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## Article

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# Do bank stock prices efficiently reflect the information content in a key tax reform event?

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## ABSTRACT

This study examines the behavior of bank stock prices in Jordan in relation to a significant tax reform event. We analyze a sample of all banks listed on the Amman Stock Exchange to study the market response to the Amended Income Tax Law 2018. In the proposal period, investors were anticipating a mandatory tax increase of 5%, though the enacted law differed from expectations by implementing only a temporary, slight tax increase of 3%. Our findings reveal that there are higher stock returns observed during the post-approval period of the Amended Income Tax Law 2018 compared to the pre-approval period. This holds for both individual stocks and portfolios, indicating a positive market response to the tax reform. This paper contributes to the existing body of literature that examines pricing anomalies. The findings of this study indicate that when a tax bill is passed with a corporate tax rate lower than the proposed level, it creates a positive earnings surprise. However, the market displays inefficiency in promptly revising its expectations, resulting in a delay in the stock return pattern. This suggests that there is a discrepancy between the market's reaction as implied by the efficient market hypothesis and the actual impact of the tax reform on bank stock prices.

## IMPACT STATEMENT

This study investigates the impact of a significant tax reform event on the behavior of bank stock prices in Jordan. Using event study methodology, the research examines whether the market responds rationally to the earnings news related to the establishment of the National Solidarity Account, comprising 3% of banks' taxable income under the enacted Amended Income Tax Law 2018, compared to a higher increase of 5% of banks' taxable income proposed during the pre-approval period of the tax law. The findings suggest that tax laws influence financial markets and affect stock prices, as stock investors extrapolate their prior negative expectations into the future making it possible to trade based on this macroeconomic event. Investor sentiment, limited attention capacity, overconfidence, and anchoring bias could lead investors to react irrationally to actual statistics on the release date by taking prior forecasts at face value. The study has important implications for academics, practitioners and policymakers.

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## SUBJECTS

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## 1. Introduction

Corporate income taxes are a challenging aspect of revenue policy for governments, as taxes reduce the earnings and cash flows available for common stock holders, inhibit the potential of their investments, and create risks that adversely affects stock prices (e.g. Ardagna, 2009; Arin et al., 2009; Blouin et al., 2009; Dai et al., 2008; Gaertner et al., 2020; Golob, 1995; Lang & Shackelford, 2000; Wang & Macy, 2022). Chang et al. (2017) point out that taxes have significant economic implications and that firms can increase their dividends and stock prices when corporate taxes are reduced. Erosa and González (2019) demonstrate that taxes harm after-tax income, reducing firms' growth potential. Indeed, the role of

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earnings in stock prices is very well emphasized (e.g. Huang et al., 2015; Johnson & Zhao, 2012; Le et al., 2019; Miller, 2005; Park et al., 2014).

During the pre-approval period of the Amended Income Tax Law (AITL) in Jordan dated Sunday, 2 December 2018, a new tax bill proposed to increase the corporate tax rate of banks from 35% to 40%, which the market may perceive as negative earnings news. However, the enacted AITL 2018 did not approve this 5% increase, instead maintaining the 35% tax rate and establishing the National Solidarity Account consisting of 3% of banks' taxable income. The revenues of this account shall be allocated in the general budget to settle the public debt. This account is mandatory as long as the country has public debt.

The study conducted by He and Li (2020) introduces the concept of using the prior day's average earnings surprise as a reference point for investors who experience cognitive constraints when processing information. This reference point serves as a benchmark for their decision-making process.

On the other hand, Hartzmark and Shue (2018) explore the impact of errors in investors' perceptions rather than their expectations. Their research highlights how these perceptual errors can influence investment decisions and subsequently affect market outcomes. Both studies shed light on different aspects of investor behavior and decision-making, emphasizing the role of cognitive limitations and perceptual errors in shaping market dynamics. Following these studies, we test whether investors use prior tax news based on the higher tax rate proposal, as a relevant earnings reference point and classify the AITL 2018 announcement date as containing positive earnings news. Second, because earnings news has information content related to stock prices (e.g. Bouteska & Regaieg, 2017; Choy & Zhang, 2021; Ozo & Arun, 2019; Sponholtz, 2008; Syed & Bajwa, 2018), we explore whether the less-experienced individual investors in the Amman Stock Exchange (ASE), who constitute a relatively high proportion, extrapolate their pessimism into future, pushing prices below their fundamental values. Put differently, we aim to determine the outcome if stock investors could adjust their expectations about the earnings surprise at the time the tax bill was signed into law, but failed to efficiently reflect this updated information quickly, making it possible to trade on that basis.

We contribute to the existing literature by utilizing data on banks, which constitute the dominant economic sector in Jordan, to examine the market reactions to a key tax reform event.<sup>1</sup> This study differs from prior work in several ways. First, we compare the buy-and-hold returns (BHRs) of the sample banks in the pre- and post-AITL 2018 approval periods based on individual stocks and portfolios.<sup>2</sup> The portfolio approach has the advantage of diversifying away the most unsystematic risks. Second, when using the portfolio approach on a value-weighted basis, we recalculate a bank's market capitalization for the pre- and post-approval periods. Third, we employ panel regression methods to test for the effect of the tax reform on the stocks' cumulative abnormal returns (CARs). We check the robustness of the results by comparing the results of the BHRs and CARs. Fourth, we rely heavily on the efficient market hypothesis (EMH) to consider how the market integrates publicly available information into stock prices using four test windows from the event date. According to Lagoarde-Segot and Lucey (2009), the ASE is the most efficient market in the Middle Eastern region. Finally, to the best of our knowledge, this is the first study to explore stock price behavior in the banking sector around a key tax reform event in the region.

The remaining sections of the article are structured as follows: Section 2 provides a concise review of the pertinent literature and establishes the research hypotheses based on the existing knowledge in the field. Section 3 outlines the data utilized in the study and explains the empirical methodology employed to analyze the data. Section 4 presents the primary findings of the study. Finally, section 5 concludes the article, summarizing the main findings, discussing their implications, and suggesting avenues for further research.

## 2. Theoretical framework and hypothesis development

Our analysis is grounded in the Efficient Market Hypothesis (EMH), which suggests that stock prices fully reflect all available information (Fama, 1970). EMH states that any new information, including tax law changes, should be quickly integrated into stock prices, leaving no room for abnormal returns based on publicly available data. However, empirical evidence suggests that tax laws do influence financial markets and thus affect stock prices, albeit in ways that may sometimes seem at odds with the predictions of EMH (Chudek et al., 2011; Eichfelder & Lau, 2014; Wagner et al., 2018a, 2018b; Wang & Macy, 2021).

Tasnia et al. (2021) posit that investors are tax-averse, finding a positive association between taxes and the volatility of bank returns. Stock price reactions to tax changes largely depend on the

unanticipated component of a tax announcement, as documented by Pástor and Veronesi (2012). Wang and Macy (2021) examine how markets in different countries react to corporate tax cuts using a global dataset covering 16 years starting from 2002. Their findings indicate that the greater the tax decrease, the higher the abnormal returns earned by investors. Moreover, they observe that sample markets reacted to expected tax changes well before and continued after the tax change, challenging the assumption that markets fully and immediately integrate economic effects as the EMH would imply.

Wagner et al. (2018a) explore the market reaction to the election of Donald J. Trump as U.S. president in 2016 by regressing abnormal stock returns on cash effective tax rates (ETR), with abnormal returns estimated using both the capital asset pricing model and the Fama-French three-factor model. Anticipating large tax cuts, they found excess returns positively (negatively) associated with high (low) tax-paying corporations. Moreover, firms with substantial deferred tax liabilities outperformed those with deferred tax assets. Wagner et al. (2018b) extend this work by investigating stock market reactions to the Tax Cuts and Jobs Act of 2017 during its legislative period. They found a significant positive coefficient on the ETR explanatory variable for the full legislative period, suggesting that highly taxed corporations benefited more from the new tax law and thus outperformed firms with low taxes.

However, the evidence on the relationship between corporate taxes and stock returns is mixed. Gaertner et al. (2020) observed heterogeneous stock price reactions around the U.S. Tax Cuts and Jobs Act of 2017 across different foreign exchanges. Chinese firms suffered significant negative returns, while firms in other sample countries experienced positive returns. Wang and Macy (2022) studied market responses to large corporate tax cuts in European countries, finding positive cumulative abnormal returns (CARs) for Slovakia and Germany, but negative returns for Poland and Austria. The researchers attributed the unexpected negative returns in Poland and Austria to noise or simultaneous events offsetting the expected benefits from the tax cuts.

Further inconclusive evidence exists. Muthitacharoen (2021) found an adverse relationship between corporate taxes and investments in less developed countries. Sankarganesh and Shanmugam (2021) documented a similar adverse relationship between effective taxes and corporate investments. Dobbins and Jacob (2016) report an inverse relationship between marginal corporate taxes and investments by local firms. Conversely, Gary et al. (2016) observed significant growth in intercorporate investment following increases in corporate marginal tax rates, which they attributed to firms redirecting excess resources from less attractive internal expansion to more attractive equity investments.

Finally, corporate income taxes and the potential for future payouts are key determinants of firms' resource allocation. Venezian (2007) emphasized that, in addition to tax changes, stock prices also depend on firms' future payouts. Wong et al. (2017) showed that news of dividend tax reductions led to significant excess returns. Similarly, Becker et al. (2013) demonstrated that elevated dividend taxes encourage profitable firms to finance their investments internally. Campbell et al. (2013) found that lower taxes on firms' payouts improve corporate investment.

Market efficiency requires stock prices to reflect publicly available events fast enough that any observed abnormal returns are a mere luck. In a tax context, Eichfelder and Lau (2014) find a delayed market response to tax announcements, caused mainly by investors who are not fully tax-aware, making trading on that basis a plausible investing strategy. Adam et al. (2015) demonstrate that in response to a tax change, less sophisticated investors emphasize past performance relative to more sophisticated investors, which drives assets prices away from fundamentals, creating the opportunity for wealth reallocation. Additionally, Wagner et al. (2018a, 2018b) observe stock price anomalies in response to tax changes. Specifically, investors require a long time to fully integrate the information about the tax change, and they find that abnormal returns exhibit a non-monotonic pattern.

The earnings-related literature adds to the debate on why stock prices may deviate from the EMH. (e.g. Birz, 2017; Chudek et al., 2011; Ekholm, 2006; Gervais & Odean, 2001; Gilbert et al., 2012; Jacobs & Weber, 2012). According to Birz et al. (2021), anchoring bias makes investors unable to correctly recognize the surprise component of macroeconomic announcements, and they therefore react irrationally to actual statistics upon their release, taking prior forecasts at face value. Using Chinese data to test the market reaction to releases of earnings news, Feng and Hu (2014) report that behavioral bias can explain investors' initial underreaction at the earnings announcement date. The authors also document that the more earnings announcements occurring on the same day, the weaker the immediate market response

and the stronger the post-announcement drift. Similarly, Hirshleifer et al. (2009) observe that investors become confused if they perform multiple analyses simultaneously, attributing this irrational behavior to investors' limited attention. A more recent study by Dong et al. (2022) emphasizes that investor attention distorts stock prices. Wagner et al. (2018b) make similar arguments in the taxation context.

Further evidence that the market cannot properly price capital assets is based on investor sentiment, where investor emotions irrationally drive stock prices (e.g. Abdelhedi-Zouch & Ghorbel, 2016; Karavias et al., 2021; Ke & Sieracki, 2019). Investor sentiment plays an important role in investor fund selection decisions (e.g. Jiang & Yüksel, 2019).

Using data from Finnish companies, Ekholm (2006) finds systematic differences between large investors representing the minority and smaller investors representing the majority. While large investors are less willing to sell after good earnings news, small investors are more likely to sell. Ekholm (2006) attributes the irrational behavior of smaller investors reducing their holdings following good public news to overconfidence. Rational large (irrational small) investors exhibit less overconfidence (more overconfidence) when perceiving good public news as correct (less correct). Ekholm (2006) draws on Gervais and Odean (2001), who find that inexperienced new traders who are successful can become overconfident, highly crediting their skills. Over time, inexperienced traders will learn, become more sophisticated, and thus become less overconfident. The researchers conclude that the market will always have new, irrational, overconfident traders.

Thus, the rationality with which the Jordanian market reacts to tax-related macroeconomic announcements is unclear. Unsophisticated individual investors, who tend to be irrational and driven by attention and emotions, represent 35% of all investors in the ASE.<sup>3</sup> Therefore, we propose that investors in Jordan's banking sector mistakenly exhibit contrasting effects when they look at the current earnings surrounding the AITL 2018 event date by reacting to the extra and temporary (based on the existence of public debt) tax of 3% in terms of the earnings news in the pre-approval period when the proposed tax bill suggested a higher, permanent tax rate of 5%, and classify the new tax law as containing positive earnings news. Hence, we would find a positive market reaction (see: Hartzmark & Shue, 2018).

Again, in light of the theoretical rationale of the efficient market hypothesis (EMH), stock prices comprehensively encompassing existing information, and additional information is promptly and precisely assimilated into stock prices (Beechey et al., 2000). In relation to tax reform event (AITL 2018), the announcement and following approval of the tax reform act can be considered substantial information that has the potential to impact the financial performance of banks (Hellwig, 2009; Huang et al., 2019). Hence, during the pre-approval period, market participants may have harbored uncertainties regarding the outcome and potential consequences of the tax reform. Accordingly, the prices of bank stocks might not have fully reflected the anticipated effects of the reform. Nevertheless, subsequent to the approval of the tax reform act, the market gains clarity concerning the specific provisions and their impact on the financials of banks.

Looking more closely at the case of Jordan, the banking sector notably plays a crucial role in the development of its economy (Mohammad & Darwish, 2022), and any significant regulatory or policy changes can have a significant impact on the financial performance and investor sentiment towards banks. In the context of emerging markets like Jordan, the market dynamics can be influenced by various factors, including information asymmetry, investor sentiment (Healy & Palepu, 2001) and informal institutions (Melhem & Darwish, 2023). The latter adds a significant layer of informality to the flow of market and regulatory news that could be accessed by informal networks' actors.

During the pre-approval period of AITL 2018, investors in Jordan's banking sector might have faced uncertainty regarding the specific provisions and implications of the proposed tax reform. The emerging market context, combined with potential information asymmetry and limited financial information, may have caused market participants to exhibit caution and delay their reactions to the expected impact of the tax reform. However, after the tax reform act is approved, the market receives clarity on the tax provisions and their implications for banks operating in Jordan. This increased transparency and understanding among market participants can lead to a reassessment of the information and a more informed valuation of bank stocks. Hence, in the context of Jordan, the market's response to the tax reform event is likely to be more pronounced. The positive news of a lower-than-expected tax increase can generate optimism and enhance investor confidence in the banking sector. Alternatively, this could be accessed by informal network actors prior to the news release considering the salience of informal networking



modes in Jordan. Consequently, this positive sentiment can drive higher demand for bank stocks, resulting in increased BHRs during the post-approval period compared to the pre-approval period in Jordan. Hence, we propose the following hypothesis:

*H1: For banks listed on the ASE, the BHRs on individual stocks are higher for the AITL 2018 post-approval period than in the pre-approval period.*

Notably, the impact of a tax reform event on bank stock prices can extend beyond individual stocks to influence the overall performance of the sector. According to portfolio theory, investors often adopt diversification strategies to manage risk and enhance returns (Scholtens, 2009). Given the economic significance of the banking sector, it represents a crucial component of investment portfolios. Tax reform events, such as the AITL 2018, can significantly affect the financial prospects and performance of multiple banks within a portfolio simultaneously (Hemmelgarn & Teichmann, 2014).

Furthermore, tax reforms introduce systemic risk to the banking sector, as changes in tax policies can impact the profitability and financial health of banks, leading to a collective response in the market (Hellwig, 2009; Huang et al., 2019). In an emerging market like Jordan, where market participants may exhibit higher sensitivity to systemic risk factors, the post-approval period of a tax reform event can trigger a more pronounced reaction, influencing the performance of the entire banking sector portfolio.

Investor sentiment and market efficiency also play significant roles in portfolio performance. As suggested by the EMH, markets should quickly and accurately incorporate new information, including tax reforms. However, deviations from this ideal, such as delayed reactions or investor sentiment-driven behavior, can result in significant shifts in portfolio performance (Gao et al., 2021). Positive news, such as a lower-than-expected tax increase, can boost investor confidence, leading to increased buying interest in bank stocks and driving up the prices of individual stocks within the portfolio. This positive market sentiment could contribute to higher BHRs for the portfolio during the post-approval period compared to the pre-approval period. Taking these factors into account, we propose the following hypothesis:

*H2: For banks listed on the ASE, the BHRs on a portfolio consisting of all stocks is higher for the AITL 2018 post-approval period than in the pre-approval period.*

Wang and Macy (2022) emphasize the market's forward looking. Consequently, by the time a tax bill becomes law as on the event date, regressing the abnormal stock returns on the AITL 2018 differential tax effect should yield a positive coefficient. It can also be argued that changes in tax policies can directly impact earnings of firms (see, for example, Guenther, 1994). In the case of the AITL enactment, banks in Jordan may experience variations in their tax liabilities and potential adjustments in their financial statements. Market participants, including investors and analysts, are likely to incorporate these earnings implications into their expectations and valuation models. Also, as the efficient market hypothesis suggests, stock prices reflect all available information, including earnings surprises; positive earnings surprises, which occur when actual earnings exceed market expectations, often lead to upward stock price adjustments (see Beechey et al., 2000). In the context of the AITL enactment, if the earnings implications are perceived as positive by the market, banks' cumulative abnormal stock returns are expected to be positively affected. Our third hypothesis is therefore:

*H3: For banks listed on the ASE, cumulative abnormal stock returns are positively affected by the earnings implications of the AITL enactment on 2 December 2018.*

### 3. Data and methodology

#### 3.1 Data

The main data consist of the daily returns for all 15 banks listed on the ASE from Sunday, 11 November 2018 to Thursday, 20 December 2018. Thus, we consider bank returns for 30-working days consisting of two equal periods: 15 days before and 15 days after the AITL 2018 announcement date when it was enacted into law (referred to as the event date). We collected stock prices directly from the ASE's official website (<https://www.ase.com.jo>). No stock price restatements or cash dividend adjustments were needed as no capital changes such as stock splits, scrip issues, or declarations of cash dividends

occurred during this sample period. Finally, we calculated the study variables using banks' data for the third and fourth quarters of 2014–2018 from <https://www.ase.com.jo/en/disclosures>.

### 3.2 Methodology

We employ an event study methodology to investigate the consequences of the AITL 2018 on banks' stock prices in Jordan. More specifically, we use data on all 15 banks listed on the ASE to examine whether investors in the banking sector efficiently perceived the earnings-related effects of the tax law enacted on 2 December 2018.

As the ASE does not maintain a stock return file, starting from 11 November 2018 to 20 December 2018, we estimate individual stock returns as the difference between the stock price on day  $t$  and the price on day  $t-1$ , divided by the price on day  $t-1$ . For a day  $t$  with no trading, and therefore no price record, we use the value for  $t-1$ , following a similar approach as Wagner et al. (2018b).

Then, we explore the AITL 2018 post-approval estimated differential tax effect on banks' stock prices using three main approaches. First, we compare the 15 stock return observations before and after the event date using 15 counterpart-test periods starting from one day, and accumulated daily until the longest of 15 working days. For this purpose, we analyze the BHRs, which is a common metric in research (e.g. Dorey et al., 2017; Jegadeesh & Titman, 1993; Vo & Truong, 2018; Gang et al., 2019; Boussaidi & Dridi, 2020; Barbopoulos et al., 2020; Ahmad et al., 2021; Ahmad & Abu-Ghunmi 2021). For stock  $i$ , the BHRs, accumulated over period  $t$  are:

$$BHR_{it} = \prod_{t=0}^t [1 + R_{it}] - 1, \quad (1)$$

where  $R_{it}$  is the simple daily return on stock  $i$  during period  $t$ .

Extending the event windows on a daily basis allows us to observe if the market needs time before it fully absorbs any tax-related effect. We applied the Mann Whitney  $U$  test to check the equality between the paired BHRs. After applying the first approach, if a stock's BHRs during the AITL 2018 pre- and post-approval periods are statistically different, then a portfolio analysis may support such a finding. Thus, we conduct a portfolio analysis to test if the BHRs on an investment consisting of holding all stocks from the banking sector for periods of 2, 5, 10, and 15 working days before 2 December 2018 are statistically different from the subsequent counterpart BHRs.

We employ equally- and value-weighted methods to estimate the portfolio returns. In the former, the portfolio's raw daily returns are equal to the arithmetic mean return of all the stocks in the portfolio; in the latter, the market capitalizations according to the ASE are proportionate to the portfolio returns only for the investment on the first day for each test period (2, 5, 10, and 15 working days). The market capitalizations for each stock are then calculated based on the stock's corresponding daily returns thereafter. Thus, we avoid the effect of transactions such as equity issues, mergers, acquisitions, and so on, on a firm's capitalization.

Third, we assess if the introduction of the AITL 2018 can explain the stock returns from 2 December 2018 to the end of the sample period using a panel regression to consider the cross-sectional and time-varying effects. Specifically, we regress banks' CARs on the AITL 2018 estimated differential tax effect (EDTE), an income tax expense component representing the independent variable, and control variables that include earnings per share (EPS), the natural log of total assets ( $\ln.TA$ ), the debt ratio calculated as total liabilities divided by total assets ( $D.Ratio$ ), and the quick ratio ( $Q.Ratio$ ) defined as 'cash and balances at central banks plus balances and deposits at banks and financial institutions plus financial assets at fair value through profit' all divided by total deposits (customers deposits plus banks and financial institutions deposits). Shafi et al. (2023) test how firm-specific aspects can play a role in the green tax incentive scheme introduced in Sweden. As in Brown and Warner (1985) and others (Bouteska & Regaieg, 2019; Chang et al., 2017; Ozo & Arun, 2019; Wang & Macy, 2022), we estimate bank  $i$ 's abnormal returns ( $AR_i$ ) for day  $t$  using the following model:<sup>4</sup>

$$AR_{it} = R_{it} - \{\hat{\alpha}_i + \hat{\beta}_i R_{mt}\}, \quad (2)$$

where  $R_i$  and  $R_m$  are the returns for bank  $i$  and the market on day  $t$ , and  $\{\hat{\alpha}_i, \text{ and } \hat{\beta}_i\}$  are the market model estimated intercept and slope obtained using a 250-day estimation period that ends 15 days



before the event date to prevent the effects of other events from influencing the estimated parameters (see Ellis & Keys, 2014). Some other researchers use event study methodology and skip just 10 days before the event date to start the estimation period (e.g. Singh & Padmakumari, 2020).

We then estimate the CARs for each stock. For consistency with the prior tests,  $CAR_{ip}$  represents the estimated daily accumulated abnormal returns for bank  $i$  for a period of days,  $p$ , where  $p$  can equal 2 working days (D0-D1), 5 working days (D0-D4), 10 working days (D0-D9), and 15 working days (D0-D14), all as from the event day (D0), as follows:

$$CAR_{ip} = \sum_{p=D0}^{D1, D4, D9, D14} AR_{ip}, \quad (3)$$

Hence, we establish our main regression model:

$$CAR_{ip} = \alpha_1 + \alpha_2 \text{EDTE}_{ip} + \alpha_3 \text{EPS}_{ip} + \alpha_4 \text{Ln.TA}_{ip} + \alpha_5 \text{D.Ratio}_{ip} + \alpha_6 \text{Q.Ratio}_{ip} + \varepsilon_{i,t}, \quad (4)$$

where  $\text{EDTE}_{ip}$  is the AITL 2018 post-approval estimated differential tax effect for bank  $i$ , accumulated on a daily basis considering the four test windows ( $p = 2, 5, 10$ , and  $15$ ) and scaled by the total assets for each period of ( $p$ ).  $\text{EPS}_{ip}$ ,  $\text{Ln.TA}_{ip}$ ,  $\text{D.Ratio}_{ip}$ , and  $\text{Q.Ratio}_{ip}$  represent the control variables for bank  $i$ , all accumulated on a daily basis for each event window period ( $p$ ). Therefore, we use this regression to observe delays in investors' reactions to the public information released at the AITL 2018 announcement.<sup>5</sup>

However, since the tax reform law was signed 63 days into Q4 2018, to test for any related effects on banks' daily returns for periods of 2, 5, 10, and 15 working days using equation (4), investors will need first to estimate the banks' variables as of the event date; that is, 2 December 2018. We therefore employ a two-step procedure. First, we estimate the *regression variables'* growth rates in Q4 for the five most recent years, including 2018. We use the ASE official site to obtain the banks' financial reports for Q3 (dated 30 September) and Q4 (dated 31 December) of 2014 through 2018. We include the data for 2018 because investors are likely to search for leaked information for the current year prior to the year end. We then calculate the Q4's 2018 arithmetic growth rate mean for each regression variable based on the five sample years. In the second step, we apply the estimated variables' arithmetic growth rate means, obtained from the first step, to adjust the variables' corresponding actual amounts for Q3 2018, making them daily estimates as of 2 December 2018 through 20 December 2018.<sup>6</sup>

Finally, to estimate a stock's EDTE, we apply the AITL 2018 additional tax rate of 3% to the stock's estimated income before tax, all scaled by corresponding estimated total assets depending on the length of the test window ( $p$ ).

## 4. Results and discussion

We would first expect to observe higher stock returns for the post-AITL 2018 approval period relative to the pre-approval period, as enacting a lower-than-expected corporate tax rate should represent a positive earnings surprise. Second, in a more efficient market, investors reflect their perceptions of the earnings surprise in stock prices more quickly, making it unprofitable to trade based on such information.

### 4.1 Comparing the pre- and post-approval period stock returns

The results in Table 1 evaluate a stock's mean BHRs for the AITL 2018 pre- and post-approval periods.

The individual BHRs for each stock are higher for the AITL 2018 post-approval period relative to the pre-approval period, regardless of the period length. However, the difference is statistically significant on 12 out of 15 days, with P values equal to or lower than 1%. This could be because of the relatively small sample size. We then repeat this test on a portfolio basis to eliminate the possibility that the individual stock returns can be explained by a diversifiable risk. In Table 2, we summarize the portfolio BHRs using the equally and value-weighted approaches.

We find that the estimated BHRs are higher during the AITL 2018 post-approval periods than in the corresponding pre-approval periods, regardless of the length of the test window ( $p = 2, 5, 10$ , and  $15$ ).

**Table 1.** Comparison of mean BHRs during the AITL 2018 pre- and post-approval periods.

Period length (working days)	Mean rank			Mann-Whitney <i>U</i>	<i>p</i> Value
	Period	Before	After		
1	D-1	11.4	19.6	D0	−2.557
2	D-2 to D-1	13.1	17.9	D0 to D + 1	−1.507
3	D-3 to D-1	13.5	17.5	D0 to D + 2	−1.252
4	D-4 to D-1	12.8	18.2	D0 to D + 3	−1.696
5	D-5 to D-1	12.23	18.77	D0 to D + 4	−2.041
6	D-6 to D-1	11.47	19.53	D0 to D + 5	−2.515
7	D-7 to D-1	10.73	20.27	D0 to D + 6	−2.967
8	D-8 to D-1	10.07	20.93	D0 to D + 7	−3.402
9	D-9 to D-1	9.33	21.67	D0 to D + 8	−3.846
10	D-10 to D-1	10.2	20.8	D0 to D + 9	−3.299
11	D-11 to D-1	10.57	20.43	D0 to D + 10	−3.073
12	D-12 to D-1	10.57	20.43	D0 to D + 11	−3.073
13	D-13 to D-1	10.23	20.77	D0 to D + 12	−3.28
14	D-14 to D-1	10.5	20.5	D0 to D + 13	−3.123
15	D-15 to D-1	10.8	20.2	D0 to D + 14	−2.931

Individual bank BHRs are estimated for 15 working days before and after the AITL 2018 approval. Then, the nonparametric Mann Whitney *U* test was used to test the equality between the paired BHRs. Equation (1) is used to calculate the BHRs for each bank stock.

**Table 2.** Bank portfolio BHRs during the AITL 2018 pre- and post-approval periods.

Period (P) in Days	Before and After 2 December 2018	E.W (BHRs) <i>p</i> = 2, 5, 10, and 15	E.W (BHRs) Annualized	V.W (BHRs) <i>p</i> = 2, 5, 10, and 15	V.W (BHRs) Annualized
<i>p</i> = 2	Before	−0.0358	−0.9913	−0.0214	−0.9403
	After	−0.0016	−0.1871	−0.0005	−0.0574
	Diff.	0.0342	0.8042	0.0210	0.8829
<i>p</i> = 5	Before	−0.0452	−0.9099	−0.0366	−0.8561
	After	−0.0160	−0.5681	−0.0084	−0.3541
	Diff.	0.0292	0.3417	0.0282	0.5020
<i>p</i> = 10	Before	−0.0392	−0.6461	−0.0180	−0.3760
	After	0.0223	0.7746	0.0328	1.3160
	Diff.	0.0615	1.4207	0.0508	1.6920
<i>p</i> = 15	Before	−0.0436	−0.5386	−0.0163	−0.2480
	After	0.0200	0.4084	0.0308	0.6929
	Diff.	0.0636	0.9471	0.0471	0.9409

Equally and value-weighted approaches were used to calculate differences in the BHRs for portfolios consisting of all 15 banks listed on the ASE for four periods (*p* = 2, 5, 10, and 15 working days from the event date) representing the AITL 2018 pre- and post-approval periods. The estimated BHRs are annualized based on a total of 260 working days in a year.

**Table 3.** Descriptive statistics.

Variable	Mean	Minimum	Maximum	Std. deviation
<i>EDTE<sub>ip</sub></i>	0.00035	0.00004	0.00057	0.00014
<i>EPS<sub>ip</sub></i>	.1778	.01	1.00	.23977
<i>Ln.TA<sub>ip</sub></i>	21.6873	20.80	23.93	.83816
<i>D.Ratio<sub>ip</sub></i>	.873341	.8369	.9093	.0250046
<i>Q.Ratio<sub>ip</sub></i>	.242302	.1156	.3533	.0676952
Obs.	30	75	150	225

*EDTE<sub>i</sub>* is the AITL 2018 estimated differential tax effect for bank *i* scaled by total assets, all based on last quarter's financial reports just before the tax law announcement date; the third quarter (Q3), dated 30 September of 2018. *EPS<sub>i</sub>*, *Ln.TA<sub>i</sub>*, *D.Ratio<sub>i</sub>*, and *Q.Ratio<sub>i</sub>* are the earnings per share, natural log of total assets, debt ratio, and quick ratio for bank *i* estimated based on the banks' Q3 financial reports dated 30 September 2018. (Obs.: 15).

These results are in line with those in Table 1. However, the results are not statistically relevant as we have only one observation before and after the AITL 2018 announcement date for each test window.

#### 4.2 Panel regression results

The debate about the EMH is the main concern of this analysis. We estimate equation (4) to determine the effect of a bank's EDTE (explanatory variable) after the AITL on December 2 2018 on its CARs (dependent variable) after controlling for *EPS*, *Ln.TA*, *D.Ratio*, and *Q.Ratio*. Table 3 reports descriptive statistics for the explanatory and controlling variables in the regression. We provide these statistics at the individual stock level based on *actual* data as reported by Q3 of 2018. Accordingly, a bank's EDTE is

**Table 4.** Panel regression test results.

Model:  $CAR_{ip} = \alpha_1 + \alpha_2 EDTE_{ip} + \alpha_3 EPS_{ip} + \alpha_4 Ln.TA_{ip} + \alpha_5 D.Ratio_{ip} + \alpha_6 Q.Ratio_{ip} + \varepsilon_{i,t}$

Variable	Model 1, ( $p=2$ )		Model 2, ( $p=5$ )		Model 3, ( $p=10$ )		Model 4, ( $p=15$ )	
	Coeff.	Z (Sig.)	Coeff.	Z (Sig.)	Coeff.	Z (Sig.)	Coeff.	Z (Sig.)
Intercept	0.0015	1.09	0.0027	0.81	0.0627	3.78***	0.0703	3.97***
$EDTE_{ip}$	-0.0028	-2.36**	-0.0104	-6.78***	0.0164	4.03***	0.0160	5.62***
$EPS_{ip}$	-0.0042	-0.36	-0.0039	-0.72	0.0274	3.38***	0.0114	3.82***
$Ln.TA_{ip}$	-0.0028	-0.58	-0.0044	-0.74	-0.0018	-1.21	-0.0056	-4.44***
$D.Ratio_{ip}$	0.0015	-1.33	-0.0126	0.51	-0.1113	-1.13	-0.1387	-0.96
$Q.Ratio_{ip}$	0.0291	1.11	0.0027	1.49	0.0089	1.16	0.0524	2.14**
Wald Chi <sup>2</sup>	5.16*		33.46***		16.21***		19.77***	
Adj R <sup>2</sup>	9.1%		14.2%		11.4%		12.9%	

$CAR_{ip}$  represents the CARs for bank  $i$ .  $EDTE_{ip}$  is the AITL 2018 post-approval estimated differential tax effect for bank  $i$ , scaled by total assets.  $EPS_{ip}$ ,  $Ln.TA_{ip}$ ,  $D.Ratio_{ip}$ , and  $Q.Ratio_{ip}$  are defined as in Table 3. All variables are accumulated on a daily basis for each test window ( $p=2, 5, 10$ , and 15 working days from the event date). \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

calculated through applying the AITL 2018 additional tax rate of 3% to the bank's reported income before tax, then the outcome is deflated by reported total assets.

We next investigate how quickly the ASE incorporated the information from a change in tax law as a macroeconomic event. Eichfelder and Lau (2014) and others (Chetty et al., 2009; Finkelstein, 2009) suggest that tax unawareness and behavioral aspects of individual decision-makers may cause stock prices to deviate from rationality to tax news. We present the results of this analysis in Table 4.

The results indicate that the EDTE has a significant negative effect on banks' returns in the short test windows of 2 and 5 working days, with no effect for the control variable  $EPS$ . However, the effect becomes positive and strengthens as we extend the test windows to 10 and 15 working days in the third and fourth models. In addition, the control variable  $EPS$  then has a positive effect on stock returns for the third and fourth models. Similarly,  $Ln.TA$  and  $Q.Ratio$  become significant only for the 15-working day test window. However,  $D.Ratio$  remains an insignificant factor in banks' returns regardless the length of the event window, which may be due to the variable's extremely high mean and relatively low standard deviation (see Table 3).

Our interpretation for the observed stock return behavior is that investors first extrapolated the effect of the negative earnings news based on the high corporate tax rate proposal, into the future, causing stock prices to underreact to the positive news when the adjusted tax law was enacted.<sup>7</sup> Put differently, we presume that the relatively high proportion of less-experienced individual investors in the ASE may extrapolate their pessimism into the future, pushing prices below their fundamental values. Our finding is supported by Abdelhedi-Zouch and Ghorbel (2016), who document that conventional banks react differently to earnings signals, with stronger responses associated with negative rather than positive signals.

Moreover, the negative performance associated with the shorter test windows may be due to individual investors' behaviors. Individual investors may emphasize the prior period's macroeconomic expectations, which reflects the anchoring-induced bias. This bias exaggerates the influence of historical information and casts doubt on the accuracy of the perception of the unanticipated surprise component, making the market irrational (Birz et al., 2021). This occurs mainly because stock price adjustments to tax changes largely depend on the unanticipated element of the tax announcement (Pástor & Veronesi, 2012). This potential rational may also be in line with Choy and Zhang (2021), who observe that in roughly one third of cases, the earnings surprises and resulting market responses have opposite signs.

According to our findings, stock market investors took time to reflect their perception of the AITL enacted on 2 December 2018, with significant reactions observed in test windows as long as 10 and 15 working days from the event date. This delay in the market's response aligns with the broader literature, which also suggests that market participants often require time to fully digest macroeconomic announcements. For example, Wagner et al. (2018a) noted unexpected momentum behavior in individual stocks over a three-day period, followed by a relatively extended period for the market to fully assimilate the macroeconomic news of the U.S. presidential election. Similarly, Wagner et al. (2018b)

found evidence of stock price momentum and reversals due to irrational investor analysis of a new tax law.

Our analysis highlights the behavior of investors in the banking sector listed on the ASE regarding their perceptions of the AITL enacted in 2018. While it is clear that investors did eventually incorporate their perceptions of the tax law, our findings reveal a pattern similar to the evidence observed in the U.S. Specifically, stock returns did not fully reflect the information content of the tax law at the time of its announcement, thus creating opportunities for trading based on that information.

This result presents a challenge to the principles of the EMH. According to EMH, markets are expected to integrate all available information immediately and efficiently, leaving no room for predictable abnormal returns. However, our findings suggest that the ASE may exhibit characteristics that deviate from the assumptions of market efficiency. Factors such as information asymmetry and investor sentiment could explain these deviations, implying that there were indeed opportunities for investors to generate abnormal returns by strategically trading on information related to the tax law.

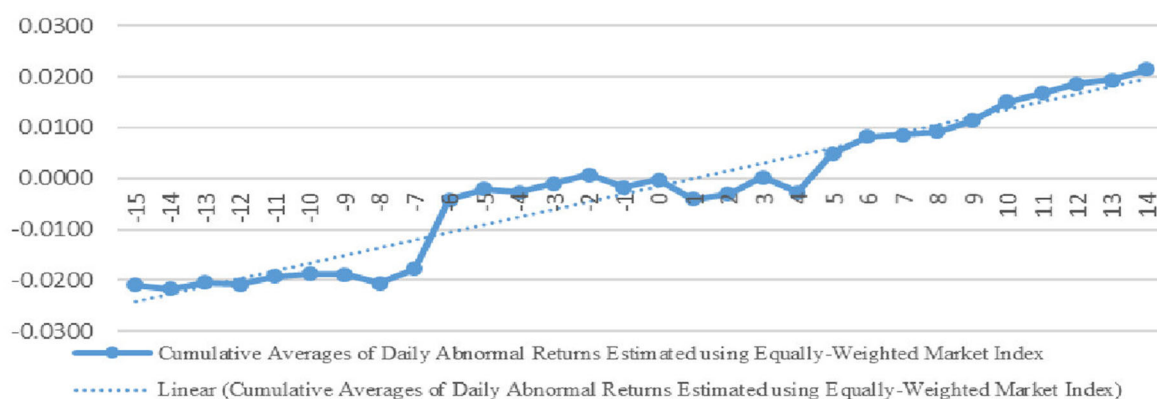
This study has some important implications for practice and recommendations for policymakers. Our findings highlight the essential role of investor education and awareness, particularly in emerging markets like Jordan. The study reveals investors' underreaction to positive news regarding the adjusted tax law, emphasizing the necessity for a deeper understanding of market regulatory changes among investors. Collaborative efforts among financial institutions, regulatory bodies, and educational institutions are recommended to develop targeted educational programs and resources aimed at enhancing investor knowledge and decision-making abilities. By focusing on a more knowledgeable investor base, market efficiency can be enhanced, potentially reducing opportunities for abnormal returns.

Furthermore, the study emphasizes the potential for generating abnormal returns through strategic trading based on regulatory events such as tax reforms. Investment firms and individual investors can leverage these insights to refine their investment strategies and exploit market inefficiencies. Conducting thorough analyses of regulatory announcements and comprehending the behavioral biases influencing market reactions can empower investors to develop more sophisticated trading strategies, incorporating algorithms, machine learning models, or principles from behavioral finance to optimize returns and manage risks effectively.

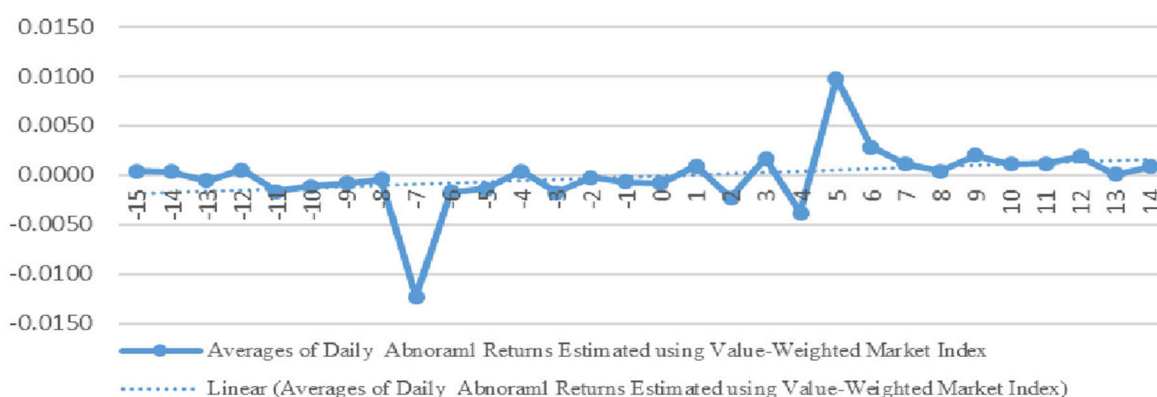
Lastly, the observed deviations from market efficiency in response to the tax reform event indicate the presence of structural inefficiencies or regulatory gaps within the Jordanian financial market. Regulatory authorities and policymakers can utilize these insights to advocate for policy reforms aimed at enhancing market transparency, reducing information asymmetry, and bolstering investor protection mechanisms. Initiatives such as streamlining disclosure requirements, enhancing market surveillance capabilities, and promoting fair and orderly trading practices can contribute to building a more efficient and resilient financial market ecosystem. Addressing these underlying issues can instill investor confidence, attract foreign investment, and support sustainable economic growth not only in Jordan but also in comparable emerging market contexts with similar economic status.



**Figure 1.** Plots averages of daily individual bank abnormal returns for 15 working days before and as from the AITL 2018 approval. Stocks' *Normal Returns* are estimated using *equally-weighted market index*.



**Figure 2.** Plots cumulative averages of daily individual bank abnormal returns for 15 working days before and as from the AITL 2018 approval. Stocks' Normal Returns are estimated using *equally-weighted market index*.



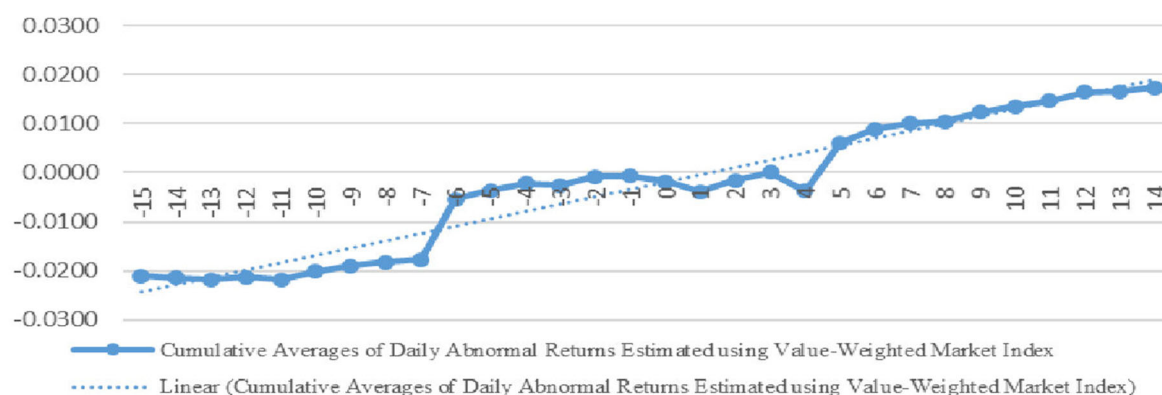
**Figure 3.** Plots averages of daily individual bank abnormal returns for 15 working days before and as from the AITL 2018 approval. Stocks' Normal Returns are estimated using *value-weighted market index*.

### 4.3 Robustness checks

We check the robustness of our findings by performing several additional tests. First, we plot averages of the daily individual bank abnormal returns calculated using returns on equally-weighted market index and the market model (see Brown & Warner, 1985), on the vertical axis, against the thirty working days considered by this study, on the horizontal axis (Figure 1). Therefore, we notice 15 observations of the sample daily abnormal return before and as from the AITL 2018 event date (D0), represented by (0) on the graph. We observe that the averages of the individual bank abnormal returns for the 15 days prior to the event date (-15 to -1) exhibit roughly constant behavior except for day -7. However, for the test period, except for the days (0, 2 and 4) where we observe negative abnormal returns, the sample banks clearly display on average positive and an upwardly abnormal return.

Second, we graph the cumulative averages of the daily individual bank abnormal returns versus the same thirty days (-15 to 14), as appears in Figure 2. Daily individual bank abnormal returns are obtained in this test in a similar manner to that of the previous test using an equally-weighted market index and the market model. This figure shows that the cumulative averages of daily abnormal returns remained relatively constant at low negative levels of about -2% over a nine-day period starting from the day (-15) to day (-7), where thereafter started a rising trend that rocketed as from the fifth day in the test period. The change pattern in the banks' cumulative averages of daily abnormal returns around the event date of AITL 2018 is strongly evidenced by the dashed diagonal line.

Third, we produce the following Figures 3 and 4 to depict the same characteristics as of Figures 1 and 2, respectively, except that we employ returns on a value-weighted market index to estimate the daily individual bank abnormal returns. Graphs in Figures 3 and 4 show the same evidence as of their prior counterparts, which overall supports the evidence reported in Table 1 when we compare the mean BHRs during the AITL 2018 pre- and post-approval periods.



**Figure 4.** Plots accumulated averages of daily individual bank abnormal returns for 15 working days before and as from the AITL 2018 approval. Stocks' *Normal Returns* are estimated using *value-weighted market index*.

## 5. Conclusion

The main findings of this study are threefold. First, we provide evidence that banks listed on the ASE experienced higher returns in the AITL 2018 post-approval period relative to the pre-approval period, both individually (except for few cases) and on a portfolio basis. This finding is robust for four test periods ( $p=2, 5, 10$ , and 15 working days from the tax reform event date). This would suggest that the market's reaction to the AITL 2018 post-approval period may have been positive due to the perception that the tax reform had favorable implications for the banking sector in Jordan. This may suggest that the clarity provided by the approval of the AITL 2018 may have strengthened the confidence of investors in the stability and predictability of the tax environment for banks in Jordan. This increased confidence could have led to higher investment flows and demand for bank stocks, driving up their prices and resulting in higher returns. In addition, our findings would also suggest that in the context of emerging markets such as Jordan, informal institutions play a significant role, even if experts assume that these markets are regulated. In other words, some stock prices in the Jordanian financial market could behave contrary to what the general public would have predicted (e.g. as a result of the original AITL announcement). This means that elites and informally connected actors in Jordan may have had an informal view of the actual AITL to be implemented, hence taking advantage of making short and/or long-term revenues. Unsurprisingly, such an event would significantly increase the price of some of the individual stocks; assuming that such elites and local players would have invested heavily in these banks in particular, increasing demand and accordingly the prices of these individual stocks.

Second, employing panel regression methodology to gauge the relationship between the EDTE subsequent the tax reform event date and banks' CARs, after controlling for *EPS*, *Ln.TA*, *D.Ratio*, and *Q.Ratio*, indicates heterogeneous investor behavior depending on the length of the event window. Contrary to the observed negative influence for the EDTE and banks' CARs when we use the short event windows of 2 and 5 working days, the results indicate a significant positive effect when we extend the event window to 10 and 15 working days. Our interpretation is that investors first underreacted to the good earnings news when the bill was enacted as a law due to the behavior associated mainly with individual investors. Investor sentiment, limited attention capacity, overconfidence, and anchoring bias could lead investors to react irrationally to actual statistics on the release date by taking prior forecasts at face value. Hence, stock prices increased as investors adjusted their perceptions of the new tax law. If true, then we establish the third conclusion, which raises concerns about the efficiency with which the market reacted to a macroeconomic event, as investors first underreacted to the tax reform announcement, extrapolating their prior negative expectations into the future, before revising their expectations, which led to a reversal in price.

## Notes

1. Here, we presume that the banking sector in Jordan is audited by only Big Four audit firms and represents 59% and 82% of the ASE total market capitalization and total assets, respectively. Source: [www.ase.com.jo](http://www.ase.com.jo), as of December 31, 2018.



2. Blume and Stambaugh (1983), Barber and Lyon (1997), and Feng and Hu (2014) support the use of BHRs, while Hegde et al. (2020) and Dutta et al. (2018) use the buy-and-hold returns and cumulative abnormal returns (CARs).
3. As of December 31, 2018. Source: ASE, <https://www.sdc.com.jo/arabic/index.php>.
4. Blaufus et al. (2019), use the market model and CARs as dependent variable to test for the effect of tax evasion and tax avoidance on stock prices.
5. During the study period, interest rates remained unchanged. In Jordan, the Federal Funds Market is almost non-existent, and the Central Bank of Jordan is solely responsible for setting and revising interest rate policy periodically. Consequently, including an interest rate variable in the regression analysis would result in a coefficient of zero, offering no additional explanatory power or meaningful insight into our model. Therefore, we believe that adding this variable is unnecessary and would not contribute to the robustness of our findings.
6. A restatement procedure was needed for EPS, a controlling variable, to allow for stocks' scrip issues and stocks' dividends that took place during any of the years 2014-2018, before estimating the variable's growth rate during Q4 of 2018.
7. In the same context, following Hirshleifer et al. (2009) notion of limited attention, Feng and Hu (2014) report that investors underreact to the more public earnings news announced on the same day, requiring more time to rationally price the news.

## Authors' contributions

Authors' individual contribution:

Conceptualization and design—A.A. and G.A.R. and N.A.;

Methodology—A.A. and M.I.;

Software—A.A. and M.I.; -

Validation—A.A. and M.J.M. and G.A.R.;

Analysis and Interpretation of then data—A.A. and M.I. and M.J.M.;

Resources—A.A. and N.A. and G.A.R.;

Data Curation—A.A. and M.I.;

Drafting of the paper—A.A. and M.I. and M.J.M.;

Revising the paper for intellectual content—M.J.M. and A.A. and M.I.;

Writing—Review & Editing—M.J.M. and G.A.R.;

Visualization—A.A. and M.I.;

Supervision—A.A. and G.A.R.;

Project Administration—A.A.

Finally, we declare that all authors agree to be accountable for all aspects of the work.

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## Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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