickiness and its positive signal (0.001 and 0.009). Hence, wage, COGS, and depreciation stickiness, as well as their signals, all increase EPS forecast error, confirming the sixth hypothesis at the 95% level.

Overall, in Iraq, wage stickiness effects dominate those of depreciation, with negative signals stronger than positive ones. In Jordan, wage effects also dominate, but positive wage signals are stronger than negative ones, in contrast to Iraq.

Table 10. Empirical findings related to Hypotheses 5 and 6

| Variable Name | Latin Equivalent | Iraq | P-Value | Jordan | P-Value |
|---|---|---|---|---|---|
| Wage Cost Stickiness | Wagesignal1 | 0.060** | 0.045 | 2.058*** | 0.000 |
| Service Cost Stickiness | Servsignal1 | 0.100 | 0.546 | 0.028** | 0.220 |
| Depreciation Cost Stickiness | Depsignal1 | 0.019*** | 0.000 | 0.001*** | 0.001 |
| Positive Wage Cost Signal | Wagesignal2 | 0.052*** | 0.000 | 4.018*** | 0.000 |
| Positive Service Cost Signal | Servsignal2 | 0.016 | 0.450 | 0.117** | 0.018 |
| Positive Depreciation Cost Signal | Depsignal2 | 0.010** | 0.041 | 0.009** | 0.044 |
| Log of Market Value of Equity | Mv | 0.017 | 0.496 | 0.340 | 0.412 |
| Loss | Loss | 1.350*** | 0.000 | -0.889* | 0.080 |
| Predicted Loss | Down | -1.286*** | 0.000 | 1.379** | 0.012 |
| Percentage Change in Sales | Vsale | -0.002*** | 0.000 | 0.193 | 0.854 |
| Operating Margin to Sales Ratio | Margin | 0.0002 | 0.274 | 0.016 | 0.993 |
| Income Change from Previous Period | Δnincome | -0.022 | 0.810 | -0.055 | 0.877 |
| Constant | Constant | -0.358 | 0.654 | -11.668 | 0.384 |
| Observations | Obs | 150 | | 150 | |
| Adjusted R2 | R2 Adj. | 34.31% | | 54.9% | |
| Wald Test | Wald Test | 98.1651 | 0.000 | 31.73 | 0.002 |
| Norm of Residuals | Norm of Resid | 0.616 | | 0.385 | |

Model III in both countries is significant at the 99% confidence level, but the explanatory power of Model III in Iraq, with an adjusted $R^2$ of 34.31%, is higher. Finally, the normality of the residuals for the regression model in both countries was tested. According to the Kolmogorov-Smirnov test, the normality statistics for the residuals of Model III in the two countries were 0.616 and 0.385, respectively. Therefore, the residuals of Model III in both countries follow a normal distribution.

## 7. Conclusion

This study examined how cost stickiness and its signaling effects influence the accuracy of earnings per share (EPS) forecasts in Iraq and Jordan. Evidence shows that higher stickiness—especially in operating expenses, wages, services, and depreciation—reduces forecast precision, with effects stronger in Iraq due to greater market sensitivity to cost rigidity.

The divergence between the two countries reflects differences in institutional and economic structures. Iraq's capital market suffers from limited transparency, weak regulation, and instability, amplifying the impact of sticky costs on earnings forecasts. By contrast, Jordan benefits from stronger disclosure, more developed reporting systems, and relative macroeconomic stability, which partially mitigate these effects. Still, stickiness in categories such as wages, services, and appreciation remains a challenge.

Overall, the findings stress the importance of institutional context in shaping how cost behavior affects forecast accuracy. Weak governance and poor disclosure increase the risk of misinformed decisions, while stronger frameworks can offset some negative effects. The results also highlight the need for disaggregated cost analysis in forecasting models, as overlooking asymmetric cost behavior risks systematic bias, particularly in less efficient markets.

## 8. Practical implications and recommendations

For analysts and investors, it is crucial to recognize that cost stickiness, particularly in environments with weak oversight and limited transparency, can distort earnings forecasts. Incorporating measures of asymmetric cost behavior into valuation models may reduce estimation error and improve investment decisions.

From a managerial standpoint, addressing cost stickiness should be part of budgeting and cost-control strategies. Rigid cost structures reduce flexibility and erode trust during revenue downturns. Managers are advised to review cost allocation policies and adopt adaptive mechanisms that enable timely adjustments, thereby enhancing transparency and responsiveness.

Regulators also play a key role. Strengthening disclosure on cost structures and enforcing accounting standards can improve reporting quality. More detailed cost breakdowns would allow stakeholders to better assess risks, while frameworks that encourage transparency and penalize excessive rigidity may enhance market efficiency.

For academic researchers, the study highlights the need to explore the multidimensional nature of cost stickiness further. Future work could analyze disaggregated costs across industries and contexts, while also examining psychological and organizational drivers. The use of dynamic panel models combined with qualitative insights may offer a deeper understanding of how cost behavior affects financial outcomes.

Finally, these insights extend beyond Iraq and Jordan to other developing economies with similar institutional characteristics. In such markets, cost stickiness poses a major challenge to earnings forecast accuracy. Policymakers and market participants should therefore focus on improving cost flexibility, enhancing disclosure, and promoting proactive financial management to strengthen confidence, improve forecasts, and support more efficient capital allocation.

### Declaration of competing interest

The authors declare that they have no known financial or non-financial competing interests in any material discussed in this paper.

### Funding information

The authors declare that they have received no funding from any financial organization to conduct this research.

### Author contribution

Ali Shaker Dakhel: Conceptualized the study, developed the research framework, and conducted the literature review. He was responsible for drafting the initial manuscript and coordinating revisions.

Naser Izadinia: Contributed to the methodology design and data analysis. He provided critical insights into the application of activity costing in outsourcing decisions and helped refine the manuscript.

Alireza Rahrovi Dastjerdi: Assisted in data collection and interpretation. He contributed to the discussion on sustainable value and its implications for outsourcing decisions, as well as editing the final manuscript for clarity and coherence.

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