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Revisiting the ability of research and development activities to improve value relevance

Dedhy Sulistiawan and Felizia Arni Rudiawarni
Faculty of Business and Economics, University of Surabaya, Surabaya, Indonesia

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Abstract

Purpose – This article aims to evaluate the informativeness of accruals on stock prices. Investors may misinterpret the information contained in accruals and produce accrual anomalies. Accruals accounting improves the quality of financial statements by providing useful information, although it also contains judgments and is less objective than operating cash-flows.

Design/methodology/approach – We employ data panel regression analysis to investigate the value relevance of financial information. Our study takes the object of companies listed on the Nasdaq stock exchange (NASDAQ) as the representative of the prominent stock exchange for technology-driven enterprises and entrepreneurs. Expanding the findings, we also use Shanghai Stock Exchange (SSE) data.

Findings – Our research finds that accruals are still relevant. However, firms with R&D expenditures reduce the ability of accruals to explain stock prices for non-technology firms and firms without intangible assets. After analyzing only tech firms (and firms with intangible assets), our tests show that R&D expenditures improve the relevancy of accruals. These findings apply to both Nasdaq and SSE.

Practical implications – Practitioners and the investment community get valuable insights into how the recognition and measurement of R&D expenditures affect the value relevance. Information about R&D increases relevancy only in firms with intangible assets and those that operate in the technology industry.

Originality/value – Our paper provides benefits by using R&D expenses to affect accruals' informativeness by comparing two countries with different recognition of R&D.

Keywords Accruals, Innovation, Stock price, R&D, Valuation

Paper type Research paper

1. Introduction

This paper aims to reassess the significance of research and development (R&D) activities in improving value relevance. Using an efficient market hypothesis, we bring value relevance issue to connect accruals as the earnings component and R&D to stock return. Value relevance issues arise from the use of residual income models that do not consider a firm's innovation, as represented by R&D. The lack of a clear relationship between the expenditures and subsequent advantage was a key factor in the implementation of SFAS no. 2, which mandated the full expense recognition of R&D activities in the financial statements in the US (Lev and Sougiannis, 1996). Our inquiry is motivated by Lev and Gu's (2016) argument regarding "the end of accounting," as current financial accounting practices neglect internally developed intangible assets, particularly in the context of the transition from an industrialized era to a high-tech economy.

Currently, new economy firms have emerged as dominant players in the list of the largest companies in the US and international stock markets. Notable examples include Apple, Microsoft, Alphabet (Google), Amazon, NVIDIA, Tesla, and Meta (Facebook). These new economy firms leverage technology to establish their uniqueness and drive innovation (Balkin *et al.*, 2000), which are integral aspects of both the business environment and society (Liao *et al.*, 2017).

According to Microsoft's annual report in 2022, the company allocated more than 10% of its sales to R&D expenses. Alphabet (Google), in its 2022 Form 10-K report, revealed that it

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had invested over $100 billion in R&D over the past five years to drive innovation. It is widely acknowledged that the success of firms in launching new science-based products or services is significantly influenced by their R&D activities. Supporting this notion, Zhan *et al.* (2020) provide empirical evidence indicating that Chinese firms have increased their research expenditures in response to the government's strategic shift to promote innovation.

Nevertheless, the requirement for full R&D spending in the U.S. is very conservative and unable to capitalize the expenditure. In producing innovation, R&D expenditures should be recognized immediately. It is stated in FAS 142 (FASB, 2021), that only the purchase of intangible assets can be recognized, but self-creating intangible assets produced by firms' R&D should not be capitalized as assets.

Presently, the Accounting Standards Codification (ASC) 730 mandates immediately recognizing all R&D costs as expenses. However, certain costs, such as materials, equipment, and facilities, may be eligible for capitalization. U.S. standard-setters remain cautious about the objectivity of estimating R&D capitalization and the increased audit risk associated with expanding opportunities for earnings management. Despite firms dedicating significant time to research and pursuing new knowledge or techniques, stakeholders must acknowledge the barriers posed by the uncertainty of future economic benefits and the reliability of measurement.

Canace *et al.* (2022) surveyed financial officers in public firms and found extensive R&D capitalization practices. The majority of respondents reported having capitalized R&D expenditures at some point, highlighting the widespread nature of R&D capitalization in practice. While this survey examined beliefs rather than actions, further examination using market data is necessary to evaluate the importance of R&D for market participants.

Given the dominance of new economy firms, intangible assets and R&D play crucial roles in analyzing value relevance. Barth *et al.* (2023) discuss the evolution of value relevance in the era of service-based and information technology-driven economies. The rise of the new economy, where future revenue and profit heavily depend on intangible assets growth, has been identified as a contributing factor to declining value relevance (Lev and Zarowin, 1999; Donelson *et al.*, 2011; Srivastava, 2014; Lev, 2018).

In China, Bin Khidmat *et al.* (2019) present that R&D improves value relevance of earnings and book value. R&D World (Statista, 2024) presents a list of the top countries in R&D spending in 2022, with the US leading in gross expenditures on R&D, accounting for approximately 3.07% of its GDP, equivalent to $679.4 billion. As the second-largest stock exchange globally, Nasdaq primarily lists high-tech and growth-oriented firms. In our study, we examine the role of R&D in the value relevance of accruals using data from Nasdaq. Accruals represent revenues earned or expenses incurred that impact a firm's profit or loss.

U.S. and China are prominent countries in terms of nominal gross domestic product (GDP). Besides being the dominant forces in the global economy, the US and China also hold prominent positions as leaders in innovation. China is the top contributor to international patent applications to the World Intellectual Property Organization (WIPO). According to WIPO data from 2023, the National Intellectual Property Administration of the People's Republic of China (CNIPA) obtained 1.6 million patent applications in 2022, which is a 2.1% increase compared to 2021. The U.S. Patent and Trademark Office (USPTO) came in second with 594,340 applications. In 2022, the share of Chinese patents in global patents was 46.8%, while the U.S. was 17.2%. It indicates that China has been closing up to the United States regarding R&D investment.

This article aims to examine the significance of accruals in relation to R&D expenditures in terms of their impact on value. The novelty of this paper lies in the new area for providing empirical findings about the use of R&D in improving the information content of accruals. Accruals are the essential component of earnings. We also provide a comparison of the findings between NASDAQ and SSE as both stock exchanges have dominance in the world.

The incorporation of data from U.S. companies listed on the NASDAQ underscores the importance of R&D endeavors in connection to accruals. In addition, we incorporate Chinese companies listed on the SSE, given that many of the leading tech companies are listed on the SSE. Bin Khidmat *et al.* (2019) assert that Chinese firms began acknowledging capitalized R&D expenses on their financial statements following the year 2007, whereas FASB obligates U.S. firms to expense their R&D expenditures. An analysis of the accrual relevance of companies listed on the SSE and NASDAQ would provide valuable insights.

By decomposing earnings into accruals and operating cash flow, our tests reveal that both accruals and operating cash flow positively affect stock prices, aligning with the fundamental logic of the value relevance of earnings components. Further investigation finds that R&D expenditures decrease the value relevance of accruals, particularly for the full sample and loss firms. Moreover, the impact of R&D expenditures also affects firms with intangible assets differently than those without.

Our research contributes to the field of R&D studies by providing evidence of the usefulness of R&D in decision-making processes related to firm value. This study offers insights to investors, highlighting how R&D activities can assist in the equity valuation process and provide valuable information when assessing firm value. By highlighting the impact of R&D on the correlation between accruals as earnings components and stock prices, this work also contributes to the body of research on value relevance.

The remainder of this article is organized as follows. The next section presents a literature review, followed by a description of the data and methodology in section three. Section four provides the results and analyzes the findings, and the last section concludes the article and highlights areas for future research.

2. Literature review

Efficient market theory, specifically semi-strong efficiency, predicts that stock price reflects published information (Fama, 1970). Financial information items affect firms' valuation. One of the important issues in connecting that information is value relevance. Ohlson (1995) established a value relevance model for earnings and book value, guiding value relevance research today. In its development, value relevance discusses the relevance of earnings and the importance of earnings components – accrual and cash flow – and other financial information, including R&D, especially for today's new economy (Barth *et al.*, 2023).

Numerous literature works have examined the study of value relevance, specifically the relationship between earnings and stock price (Beaver, 1968; Ball and Brown, 1968; Hayn, 1995; Collins *et al.*, 1999; Lev and Zarowin, 1999; Beisland, 2009; Lev, 2018). The main focus of value relevance research revolves around the usefulness of financial information, as it constitutes a significant aspect of the qualitative characteristics of financial reporting. Understanding the decline in relevancy is crucial. Barth *et al.* (2023) discuss two primary reasons for value relevance: (1) the rise of the new economy and the use of intangible assets, including R&D activities (Core *et al.*, 2003), which has stimulated the idea of the "end of accounting" (Lev, 2019), and (2) the increased presence of loss-making firms. Our study specifically focuses on the role of R&D activities in explaining the value relevance of accruals, as components of earnings, to stock price while also addressing the issue of profit/loss firm conditions. Table 1 shows related value relevance topics.

New economy and modern firms tend to possess a greater amount of intangible assets, R&D expenses, advertising expenses, and substantial sales growth that, from certain perspectives, cannot be adequately accommodated by existing formal financial statements. These business models primarily rely on their intangible assets, which are often not included on the balance sheet. While R&D activities are highly important for firms, ASC 730 recognizes R&D expenditures as immediate expenses, effectively preventing the

No	Authors	Method	Findings
1	Chen *et al.* (2020)	They divided financial information from U.S. companies into highest versus lowest industry comparability. The Ohlson Model (1995) inspired their research	Comparability of financial accounts boosts earnings relevance but not book value. Increased comparability benefits come from high-opacity financial reports with internal control vulnerabilities
2	Boonlert-U-Thai and Schaberl (2022)	This study employs Lubberink and Willett's (2021) log-linear models to analyze accounting number value relevance and Schaberl's (2016) incremental value relevance. Future earnings are included in a basic Ohlson (1995) valuation model to analyze stock price forwardness. They use companies listed in Japan and the U.S. as research objects	The results show that the value relevance of earnings and book value increases over time. Meanwhile, earnings and book value have different relevance when viewed from the life cycle and market uncertainty
3	Dunham and Grandstaff (2022)	The conduct literature review for three streams of value relevance • Value relevance of earnings and book value • Value relevance of other accounting information • The role of economic conditions on the value relevance	They reviewed value relevance literature and concluded that despite much of the study, it could not explain value relevance changes over time. They provide insights for future value-relevance research
4	Barth *et al.* (2023)	Prices and accounting items are analyzed using CART (Classification and Regression Trees). Old economy, new economy, old economy profit, and old loss firms are analyzed separately. Compustat data from 1962 to 2018 is used for NYSE, NASDAQ, and AMEX corporations	Accounting information evolves. Information about intangible assets, growth opportunities and alternative performance measurements has become relevant in the new economy era
5	Canace *et al.* (2022)	They surveyed experts and interviewed seven financial executives in U.S. They also reviewed scholarly articles. The authors compare accounting practice for R&D to academic literature	Over 90% of experienced financial officers claim their firm capitalizes R&D. When profits decline; most companies cut R&D spending, except for R&D which has long-term consequences
6	Bin Khidmat *et al.* (2019)	Chinese A-listed companies from 2008 to 2016 are studied. The hypothesis is tested using the Ohlson Model (1995). Researchers divided a company's life cycle into growth, mature, and stagnant. Additionally, researchers examined industrial competitiveness	This life cycle stage-based study evaluates the value relevance of R&D and FCF in efficient investment companies. According to studies, R&D and FCF boost EPS and book value value, especially for mature companies and those operating in competitive industries
7	Ertuğrul (2020)	Borsa Istanbul 2009–2018 listed companies are the research object	Studies suggest that R&D boosts market value. Additional findings demonstrate that book value (earnings) significance reduces (increases) with R&D, indicating a market shift from balance sheet to income statement components. They also show that R&D has different value relevance consequences for companies with profits and losses and those without R&D

Table 1.
Previous studies of value relevance topics

Source(s): Table created by authors

capitalization of intangible assets, except for materials, equipment, and facilities utilized in R&D activities. Although these assets are categorized as tangible assets, they are used in the R&D process and are only expensed after firms use them. With the ASC 730 rule, the consequence is that R&D expenses are already reflected in the income statement. However, despite R&D being immediately recognized as an expense, financial officers of listed firms believe that certain R&D activities yield future economic benefits, as they have capitalized R&D at some point in the past (Canace *et al.*, 2022). Investors also consider R&D as a means to capture future benefits for firms (Lev, 2019).

Investments in R&D contribute to the innovation of novel products or processes, thus introducing an element of uncertainty regarding future benefits. In this regard, R&D carries inherent risk. R&D investments have positively impacted bond default risk and bond risk premiums (Shi, 2003). Kothari *et al.* (2002) exhibit that investing in R&D results in uncertain future rewards, while Amir *et al.* (2007) conclude that R&D stimulates earnings variability. From these perspectives, although R&D may enhance future performance, it also entails increased risk or uncertainty. Both aspects implicitly indicate the relevance of R&D, albeit with differing impacts.

H1. Firms with R&D receive higher valuation from the market.

When examining the correlation between earnings level or its components and stock price, R&D may influence this relationship. Understanding the evolution of value relevance gives insights into accounting information in the new economy era. This is significant because the accounting standards are primarily designed for industrial firms. Therefore, analyzing the role of R&D expenditures in connecting financial data and the market is crucial for discussion.

From a negative standpoint, R&D may undermine the relevance of accruals due to its inherent risk or uncertainty. The outcomes derived from intangible assets produced through R&D activities are uncertain. According to Kannan *et al.* (2023), the uncertainty surrounding when and how much economic advantages may arise from the investment makes assessing the value of intangible assets challenging.

However, from a positive perspective, investors who believe that R&D impacts the valuation process incorporate this information and adjust the firm's value. When it comes to intangible assets, we consider R&D expenses to be recognized as intangible assets. Lev and Sougiannis (1996) provide evidence that R&D expenses positively correlate with future operating earnings, which supports this argument. This result is consistent with the findings of Aboody and Lev (2000). In the new economy, where intangible assets have significant value for companies, we anticipate these items to be more pertinent. Chan *et al.* (1990) argued that companies that invest in R&D experience increased stock prices. However, the success of this trend is contingent upon whether or not the enterprises belong to the high-technology sector.

These studies show that R&D increases earnings relevancy. Earnings are composed of accruals and operating cash flows. Cash flow alone cannot forecast future success because it merely shows value distribution (Hutton *et al.*, 2009). The earnings figure must include accruals to reflect the company's performance. Several studies show that accruals have value relevance and accurately contain information for investors (Dechow, 1994; Barth *et al.*, 1999). Dechow (1994) found that accruals are more important in judging short-term performance when working capital, investment, and finance activities become more volatile and the operational cycle lengthens. Meanwhile, the relevance of operating cash flows in these cases is weakening.

Recent studies related to R&D relevance in the US and China contributed to the development of this study. According to research by Autor *et al.* (2020) in the United States, global competition and exposure to imports increase competitive pressure, which can reduce

R&D expenses for US companies. They found that US patents declined in sectors that faced high import competition, especially in less profitable and capital-intensive companies.

Barth *et al.* (2023) revealed that the value relevance of US corporations grew across financial report items, not simply earnings and book value. In new economy companies, intangible assets, growth potential, and alternative performance indicators increased significantly. In their research, intangible assets covered R&D expenditures. R&D expenditures are required by U.S. GAAP to be expensed. However, their research shows a positive correlation between R&D expenses and stock prices, suggesting investors view them as investments (Barth *et al.*, 2023) and potential sources of future operating earnings (Lev and Sougiannis, 1996).

Chinese researchers studied how R&D affects business value in various settings. Kim *et al.* (2018) found that R&D investments in companies with low state ownership have an inverted U-shaped effect on firm valuations. Bin Khidmat *et al.* (2019) examine the impact of R&D relevance and free cash flow on investment-efficient companies. The results show that R&D increases the relevance of earnings and the book value of efficient investment firms, especially those in mature stages and in competitive industries. Li *et al.* (2021) studies how investors react to earnings management by decreasing R&D. Investors dislike firms that cut R&D to manage earnings. If this cut is short-term and the company increases R&D spending again in the subsequent period, then this reaction is also short-term, and investors assess it as they assess earnings management accruals. Kong *et al.* (2023) found that innovation efficiency increases firm value, especially in high-tech and intellectual property-protected industries.

Those previous studies show that investors react to financial report information, including R&D. However, previous research does not mention how R&D can increase the information content of accruals as an important component of earnings. Filling the gap in previous studies, our study investigates whether R&D can increase value relevance accruals. We believe that R&D may improve the relevance of accruals due to the potential for future economic benefits. Hence, we propose our hypothesis as follows:

H2. R&D expenditures affect the value relevance of accruals.

3. Data and methodology

This research examines data for companies listed in the NASDAQ and SSE. We use all data available from Unicorn Data Service. We get data from NASDAQ from 1986 to 2023 and SSE from 2004 to 2022. NASDAQ possesses unique characteristics derived from its technology-driven approach and focus on technology growth and innovation firms. The SSE is a rapidly expanding stock exchange with prominent technology companies, including Tencent, Alibaba, and Baidu. Due to these factors, Nasdaq and SSE are prominent stock exchanges for technology-driven enterprises and entrepreneurs, although they also include listings from other industries. After removing observations with missing data, our final sample consisted of 44,464 firm-years for NASDAQ and 22,074 firm-years for SSE.

To address the hypothesis in this study, we employed the following regression Equation (1):

$$SP_{i,t} = \beta_0 + \beta_1 BV_{I,t-1} + \beta_2 ACCR_{i,t} + \beta_3 OCF_{i,t} + \beta_4 RnD_{i,t} + \beta_5 D\_RnD{*}ACCR_{i,t} + \varepsilon \quad (1)$$

In Equation (1), SP represents the year-end closing price, while BV denotes the book value per share at the beginning of the year. EPS refers to earnings per share, which we further decompose into accruals per share (ACCR) and operating cash flow per share (OCF). Accrual per share (ACCR) is determined by subtracting operating cash flow per share from EPS. RnD

represents the proportion of R&D expenses to sales. Additionally, we employ a dummy variable for R&D (D_RnD) as a moderating variable, where the dummy equals 1 for companies with R&D expenses and 0 otherwise.

Table 2 shows the descriptive statistics. The stock price (SP) exhibits a wide range, indicating substantial investments in R&D by companies listed on Nasdaq and SSE. Approximately 37.8% of our research subjects are companies engaged in R&D activities for companies in NASDAQ and 54.1% for companies in SSE. This data shows that companies investing in R&D in SSE are much higher than those in NASDAQ.

Table 3 shows the correlation matrix for NASDAQ (Panel A) and SSE (Panel B). As predicted, SP positively correlates with BVPS and EPS on NASDAQ and SSE. When EPS is decomposed into ACCR and OCF, SP appears to correlate negatively with ACCR on NASDAQ, but ACCR still correlates positively in SSE. The negative (positive) correlation indicates that the higher the accruals, the lower (higher) the stock price for NASDAQ (SSE).

4. Results and discussion

All the regression tests we carried out were preceded by selecting the appropriate panel data regression method. We tested our data using the Chow Test, and the results suggested we use the Fixed Effect Model. First, we assessed the relevance of R&D and accruals for each stock exchange; then, we analyzed firms in both markets.

4.1 NASDAQ results

The regression results are presented in Table 4, indicating that accruals alone are insufficient to explain stock prices. However, when considering R&D expenditures, accruals' significance diminishes in predicting stock prices. This is evident from the significantly negative coefficient of D_RND*ACCR at the 1% confidence level.

In Table 5, we conduct a regression analysis using a split sample based on profit/loss and the presence of intangible assets in the company. We also complete the investigation by

	Min	Max	Mean	Std. Deviation
Panel A: NASDAQ (N = 44.464)				
$SP_{i,t}$	0.007	8087.500	33.434	133.992
$BVPS_{i,t-1}$	−507.352	956.666	10.900	27.261
$EPS_{i,t}$	−2598.027	1405.573	0.028	18.392
$OCF_{i,t}$	−450.158	716.112	1.425	9.992
$ACCR_{i,t}$	−2598.025	1405.573	−1.397	19.507
$D\_RnD_{i,t}$	0.000	1.000	0.378	0.485
$D\_INTA_{i,t}$	0.000	1.000	0.646	0.478
$D\_Profit_{i,t}$	0.000	1.000	0.626	0.484
Panel B SSE (N = 22.074)				
$SP_{i,t}$	0.158	2050.000	12.063	30.922
$BVPS_{i,t-1}$	−24.178	150.880	3.543	3.755
$EPS_{i,t}$	−21.860	49.930	0.343	1.002
$OCF_{i,t}$	−109.817	247.426	0.547	2.710
$ACCR_{i,t}$	−246.963	110.163	−0.204	2.555
$D\_RnD_{i,t}$	0.000	1.000	0.541	0.498
$D\_INTA_{i,t}$	0.000	1.000	0.969	0.173
$D\_Profit_{i,t}$	0.000	1.000	0.898	0.303

Note(s): D_RnD = 1 if a company has R&D expenditures, and 0 otherwise. D_INTA = 1 if a company has intangible assets, and 0 otherwise. D_Profit = 1 if a company is profitable and 0 otherwise
Source(s): Table created by authors

Table 2.
Statistic descriptive

	$SP_{i,t}$	$BVPS_{i,t-1}$	$EPS_{i,t}$	$OCF_{i,t}$	$ACCR_{i,t}$	$D\_RnD_{i,t}$
Panel A: NASDAQ (N = 44.464)						
$SP_{i,t}$	1	0.493**	0.403**	0.427**	−0.265**	0.000
$BVPS_{i,t-1}$	0.248**	1	0.416**	0.481**	−0.310**	−0.194**
$EPS_{i,t}$	0.023**	0.049**	1	0.692**	0.082**	−0.278**
$OCF_{i,t}$	0.160**	0.388**	0.157**	1	−0.484**	−0.249**
$ACCR_{i,t}$	−0.060**	−0.152**	0.863**	−0.365**	1	0.013**
$D\_RnD_{i,t}$	0.040**	−0.087**	−0.040**	−0.078**	0.002	1
Panel B: SSE (N = 22.074)						
$SP_{i,t}$	1	0.612**	0.732**	0.279**	−0.009	0.124**
$BVPS_{i,t-1}$	0.502**	1	0.655**	0.294**	−0.055**	0.205**
$EPS_{i,t}$	0.550**	0.530**	1	0.335**	0.037**	0.112**
$OCF_{i,t}$	0.303**	0.387**	0.495**	1	−0.929**	0.019**
$ACCR_{i,t}$	0.047**	−0.105**	0.103**	−0.708**	1	0.024**
$D\_RnD_{i,t}$	0.323**	0.323**	0.218**	0.137**	0.035**	1

Note(s): **Correlation is significant at the 0.01 level (2-tailed)
Pearson (Spearman) correlations appear above (below) the diagonal
Source(s): Table created by authors

Table 3.
Correlation matrix

Dependent variable: stock price (SP)			
Variables	Model 1 (Coeff.) (*t*-value)	Model 2 (Coeff.) (*t*-value)	Model 3 (Coeff.) (*t*-value)
C	20.500*** (30.050)	13.923*** (16.724)	14.200*** (17.065)
$BVPS_{i,t-1}$	1.054*** (45.133)	1.078*** (44.048)	1.061*** (43.335)
$ACCR_{i,t}$	−0.001 (−0.015)	0.012 (0.349)	0.160*** (4.332)
$OCF_{i,t}$	1.018*** (14.410)	1.068*** (15.113)	1.137*** (16.036)
$D\_RND_{i,t}$		16.605*** (12.927)	15.506*** (12.038)
$D\_RND_{i,t}$*$ACCR_{i,t}$			−0.823*** (−9.779)
N	44,464	44,464	44,464
Adj R^2	0.070	0.074	0.076
F-stat	84.887***	87.203***	87.585***
DW	0.2532	0.255	0.258
Fixed effect	Yes	Yes	Yes

Note(s): ***, **, and * represent the significance at 1, 5, and 10%, respectively (one-tailed test)
Source(s): Table created by authors

Table 4.
Regression for NASDAQ: full sample

dividing the sample by companies engaged in the technology industry and those not engaged in technology-based industries. Table 5 Column 1 shows that accounting information, such as BVPS, accruals, and operating cash flow, exhibits value relevance to stock prices for profitable corporations.

A similar condition is also shown in Table 5 Column 2. R&D expenditures reduce the relevance of accrual for companies that have and do not have intangible assets. We suspect this condition occurs because investors find it difficult to digest information about intangible

Table 5.
Regression analysis: NASDAQ sub-sample

Dependent variable = stock price

	(1)		(2)		(3)	
Samples Variables	Profit (Coeff.) (*t*-value)	Loss (Coeff.) (*t*-value)	INTA = 1 (Coeff.) (*t*-value)	INTA = 0 (Coeff.) (*t*-value)	Tech (Coeff.) (*t*-value)	Non-tech (Coeff.) (*t*-value)
C	11.020***	15.457***	10.764***	18.062***	31.349***	12.645***
	14.638	7.695	10.291	13.720	13.655	14.005
$BVPS_{i,t-1}$	0.931***	0.828***	1.362***	0.559***	0.536***	1.138***
	38.455	15.462	46.313	13.210	10.309	41.808
ACCRi,t	0.897***	−0.225***	2.141***	−0.079**	0.007	0.199***
	16.647	−3.911	22.347	−1.962	0.112	4.677
OCFi,t	2.840***	−1.212***	3.262***	−1.348***	2.238***	1.093***
	35.021	−8.279	31.948	−9.850	13.693	13.951
D_RNDi,t	19.227***	11.053***	15.502***	9.877***	−5.751	19.680***
	14.374	4.184	10.299	4.126	−2.219	12.726
D_RNDi,t*ACCRi,t	−0.707	−0.484***	−2.440***	−2.786***	0.355**	−1.378***
	−3.223	−4.134	−20.385	−11.785	3.165	−13.279
N	27,840	16,624	28,716	15,748	6,863	37,601
Adj R^2	0.192	0.024	0.148	0.028	0.122	0.077
F-stat	158.326***	10.863***	119.432***	11.856***	24.207***	75.811***
DW	0.221	0.321	0.360	0.159	0.396	0.251
Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes

Note(s): ***, **, and * represent the significance at 1, 5, and 10%, respectively (one-tailed test)
Firms with Intangible Assets (INTA = 1) and firms with no Intangible Assets (INTA = 0)
Source(s): Table created by authors

assets and R&D expenditures. R&D expenditures are considered expenses by accounting, so for investors, they only reduce earnings and are not considered an investment that can be capitalized as an asset. Table 5 Column 2 shows that accrual information and the existence of R&D investments alone are not able to explain stock prices.

However, the test results in Table 5 Column 3 show a joint effect between D_RND and ACCR, meaning that the presence of R&D expenditure (D_RND) information is able to increase the relevance of accrual to stock prices in technology companies. The results of this study are in accordance with Khan *et al.* (2020), who states that R&D investment is strongly affected by the environment in which the company operates. In our research, if companies in the technology industry invest in R&D, this information will positively affect the value relevance of accrual.

4.2 SSE results

The main purpose of this paper is to investigate the value relevance of accruals with a focus on R&D expenditures. The inclusion of data from US firms listed on the Nasdaq highlights the significance of R&D activities in relation to accruals. We extend the scope of this study to provide a comparison between US firms and Chinese firms, considering that both the US and China are leading countries in terms of nominal gross domestic product and innovations. Additionally, Bin Khidmat *et al.* (2019) state that firms in China started recognizing capitalized R&D expenditures on their balance sheets after 2007, while US GAAP still expensing their R&D expenditures.

Using the Fixed Effect Model, Table 6 shows that accrual positively affects stock price for all models. Similar to NASDAQ data, book value, earnings, and operating cash flow coefficients still show that those accounting numbers have value relevance, and firms with R&D expenditures decrease accrual relevance.

We further divided the sample on the basis of (1) profit and loss firms, (2) firms with and without intangible assets, and (3) technology and non-technology firms. Table 7 displays these outcomes.

Dependent variable: stock price (SP)

Variables	Model 1 (Coeff.) (*t*-value)	Model 2 (Coeff.) (*t*-value)	Model 3 (Coeff.) (*t*-value)
C	−1.565***	−3.597***	−3.488***
	−7.671	−12.794	−12.424
$BVPS_{i,t-1}$	2.134***	2.161***	2.113***
	40.521	41.093	40.108
$ACCR_{i,t}$	17.417***	17.315***	17.703***
	94.089	93.637	93.999
$OCF_{i,t}$	17.585***	17.498***	17.744***
	96.336	95.992	96.732
$D\_RND_{i,t}$		3.626***	3.320***
		10.475	9.578
$D\_RND_{i,t}*ACCR_{i,t}$			−2.136***
			−10.249
N	22,074	22,074	22,074
Adj R^2	0.574	0.576	0.578
F-stat	1419.349***	1366.501***	1317.821***
DW	0.569	0.571	0.563
Fixed effect	Yes	Yes	Yes

Note(s): ***, **, and * represent the significance at 1, 5, and 10%, respectively (one-tailed test)
Source(s): Table created by authors

Table 6.
Regression for SSE: full sample

Table 7.
Regression analysis: SSE sub-sample

Dependent variable = stock price

	(1)		(2)		(3)	
Samples Variables	Profit (Coeff.) (*t*-value)	Loss (Coeff.) (*t*-value)	INTA = 1 (Coeff.) (*t*-value)	INTA = 0 (Coeff.) (*t*-value)	Tech (Coeff.) (*t*-value)	Non-tech (Coeff.) (*t*-value)
C	−3.324***	3.397***	−3.637***	5.158***	1.037	−3.594***
	−11.987	7.086	−12.482	7.992	0.703	−12.688
$BVPS_{i,t-1}$	0.636***	1.484***	2.043***	0.079	2.725***	2.063***
	11.301	15.103	37.991	0.354	13.388	38.165
$ACCR_{i,t}$	26.314***	−0.537*	18.375***	3.330***	13.337***	17.760***
	121.254	−1.906	94.778	6.256	8.609	93.109
$OCF_{i,t}$	26.206***	−0.902***	18.354***	6.219***	21.150***	17.796***
	123.391	−2.912	97.344	9.789	22.283	95.577
$D\_RND_{i,t}$	3.446***	1.255*	3.419***	4.655***	0.219	2.797***
	10.175	1.892	9.679	2.585	0.122	7.937
$D\_RND_{i,t}$*$ACCR_{i,t}$	0.187	1.669***	−2.220***	−6.171***	3.381**	−2.253***
	0.884	4.714	−3.637	−4.308	2.042	−10.645
N	19,816	2,258	21,389	685	1,924	2.0150
Adj R^2	0.670	0.153	0.589	0.226	0.452	0.595
F-stat	1749.295***	18.708***	1331.240***	9.669***	70.051***	1288.692***
DW	0.642	0.272	0.560	0.388	0.583	0.573
Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes

Note(s): ***, **, and * represent the significance at 1, 5, and 10%, respectively (one-tailed test)
Firms with Intangible Assets (INTA = 1) and firms with no Intangible Assets (INTA = 0)
Source(s): Table created by authors

In Table 7, we observe that BVPS produces a positive relation with stock price for profit and loss firm's sample (Column 1). Additionally, accruals boost (decrease) stock prices for profit (loss) firms. R&D expenditures are useful in improving the value relevance of accruals when firms lose. The result answers the discussion of Barth *et al.* (2023) that loss firms' situation is one of the important reasons making declining value relevance, and firms' R&D can overcome that situation.

Analyzing samples based on firms with and without intangible assets (Table 7 Column 2), our findings give similar results with NASDAQ. R&D expenditures decrease accrual relevancy. We also split the sample based on technology and non-technology (Table 7 Column 3). Tech-firms with R&D expenditures boost the value relevance of accruals. We find that NASDAQ and SSE data produce similar results.

4.3 Universal analysis

In Table 8, we combine the data and test the impact of R&D expenditures between those countries. We assign dummy variable D_COUNTRY = 1 (0) for firms listed in NASDAQ (SSE). The result is similar to our previous tests. Moreover, we find that the coefficient for D_COUNTRY*D_RND*$ACCR_{i,t}$ is negative and significant. This finding indicates that R&D in NASDAQ generates lower value relevance of accrual than those in SSE.

In general, our findings indicate that R&D expenditure significantly influences the value relevance of accruals, a result that holds across all samples, including split samples. Therefore, our research supports H1.

Table 8.
Regression analysis: NASDAQ and SSE sample

Dependent variable = stock price	
Variables	NASDAQ and SSE firms (Coeff.) (*t*-value)
C	0.910
	1.034
$BVPS_{i,t-1}$	1.076***
	53.336
$ACCR_{i,t}$	1.054***
	3.550
$OCF_{i,t}$	1.206***
	20.605
$D\_RND_{i,t}$	10.797***
	12.180
$D\_RND_{i,t}$*$ACCR_{i,t}$	1.122
	1.029
D_COUNTRY	15.390***
	16.441
D_COUNTRY*$ACCR_{i,t}$	−0.872***
	−2.943
D_COUNTRY*D_RND*$ACCR_{i,t}$	−1.982**
	−1.814
N	66,538
Adj R^2	0.085
F-stat	138.350
DW	0.257
Fixed Effect	Yes

Note(s): ***, **, and * represent the significance at 1, 5, and 10%, respectively (two-tailed test)
D_Country = 1 if NASDAQ and 0 otherwise
Source(s): Table created by authors

Furthermore, our study reveals that book value per share (BVPS) and operating cash flow (OCF) are relevant to stock prices in a general sense. This finding aligns with the research conducted by Cañibano *et al.* (2000), who examined accounting data from Spanish enterprises and found that the combined explanatory power of earnings and book values has not diminished in recent decades.

One of the primary concerns expressed by participants in capital markets is determining a firm's value based on its earnings and operating cash flow. Contemporary perspectives in financial theory emphasize the use of cash flow as a metric for evaluating firm value. This is because accounting earnings, being reliant on the accrual method and governed by accounting principles and assumptions, may not provide sufficient information to investors. Moreover, earnings can be easily influenced by managerial decisions and actions.

4.4 Discussion

Overall, our findings align with the research of Kothari *et al.* (2002), which suggests that R&D activities introduce uncertainty regarding future benefits. This perspective is also supported by Nakata (2020), who asserts that R&D investments are associated with innovation activities characterized by a high failure-to-success ratio. Therefore, R&D spending contributes to earnings volatility (Amir *et al.*, 2007), limiting the predictive power of accruals for future performance and reducing their relevance to stock prices.

From a relevancy point of view, Ou and Penman (1989) discussed that fundamental accounting information, including book value and earnings, can accurately estimate stock prices. In this condition, investors place confidence in the primary accounting information of BVPS, accruals, and operating cash flow. Moreover, investors demonstrate confidence in the company's strategy, leading to an increase in stock prices when profit-making companies invest in R&D.

The situation is slightly different for loss firms. Earnings actually depress stock prices in loss firms, as well as when earnings are broken down into their components: accruals and operating cash flow. This result is consistent with Hayn (1995), who discovered that loss firms have a lower earnings response coefficient than profit firms. This is because the loss is not expected to be repeated in the future (Hayn, 1995). In loss firms, investors rely on other accounting information, specifically BVPS, to make decisions. The results in Table 5 Column 1 are consistent with the idea of Sloan (1996), who discovered that loss firms exhibit a stronger negative correlation between accruals and future abnormal stock returns than profit firms. Due to the complexity of recognizing R&D expenditure in financial reports, the presence of R&D investment in loss firms lowers the importance of accrual in explaining stock prices, making it difficult for investors to understand them (Lev and Zarowin, 1999).

Currently, several studies have tested the value relevance in China. For instance, Lin and Chen (2005) and Liu *et al.* (2014) established the relevance of earnings and book value. In terms of trends, Qu and Zhang (2015) provide evidence that the value relevance of earnings has experienced a slight decline, whereas the value relevance of book value has increased over time. In this study, we extend the value relevance of earnings by decomposing earnings into accruals and operating cash flows, employing data from the SSE. The SSE is the largest stock market in Asia and the third largest globally, per the World Federation of Exchanges (WEF) data for 2023. A comparison of accrual relevance between firms listed on the SSE and NASDAQ would yield useful insights.

5. Conclusion

This study examines the role of R&D in enhancing the relevance of accrual values. Given the current economic landscape, characterized by the emergence of numerous new economies,

this research holds significant importance. Notably, these new economies predominantly comprise technology-based companies that invest heavily in R&D activities.

Our findings indicate that the presence of R&D investment diminishes the ability of accruals to explain profits, except for firms operating in the technology industry. This phenomenon can be attributed to the high level of uncertainty associated with R&D investment, which impacts its future implications for non-tech firms. After only considering technology firms, R&D enhances accrual relevancy. In technology firms, R&D expenditures are considered to be capitalized by investors, although those are recognized as expenses in the firm's financial statements. There are no differences in the effects of R&D expenditure and value relevance of accruals between the NASDAQ and SSE.

This study provides theoretical and practical contributions. From a theoretical point of view, the contribution extends to the realm of value relevance research, as it sheds light on the present state of accounting information's value relevance. Our extensive examination of R&D value relevance on NASDAQ and SSE, two of the world's major exchanges, adds to the literature. We also discuss R&D's value relevance and the impact of R&D on accruals' information content in profitability, intangible assets, and industry-based analysis. Our research provides a complete picture of value relevance research by analyzing different contexts and settings.

This research also provides a practical contribution that is useful for investors and potential investors. Only technology companies witnessed value accruals rise due to R&D. R&D investment does not always pay off for every company, but technology companies are suited for it.

Furthermore, this research bears practical contributions and implications for investors and potential investors who seek to invest in R&D-driven and innovative companies. Technology companies that allocate significant resources to R&D expenditures emerge as attractive options, as such investments augment the value relevance of accruals. Consequently, this facilitates more informed investment decision-making for these individuals.

This research presents avenues for future exploration. First, our study exclusively focuses on companies listed on the NASDAQ and SSE. Therefore, future research could encompass a comparative analysis of stock exchange conditions or companies operating in jurisdictions that have adopted IFRS and non-IFRS accounting for potential variations in the treatment of R&D expenditures. Second, this research develops the Ohlson Model (1995) by decomposing earnings into accruals and operating cash flows. Future research could decompose accruals into discretionary and non-discretionary accruals since discretionary accruals contain more managerial discretion. Third, this study examines EPS, BVPS, accruals, and R&D value relevance. Future studies can also include firm characteristics and other value-relevant items.

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About the authors

Prof. Dedhy Sulistiawan, is Professor at the Faculty of Business and Economics, University of Surabaya. He also serves as the chairman of the Social Science and Business Research Network (SSBRN). He is a reviewer and guest editor in several reputable journals He has published books, articles in academic journals and delivered seminars and workshops at international events.

Dr Felizia Arni Rudiawarni, is Associate Professor at the Faculty of Business and Economics, University of Surabaya. She also holds a Certified Financial Planner and Certified Data Analytics. She is interested in financial accounting, especially in earnings management. She also published articles in several international journals. Felizia Arni Rudiawarni is the corresponding author and can be contacted at: felizia@staff.ubaya.ac.id

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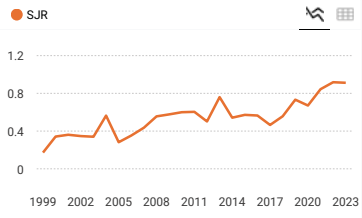

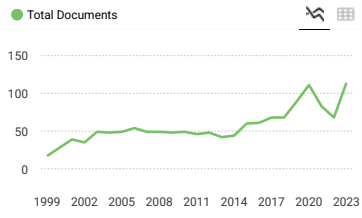

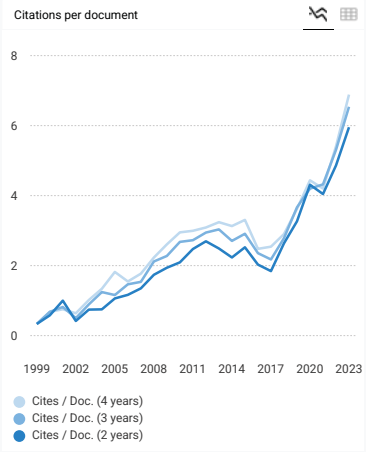

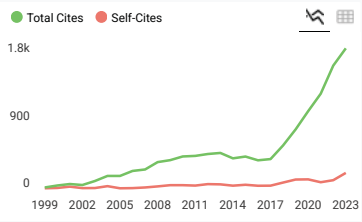

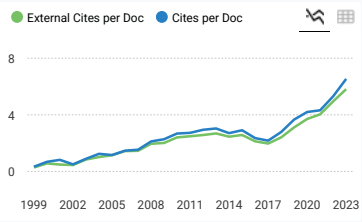

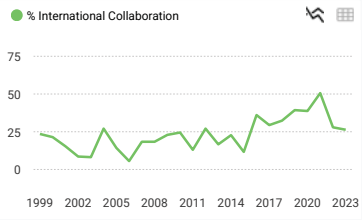

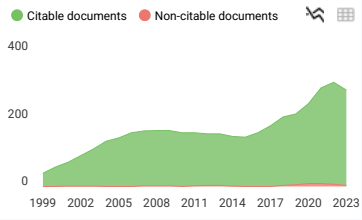

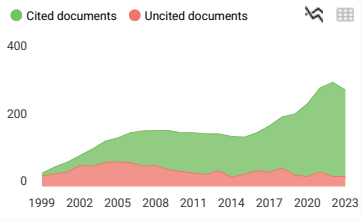

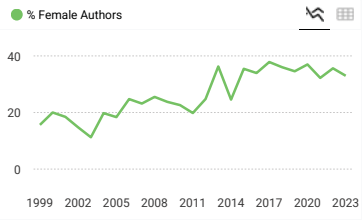

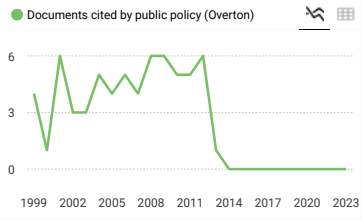

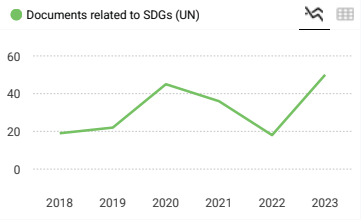

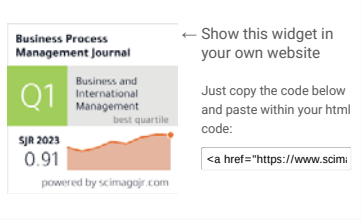

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