



CSR, firm financial performance and corporate life cycle: empirical evidence from china's pharmaceutical industry

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Abstract

This paper examines the relationship between corporate social responsibility (CSR) performance and firm financial performance (FFP) across corporate life cycle (CLC) stages and different stakeholder groups for 210 Chinese pharmaceutical firms for the 2010–2018 period. The study employs a wide range of econometric models such as pooled ordinary least squares (OLS), fixed effects and random effects models using four different estimators to address endogeneity. Our findings indicate a strong association between CSR and FFP, particularly for shareholders. We observe a positive and significant relationship between overall CSR performance (inclusive of all stakeholders' responsibility) and FFP across all CLC stages when return on equity (ROE) and return on assets (ROA) are applied. Also, we find that state-owned firms exhibit better CSR performance but are less efficient in terms of market and financial performance. The results of this study can inform and guide managers and investors on the effect of CLC stages and different stakeholders on firm performance.

Keywords Corporate life cycle · Corporate social responsibility · Firm financial performance · Chinese pharmaceutical industry

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1 Introduction

Corporate social responsibility (CSR) is frequently characterised by the expectation that companies are accountable economically, socially, environmentally and legally while maintaining a broader stakeholder focus (e.g., Hemingway 2002; Kitzmueller and Shimshack 2012; Crifo and Forget 2015). In the last thirty years, CSR has emerged as an important tool in firms' financial and investment strategy with a growing body of literature suggesting that CSR plays a significant role in enhancing firm financial performance, efficiency and value (Benlemlih and Bitar 2018; Cook et al. 2018; Úbeda-García et al. 2021). However, the extent to which CSR benefits hold across industries and institutional settings remains underexplored. CSR's financial impact is likely to be industry-specific, as regulatory settings, stakeholder expectations and market conditions shape how firms integrate CSR into financial decision-making. This study examines the relationship between corporate social responsibility performance and firm financial performance (FFP) across corporate life cycle (CLC) stages and different stakeholder groups in Chinese pharmaceutical companies.

The pharmaceutical industry presents a unique context to study CSR-CFP relationships across CLC stages, as, unlike other sectors, pharmaceutical firms face distinctive social and ethical challenges in balancing profit motives with public health responsibilities. Ethical controversies, ranging from counterfeit medicines and price-fixing scandals to drug safety violations and environmental concerns, have made CSR an essential part of corporate governance in the pharmaceutical sector (Hou and Zhang 2014). To avoid reputational damage and financial penalties for non-compliance, leading pharmaceutical companies, such as Fosun Pharma (Fosun Pharma Annual Report, 2022), have begun integrating CSR initiatives into their strategic operations to enhance long-term value creation. Also, the Healthy China 2030 strategy has been proposed (Tan et al. 2017), which plans improvements in capital investments, financing accessibility and people's wellbeing. Given these developments, the Chinese pharmaceutical sector presents a compelling case for investigating the CSR-FFP relationship, particularly in an industry where regulatory scrutiny, stakeholder expectations and financial performance are closely interlinked.

China's CSR adoption has historically been slower than in Western economies, but more recently institutional pressures and regulatory reforms have accelerated corporate engagement with CSR (Li et al. 2020). China's pharmaceutical sector is now one of the fastest-growing in the world, ranking as the second-largest pharmaceutical market globally (Daemmrigh and Mohanty 2014). In 2023, this sector generated a total revenue of US\$111.9 billion (Statista 2025) with the market projected to grow even further, driven by policy-driven healthcare expansion, R&D investments, and an ageing population (Pharma Boardroom 2023). With this rapid growth, pharmaceutical firms in China face increasing pressure to demonstrate financial resilience while complying with strict regulatory mandates, making CSR an important mechanism for balancing financial performance with ethical or social obligations. Additionally, China's pharmaceutical sector also features a unique ownership structure, with both state-owned enterprises (SOEs) and privately owned firms operating under strict government oversight. Unlike in Western economies, where pharmaceutical companies are primarily privately held and profit-driven, SOEs in China often align their business strategies with national healthcare objectives. While SOEs may benefit from regulatory support, they may also face weaker market incentives to pursue profitability compared to private firms (Yu et al. 2010). Understanding how CSR interacts with

ownership structure in this unique setting contributes to broader discussions on corporate governance, financial sustainability and policy-driven CSR strategies.

This study contributes to the extant literature and advances the CSR-financial performance knowledge by integrating three critical dimensions: stakeholder differentiation, CLC effects and ownership structure. First, most prior studies have examined CSR as a broad, uniform concept without accounting for stakeholder-specific effects (Orij 2010), which this study addresses. Uniquely, this study provides a detailed examination of how different stakeholder groups (shareholders, employees, customers and communities) impact firm performance. Secondly, the study introduces CLC theory along with the stakeholder dimension into CSR research, which, to our knowledge, has not been explored in the Chinese pharmaceutical sector. The financial implications of CSR vary depending on a firm's life cycle stage, for example, early-stage firms may focus on regulatory compliance and reputation-building, whereas mature firms may use CSR to enhance profitability, corporate value and investor confidence. Unlike the extant literature (Zhao and Xiao 2019), this study systematically examines how CSR's financial effects evolve across life cycle stages, providing new insights to managers and policymakers into when and how CSR investments are most beneficial. Finally, unlike previous research (e.g. Hasan and Habib 2017; Zhao and Xiao 2019) this study investigates if state versus private ownership of pharmaceutical firms influences CSR-financial performance relationships, contributing to broader discussions on corporate governance in state-influenced economies, such as China.

This study employs panel data methods to empirically test the CSR-FFP relationship, using a sample of 210 publicly listed Chinese pharmaceutical firms, covering 1,319 firm-year observations from 2010 to 2018. The econometric approach includes pooled OLS, fixed effects and random effects models, supplemented by instrumental variable estimators to mitigate endogeneity concerns. Additionally, potential outcome models are applied to assess causal effects, with corporate life cycle stages and ownership structures treated as key moderating factors. Compared to prior studies (e.g., Al-Hadi et al. 2019), this research utilises a larger dataset and a more comprehensive set of financial controls, including corporate governance indicators, to enhance the robustness of the findings (Bear et al. 2010; Liu et al. 2015).

The results indicate that CSR is positively associated with financial performance, as measured by return on equity (ROE) and return on assets (ROA); this aligns with the interest of pharmaceutical firms in China to invest in CSR-related activities. However, this relationship does not hold when Tobin's Q is used to measure firm value, suggesting that, while CSR enhances short-term profitability, it does not necessarily drive market valuation. Additionally, the findings suggest that CSR's financial impact varies by life cycle stage, with firms in the growth and maturity stages benefiting the most. The study also reveals that SOEs engage in stronger CSR initiatives but do not necessarily achieve higher financial returns compared to private firms. These research findings, as a whole, offer valuable insights for investors, policymakers, corporate managers and the wider public indicating that CSR initiatives and strategies in pharmaceutical companies should take into account firm stakeholders, ownership and industry life cycles to maximise corporate financial performance.

The remainder of this paper is structured as follows. Section 2 presents a review of the literature on CSR and financial performance, followed by Sect. 3, which discusses the theoretical framework and hypothesis development. Section 4 outlines the methodology, detailing the data sources, econometric models and endogeneity controls. Section 5 presents the

empirical results and analysis, assessing the financial impact of CSR using a robust panel data framework. Finally, Sect. 6 provides the conclusions, policy implications and future research directions.

2 Literature review

There has been considerable debate about the relationship between CSR and FFP characterised by divergent viewpoints. Studies that employ stakeholder theory, as articulated by Freeman (2010), posit that firms actively engaging in CSR can reap benefits such as improved reputation, heightened employee productivity, and increased investor trust, ultimately leading to sustainable long-term financial performance (Margolis et al. 2009; Eccles et al. 2014). In contrast, agency theory raises concerns that CSR activities may constitute a misallocation of shareholder resources, as managers might pursue CSR initiatives driven by personal motives rather than a genuine commitment to maximising firm value (Friedman 1970; Brammer and Millington 2008). The interplay between the theories employed highlight the complexity of CSR's impact on corporate value and performance, necessitating additional empirical investigation to elucidate the nuances of this relationship. Despite these differing viewpoints, empirical studies have increasingly found a positive correlation between CSR and firm performance (Kumar et al. 2019; Milanese et al. 2020).

Investigating the CSR–FFP relationship helps to understand if firms' adoption of social responsibility definitely improves FFP (Galbreath 2018). Orlitzky et al. (2003) conducted a meta-analysis of 56 previous studies analysing the CSR–FFP relationship and found there is a positive and significant bi-directional relationship. They reason that financially successful companies are able to spend more on social activities, and better CSR helps them become more financially successful. Similar results were found by Liu et al. (2015) and Xiong et al. (2016). Haffar and Searcy (2017), in their systematic literature on CSR and firm performance, found that many studies reason that CSR activity is a win–win as it creates shared stakeholder value as well as firm profit. They reported that many studies find a time-lag between the initial costs for the firm in implementing CSR activities and benefits that come later. In their analysis of the literature, they reported a mixed relationship between CSR–FFP (positive, negative, linear, U-shaped, etc.). It is, therefore, important to examine and confirm the CSR–FFP relationship.

One of the key themes associated with stakeholder theory is corporate social responsibility. Solomon (2021) notes that theoretical frameworks are championing stakeholder accountability besides embracing economic, legal, ethical and discretionary (philanthropic) responsibilities (Carroll 1991). Critics of CSR who champion shareholder value over other stakeholders (Friedman 1970) argue that firms who spend their economic resources on satisfying stakeholders potentially reduce profits and damage shareholders' wealth. Conversely, CSR activities are thought to send positive signals about a firm to all of its stakeholders in terms of their impact on firm performance and strategies. Zhang et al. (2014) examined the influence of CSR on stakeholders and found that philanthropic donation practices in Chinese private firms have a positive relationship with profitability, arguing that strategic CSR activities can help firms to attract suppliers and build relationships that can benefit the firms in terms of more trade credit financing from suppliers. Su et al. (2016) argued that firms that adopt CSR practices can positively signal to investors that their firms have

superior capabilities. Xiong et al. (2016) and Tan et al. (2017) note that economic industries are highly impacted by their socio-political context and stakeholders. Therefore, this study examines the impact of different stakeholder groups and ownership (state/private) on the relationship between corporate social responsibility performance and firm financial performance.

Thu and Khuong (2023) examine how firms' CSR reporting varies across corporate life cycle stages, using a sample of Vietnamese firms. They find that during the introduction and growth stages, firms disclose significantly more CSR information while firms in shake-out and decline stages tend to reduce CSR reporting, showing that corporate life cycle is a moderator of CSR transparency. A more recent study by Rauf et al. (2024), in the context of China, notes the importance of CSR reporting in increasing firm value. They find a significant moderation effect attributed to firm life cycle. Wu et al. (2023) explore if firm performance (measured as economic value added) affects CSR participation across different stages of the corporate life cycle, they find that in the early life cycle stages, firm performance is positively associated with CSR participation and this effect disappears at the maturity stage. This study examines the relationship between corporate social responsibility performance and firm financial performance across corporate life cycle stages.

China's pharmaceutical industry has seen an ideological change following the Chinese government's enactment of the Healthy China 2030 strategy (Tan et al. 2017). The new strategy plans to embrace improvements in capital investments, financing accessibility and people's wellbeing. Therefore, it is important and timely to investigate if stakeholders, firm life cycle and firm ownership play a role in affecting the CSR activities and financial performance of Chinese pharmaceutical firms.

3 The study's theoretical framework and development of hypotheses

3.1 The research's theoretical framework

When firms engage in CSR activities they usually explore resources and their unique relationships with stakeholders to create positive stakeholder perception, with an emphasis on satisfying the interests of all stakeholders instead of those of the shareholders only (Freeman 2010).

We draw upon stakeholder theory, which highlights the relevance of the impact of stakeholders on the firm (Freeman 2010), to examine how CSR activities related to different stakeholder groups' can affect firm performance in the pharmaceutical industry. When a stakeholder group controls critical resources, a higher importance will be accrued to that group, suggesting that such stakeholders steer CSR activities and firm performance (Rim and Kim 2016).

We further adopt CLC theory to analyse the association between CSR and FFP, with the theory suggesting that firms have different characteristics progressing along the CLC stages: introduction, growth, maturity and decline/shake-out (Helfat and Peteraf 2003). Firms also differ in cash flow generation, financing and investment structure between CLC stages (Miller and Friesen 1984; Habib and Hasan 2019). Since CLC has an important role in managing firm resources and long-term operations, this study has considered the role of financing structure and capital allocation as the main factors in the CSR–FFP association.

The full conceptual model used in the study is schematically shown in Fig. 1. The model enables us to understand the effects of CSR on FFP considering stakeholder prioritisation (H1) and the impact of CSR practices and firm ownership on the relationship between CSR and FFP across the CLC stages (H2 & H3).

3.2 Research hypotheses

3.2.1 Effects of CSR on FFP in relation to stakeholders

The stated, role of stakeholders in CSR is prominent. Li (2012) distinguished the impact of stakeholders on CSR in two ways: strong/weak contractual relationships; the high/low intimacy of financial connections between companies and stakeholders.

For contracted and financial stakeholders, which includes employees, investors, creditors and suppliers, CSR can be seen as a positive activity which is a win-win in the contractual relationship (Lee et al. 2013). For example, Lee et al. (2013) mention that CSR activities improve the employee attachment to the firm, leading to an increase in productivity and quality alongside any reduction in certain risks and marginal costs, thus improving firm performance. Additionally, there will be a positive impact on the long-term FFP if investors/creditors perceive an improvement in CSR. Furthermore, suppliers may offer competitive prices to the firm, potentially improving the profit margins. In contrast, non-contracted and/or nonfinancial stakeholders (e.g., customers and communities) have weak contractual relationship with firms. It can be argued that any CSR actions towards them may be less effectual or accounted for. Therefore, we posit the following:

Hypothesis 1 (H1): The performance of CSR activities directed toward contracted and financial stakeholders is positively correlated with FFP (with no significant effect for CSR actions towards non-contracted and/or nonfinancial stakeholders).

3.2.2 Effects of CSR and FFP based on capital allocation across CLC stages

Research suggests that capital allocations are affected by the firm's life cycle position (Miller and Friesen 1984; Hsu 2018). Hsu (2018) found that financing, capital structure, investment, and cash policies (equity and debt issuance, pay-out ratio, retained earnings to total asset, free cash flows and cash holdings) vary over the life cycle under CSR practice. They show a normal distribution of equity and debt issuance or cash holdings over their life cycle under

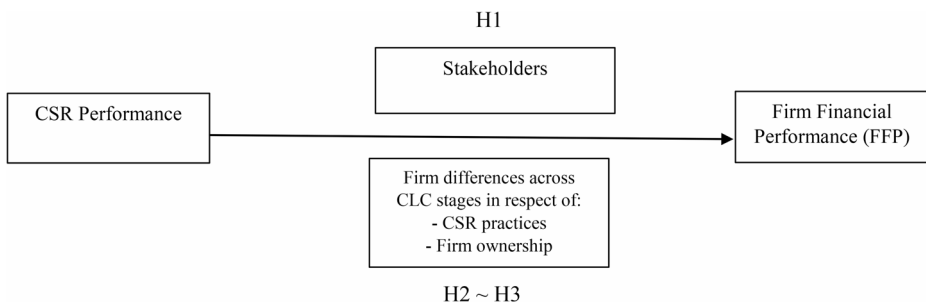


Fig. 1 Conceptual framework. Source: Developed by the authors

CSR practices, and firms with higher CSR face fewer issues and significantly lower cash holdings at the maturity stage; there is a decreasing trend in pay-out, retained earnings over total asset, and free cash flows from high-CSR firms to low-CSR firms.

Research further suggests that CLC moderates the relationship between CSR and firm financial outcomes by improving firms' financial performance (Zhao and Xiao 2019). This is achieved for two main reasons: reduction of information asymmetry due to better disclosure and superior CSR practices in the capital markets, and an enhancement in corporate image and reputation (Kim et al. 2020). Moreover, CSR initiatives can accurately reflect stakeholders' CSR needs by being aligned to the characteristics of the firms' development stages and responding through effective resource allocation and prioritisation. Firms with good CSR initiatives and performance usually satisfy stakeholder expectations of capital resources allocation and link them to the most important CSR concerns first (Cantrell et al. 2015).

Another element explored in the analysis of the CLC and CSR relationship is the presence of financial constraints. For instance, Zhao and Xiao (2019) examined the effect of CLC on the relationship between CSR and financial constraints using a sample of Shanghai and Shenzhen firms. They found that, in the growth, mature and declining stages, CSR activities are negatively correlated to financial constraints, though this not true in the initial stage of the life cycle. Zhao and Xiao's study, does not, however, consider the connection between industry-specific CLC development and CSR. Undoubtedly, CLC dynamics and the progression through CLC stages are shaped by industrial factors, contextual/country factors, and company capital or management practices (Mata and Freitas 2012). Therefore, a firm's strategic direction in terms of CSR could be different among industries and between CLC stages. In this context, studying the pharmaceutical sector and its adoption of CSR is important as this sector is unique in its capital allocations across the life cycle phases.

Moreover, Zhao and Xiao (2019) treated the firms at the introduction stage as start-ups by using a sample of listed firms, which could result in misleading conclusions. Since listing requirements are stringent and mandatory, we argue that start-ups lacking financial strengths should not be included at the introductory stage. Hence, our study only observes the listed firms with financial strengths at the introduction stage. Firms with high CSR practice and performance at this stage are expected to yield high FFP.

Pharmaceutical firms at the growth stage need more capital allocation for drug development and testing to meet higher CSR needs than firms at the introduction stage (Lakdawalla 2018). Additionally, developing a drug takes time and carries a high probability of failure. CSR practices contribute to additional expenses, and, consequently, firms embracing the practices in the growth stage could have low FFP.

At the maturity stage of the life cycle, extra costs are incurred due to competition, need for protection, extending patent rights and continuing R&D spending. However, in comparison, mature firms with high-CSR practices and performance possess more resources and capital and can contribute to improving their profits by applying higher drug prices (Lakdawalla 2018). Therefore, firms with better CSR at this stage could yield high FFP.

At the decline stage of the life cycle, generic competition accompanies the expiration of patent protection, a major focus of pharmaceutical firms. In this stage, firms develop biosimilar drugs and continue the R&D process with limited available capital, which creates more expenses for the firms thereby lowering their revenue inflows. Therefore, higher CSR practices are likely to add an extra cost burden and firms with enhanced CSR at this

stage could generate low FFP. This leads us to posit our second research hypothesis (H2) as shown below:

Hypothesis 2 (H2): Pharmaceutical firms with high CSR practices and performance are likely to have higher FFP at the introduction and maturity stages and lower FFP at the growth and decline stages of the life cycle.

3.2.3 Effects of CSR on FFP across CLC stages based on ownership

Du and Boateng (2015) suggested that, in the Chinese context, state ownership can either destroy corporate value or enhance value due to the existence of preferential treatment by the government. Although their work is on Chinese firms' mergers and acquisitions, this is important, since China, like other emerging economies, is characterised by active government involvement in business entities through ownership and regulation. Miska et al. (2016) also argued that the state is likely to influence CSR practices, motivations and responsiveness. Therefore, it is imperative to find an answer as to whether state-ownership actually impacts FFP and if this varies across CLC stages.

The literature points to the role of CLC stages in the outcomes of CSR practices. For example, a study by Lee and Choi (2018) showed that firms engage in CSR differently depending on the CLC stage, where at the growth stage firms are more involved in CSR activities. At the decline stage, firms instead are less likely to engage in CSR. Firms progressively invest less in CSR as they approach the decline stage and their results depict that the maturity stage coefficients are insignificant while the decline stage coefficients are significantly negative.

Moreover, governance and ownership research suggest that block holder ownership could mitigate overinvestment in negative net present value projects to preserve corporate assets (Zhang 2016). Therefore, we propose that ownership structures, such as state ownership, could influence the CSR–FFP relationship across the CLC stages.

While the level of debt/equity issuance tends to be U-shaped for firms across CLC stages (Hsu 2018), we expect state firms with higher CSR to be more involved in debt/equity issuance and to have less financial access, leading to lower FFP. This situation is likely to vary across the CLC stages. Therefore, we posit the following research hypothesis:

Hypothesis 3 (H3): State-owned pharmaceutical firms with high CSR-practices and performance tend to have lower FFP, while such an association could vary in CLC stages.

4 Research methodology and data

4.1 Data sample and collection

Creating a representative measure of CSR performance is challenging due to the multidimensional nature of CSR and hence the reliance on quality and specialised data providers (see Monti et al. 2022). CSR and financial performance data for Chinese pharmaceutical firms are obtained from two different databases, HEXUN and CSMAR, over the period

2010–2018, covering 210 firms. The sample period begins in 2010, which is when the CSR scores from HEXUN become available. Hexun's CSR data are based on firms' CSR reports and annual financial reports and they provide a rating of firms' responsibility to shareholders, employees, customers, communities and other stakeholders. CSMAR provides datasets for financial performance and other variables for Chinese stock market-listed firms (Du and Boateng 2015). Our study uses Dickinson's (2011) cash flow pattern method to classify firms-observations based on CLC stages. Table 1 shows the distribution of firm-observations according to CLC stages.

The initial sample size consists of 1,920 pharmaceutical firm-observations. Following Yang et al. (2019), we excluded 30 listed firm-observations with special treatments, consisting of firms with two or three consecutive years of operating loss or firms whose stocks have been suspended or subject to a trading warning. A further 571 firm-observations are excluded due to missing data, leaving a final sample of 1,319 firm-observations.

4.2 Study variables

4.2.1 Dependent variables (outcome variables)

The proxy used for the dependent variable, *financial performance*, is return on equity (ROE). Moreover, we use two other measures of performance: return on assets (ROA) and market-based measure of financial performance Tobin's Q. Details of calculations and definitions are reported in Table 2.

4.2.2 Impact variable (independent)

We measure our independent variable, *CSR performance*, using CSR scores from the HEXUN database. CSR performance scoring in this database is evaluated following an objective rating system, which is based on the numerical calculation of 38 specific indices (see Yang et al. 2019). We assess the overall CSR performance and scores for each stakeholder dimension, including shareholders (SCR), employees (ECR), customers (CCR), and communities (UCR); these are reliable measures previously used by Xiong et al. (2016).

Table 1 Number of firm-observations in each of the CLC stages in 2010–2018

Year	Introduction	Growth	Maturity	Shake-out	Decline	Total
2010	7	32	50	15	2	106
2011	9	38	53	16	6	122
2012	8	52	50	21	3	134
2013	20	41	61	12	4	138
2014	12	42	63	17	5	139
2015	12	70	48	13	3	146
2016	18	68	53	18	4	161
2017	18	56	70	26	3	173
2018	10	50	100	37	3	200
Total	114	449	548	175	33	1319

Table 2 Variable definitions and descriptive statistics

Variable	Definition (unit of measurement)	Obs	Mean	Std. Dev.	Min	Max
Panel A – Outcome Variables of FFP						
ROA	Return on Assets (net income/total assets)	1523	6.398	6.028	-15.842	21.704
ROE	Returns of Equity (net income/ shareholders' equity)	1523	8.958	9.381	-40.405	29.601
Tobin's Q	Tobin's Q (ratio of the sum of stock market capitalisation and book value of liabilities over total assets)	1523	0.336	0.194	0.046	0.843
Panel B – Impact Variables of CSR						
CSR	Total CSR performance (score)	1523	27.116	15.114	-3.450	76.020
SCR	CSR performance in terms of shareholders (score)	1523	16.093	6.232	-2.180	25.930
ECR	CSR performance in terms of employees (score)	1523	1.891	2.229	0.000	9.940
CCR	CSR performance in terms of customers (score)	1523	1.812	5.272	0.000	20.000
UCR	CSR performance in terms of the societal community (score)	1523	6.049	3.344	-9.480	13.920
Panel C – Control Variables						
State	The number of state-owned shares over total shares (%)	1523	1.969	8.394	0.000	75.000
Foreign	The number of foreign-owned shares over total shares (%)	1523	0.751	5.381	0.000	71.557
Size	Firm size (natural logarithm of total assets)	1523	21.866	1.043	17.426	26.031
Lev	Level of indebtedness of a company (short-term and long-term debt divided by total assets)	1523	0.113	0.121	0.000	0.736
Independ	Board independence (the number of independent directors over the total number of board members)	1523	0.369	0.050	0.250	0.625
Gender	Board gender diversity (female to board size ratio)	1523	0.478	0.268	0.000	1.800
Share	Board shareholding (in natural logarithm of number of shares held by board directors)	1110	15.546	3.448	5.075	20.692
Bsize	Board size (number of directors on the board)	1523	8.708	1.620	4.000	15.000
Age	Company age since incorporation	1523	17.274	5.216	2.000	38.000
Listing	Listing period	1523	10.643	7.019	0.000	28.000
MV	Market Value (average market value using monthly data – in natural logarithms of 000s CNY)	1520	15.782	0.901	13.429	19.774
Grant	Government grant (in natural logarithms of 000s CNY)	1495	16.294	1.458	7.824	20.113
RD	Research and development spending during the year (in natural logarithms of CNY)	1400	17.814	1.278	11.483	22.083

We took the natural logarithm of Share, MV, Grant and RD to reduce the nonlinearities in the data. All statistics reported are for the winsorised data to reduce the influence of outliers. Net income is calculated as total revenue minus total costs and expenses in a given year (Galant and Cadez 2017). Tobin's Q is based on the definition in Bernnouri et al. (2018)

4.2.3 Treatment variables

Corporate life cycle (CLC) is an ordinal variable for investigating the CSR and financial performance relationship over the firms' development stages. To classify CLC stages, we adopt Dickinson's (2011) cash flow method for pooled data analysis. This approach aligns with the argument that a firm's performance can be understood through the lens of its corporate life cycle (Jaggi et al. 2022). At the introduction stage, the firm is perceived to have positive net financing cash flows (FCF), negative net operating cash flows (OCF), and investing cash flows (ICF), while the net ICF is negative and both OCF and FCF are positive at the growth stage. At the maturity stage, OCF is positive, and ICF and FCF are negative. Any firm that does not meet the criteria of the first three phases is classified as being at the decline/shake-out stage.

Ownership *Ownership is a dummy variable that takes the value of 1 for a state-owned firm (where the majority owner is the state) and 0 otherwise. State-owned firms tend to be highly capital intensive, exhibit a high proportion of non-operating assets, and can lead to lower financial performance (Zhang et al. 2014).*

4.2.4 Control variables

We have controlled for state shareholding, foreign shareholding, the level of indebtedness and capital structure. In addition, we control for *size* as larger companies may have more resources and make larger investments in financial projects, which could improve their financial performance.

We further control for several corporate governance variables including board independence, board characteristics and board gender and resource diversity. More independent directors may constrain insider self-dealing and improve investment efficiency (Liu et al. 2015). Board gender diversity, especially the involvement of female directors, may improve a firm's reputation (Bear et al. 2010). Women on the board may have differing perspectives, which may enhance director understanding of the general environment and affect firm behaviours by supporting effective decision-making on CSR practices (Grosser et al. 2017) and thereby improve firm performance.

In addition, we control for *board size*, measured by the number of shares held by a board of directors, since the larger boards could bring more expertise and knowledge, which ultimately influence a firm's performance (Dalton et al. 1999).

The *board resource diversity* control variable refers to the variety in professional background, experience and network connections among board members. It is controlled because diverse board composition may enhance board understanding of a firm's external environment and support effective decision-making (Bear et al. 2010) and it could enhance network ties and improve firm resources and performance (Beckman and Haunschild 2002). Since the value of director resource diversity comes from diverse experience and knowledge of directors, director diversity can be operationalised with Blau's index, which is a common measure of diversity-as-variety and can measure the distribution of the four types of director resources across varied experience, expertise and background. Following Bear et al. (2010), we used Blau's index to measure *board resource diversity*; the index is operationalised as

the difference between 1 and the sum of the proportion of unit members p in each of the k th categories that compose the group, i.e., $\text{Diversity} = 1 - \sum (p_k)^2$.

We also included variables to capture company characteristics such as *company age* since incorporation, *listing period* and registered *location*. *R&D spending* during the year and *government grants* are included to exhibit the innovation variables. Average *market value* using monthly data can show a firm's market capitalisation. Earlier research incorporated year effects in the CSR data (Meier and Schier 2022). Therefore, we control for year effects by applying a *year dummy*. Table 2 provides further details on the units of measurement and definitions of each variable used in the data.

4.3 Econometric methodology

As discussed earlier, we apply two levels of econometric analysis: dependency and causal effects modelling. We apply panel data methods to carry out dependency analysis, which consists of testing the empirical validity of H1 and part of H2. For the purpose of examining the causal effects, we apply a potential outcome model to estimate the effect of (i) CLC stages (H2) and (ii) type of ownership (H3) on CSR–FFP relationship.

4.3.1 Mixed effects linear model

In this study, we apply mixed effects linear models to estimate the effect of corporate social performance (CSR) and firm financial performance (FFP). Mixed effects linear models offer several advantages over standard panel data models, such as fixed and random effects models, as they address the complexity of data structure and endogeneity concerns of the research undertaken (Schielzeth and Nakagawa 2013; Bell and Jones 2015).

Mixed effects models incorporate both fixed effects for time-invariant predictors and random effects for grouping variables (Rabe-Hesketh et al. 2004). This allows the model to estimate differences between groups, such as ownership types, while accounting for the non-independence of repeated observations within firms over time. Treating firms as random instead of fixed effects improves generalisability and handles missing data more effectively (Singer and Willet 2003; Schielzeth and Nakagawa 2013; Hox et al. 2017).

A key advantage of mixed effects models is their ability to address endogeneity through partial pooling, which shrinks cluster-level estimates towards the global mean. This helps mitigate biases from omitted time-invariant confounds (Bosker and Snijders 2011; Schielzeth and Nakagawa 2013). Specifically, this includes random intercepts for ownership type and firms' controls for all stable unobserved characteristics at those levels.

The mixed linear models provide an effective framework for dealing with endogeneity biases stemming from unobserved heterogeneity in the data. The inclusion of both fixed and random effects enables mixed models to account for omitted variables that may confound the relationship between predictors and outcomes (Allison 2009; Fitzmaurice et al. 2011). For example, adding random effects for individuals captures all stable unmeasured characteristics of those individuals over time. This controls for endogenous factors by parsing out the variance attributable to time-invariant confounds. Additionally, mixed models can directly model the within-cluster correlations, which arise in longitudinal data with repeated measures.

The repeated observations on the same subjects over time are likely to be correlated. Mixed linear models incorporate this dependency structure using random intercepts and slopes, rather than assuming observations are independent as in standard regression. This helps mitigate endogeneity concerns by handling the non-independence of longitudinal measurements from the same individuals while estimating exposure effects. In summary, mixed linear models provide an adaptable framework to address confounding from omitted variables and within-subject correlations – two common sources of endogeneity that can be observed in empirical studies.

The model is expressed as follows:

$$FFP_{it} = \delta_{CSP} CSR_{it} + x'_{it}\beta + z'_{it}u_i + \epsilon_{it} \quad (1)$$

where FFP_{it} is a measure of firms' financial performance and CSR_{it} is a measure of firms' corporate social responsibility performance. The term $x'_{it}\beta$ is the fixed effect part, is deterministic and refers to the conditional mean of the model. The raw vector, x'_{it} , is the set of control variables and includes the intercept. The error term is defined by the terms: $z'_{it}u_i + \epsilon_{it}$, where z_{it} is the set of observable variables, and u_i and ϵ_{it} are *identically and independently (iid)* normally distributed random variables with zero means. Formally, we have $u_i \sim N(0, \Sigma_u)$ and $\epsilon_{it} \sim N(0, \sigma_\epsilon^2)$ where the random effects parameters are the covariances and variances in Σ_u . The random effects part, $z'_{it}u_i$, includes the overall random error term, firms and type of ownership random effects. The fixed effect part includes the main explanatory variable, measures of CSR and the set of control variables.

4.3.2 Potential outcome model

We extend the dependency analysis to estimate the causal effects of two types of treatments on firms' outcomes and the role of CSR. This includes the causal effects of different CLC stages and the type of ownership. In this context, we have two types of treatment variables: a multivalued structure for CLC stages and binary structure for the type of ownership. We employ the potential outcome model for 'multivalued treatment', which is general enough to accommodate both structures and performs better than other alternatives, including the difference-in-difference estimator. In the context of this model, the five CLC stages are treated as treatment levels defined in a multivalued structure. The ownership type is the second treatment variable, which is a special case since it takes a binary structure. Thus, we estimate the average outcomes for each of the treatments.

A multivalued treatment takes $G + 1$ different levels, labelled as $\{0, 1, 2, \dots, G\}$ where '0' refers to the control group and $1, 2, \dots, G$ refer to different levels. Each firm has been assigned one of $G + 1$ possible treatment levels: $g=0, 1, 2, \dots, G$. The model is expressed as follows:

$$z_{it} = (FFP_{it}, w_{it}, h'_{it})' \quad (2)$$

z_{it} is observed for each individual firm $i = 1, 2, \dots, n$ over the period $t = 1, 2, \dots, T$. The variables FFP_{it} and $h'_{it} = [CSR_{it}, x'_{it}]$ (where x'_{it} is a $k \times 1$ vector) are the same as in Eq. (1). The variable w_i is the treatment level. The indicator variable, $d_{it}(g) = 1 (w_{it} = g)$ takes the value 1 if the firm i at time t is in the treatment group, g , and zero otherwise.

The potential outcome model compares between the observed outcome FFP_{it} and the $G+1$ potential outcome $FFP_{it}(G)$ for each treatment level $g=0, 1, 2, \dots, G$. The observed outcome is therefore expressed as a function of its potential outcome, as follows:

$$FFP_{it} = \sum_{g=0}^G d_{it}(g) FFP_{it} \quad (3)$$

We let $\mu_g = E(FFP_{it,g})$ be the population means of counterfactuals. Assuming that all confounding covariates are controlled for, the conditional mean independence assumption is satisfied using the expression below:

$$E(w_{it}, h_{it}) = E(FFP_{it,g} | h_{it}) \quad (4)$$

This implies that:

$$E(FFP_{it,g} | w_{it}, h_{it}) = \sum_{g=0}^G d_{it}(g) E(y_{it,g} | h_{it}) \quad (5)$$

As such $E(FFP_g | h)$ is identified because $E(h) = E(FFP | w = g, h)$. This latter can be estimated for each g by restricting attention to units with $w_{it} = g$.

We first estimate the potential outcomes under each CLC stage using Eq. (5). We then apply a causal inference analysis to estimate the average treatment effects; that is the effect of CLC on firms' outcomes. In this context, we can estimate the average treatment effect for treatment level j relative to g , denoted Δ_{gj} , as shown below:

$$\Delta_{gj} = N^{-1} \sum_{i=1}^N [\hat{m}_j(h_i) - \hat{m}_g(h_i)] \quad (6)$$

The outcomes and average treatment effects are estimated using various estimators including regression adjustment, augmented inverse probability weighting and the efficient-influence function. We report only one set of results since both give the same conclusions.

While our potential outcome models provide valuable insights into the relationships between CSR and financial performance across corporate life cycle stages, it is important to note that these models do not establish causality in the strict sense that a randomised controlled experiment would. Instead, they estimate average treatment effects under certain assumptions, such as the conditional independence assumption.

These models allow us to make stronger inferences than traditional regression approaches, but they still rely on observational data and cannot completely rule out all potential sources of endogeneity. Therefore, we interpret our results as strong evidence of relationships and potential causal effects, while acknowledging the limitations inherent in observational studies.

5 Results and analysis

5.1 Pre-estimation descriptive results

In this section, we present the study results and discussions. Table 2 provides the descriptive analysis of outcome, impact and control variables. The reported statistics are based on winsorised measures of FFP and CSR by dropping the bottom and top 1% of the sample.¹ In addition, variables that exhibit exponential growth are transformed into linear growth using natural logarithms; namely board shareholding (*Share*), market value (*MV*), government grant (*Grant*) and research and development (*RD*).

Panel A in Table 2 reports the descriptive statistics of three outcome variables on FFP: ROE, ROA and Tobin's Q. ROE exhibits highest variability while Tobin's Q has the least variability. Panel B reports descriptive statistics of the impact variables on CSR, this includes overall CSR and stakeholder dimensions of SCR, ECR, CCR and UCR. The mean CSR is 27.12; this indicates a low average CSR, suggesting that there have been several CSR issues in the pharmaceutical sector in China in relation to drug quality, safety of raw materials and reliability of the R&D process. The firms' score for the shareholders dimension is the highest with an average of about 16.1 (59% of the overall CSR performance), followed by the community dimension with an average of about 6.05 (about 22% of the overall CSR performance). The remaining two dimensions, employees and customers, have the lowest scores, at 1.89 and 1.81, respectively. The evidence suggests a difference in stakeholders' CSR focus. Pharmaceutical firms in China tend to perform better in terms of CSR performance for the shareholders group compared to other stakeholder groups. This is likely due to a stronger contractual and financial relationship with shareholders (see Lee et al. 2013).

Table 3 reports the descriptive statistics of the outcome variables across CLC stages. The average ROE and ROA start at very low levels in the introduction stage and reach a peak in the maturity stage, before going back to low levels in the decline stage. Tobin's Q, on the other hand, behaves conversely. It begins at the highest level in the introduction stage, then declines to reach its trough in the maturity stage before increasing to a higher level in the decline stage. These results imply that firm value and performance are not impacted equally over the CLC stages as firms pursue different priorities over their life cycle and markets may not fully capture firms' actions in their share price or valuation in the same way as performance.

We also report the correlation between the outcome variables of CSR and their dimensions using the full sample and across CLC stages in Table 4. The results do not highlight any serious problems with multicollinearity.

5.2 Panel regression estimates

5.2.1 Mixed linear models estimates

Tables 5, 6 and 7 report the maximum likelihood estimators of the mixed linear model. These estimate the effect of CSR measures on firms' performance measured by ROE, ROA

¹ FFP and CSR measures suffer from outliers and their presence may distort the analysis; therefore, we removed the outliers. Further results on the distributional properties of these variables before winsorisation are available upon request.

Table 3 Distribution of outcome variables across firms' life cycle

	Obs	Mean	Std. Dev.	Min	Max
Full Sample					
ROE	1523	6.255	7.402	-91.22	49.393
ROA	1523	8.212	38.99	-1203.54	691.794
Tobin's Q	1523	0.339	0.21	0.01	2.575
Introduction					
ROE	127	6.255	7.402	-91.220	49.393
ROA	127	8.212	38.990	-1203.540	691.794
Tobin's Q	127	0.339	0.210	0.010	2.575
Growth					
ROE	495	9.030	7.280	-40.405	29.601
ROA	495	5.594	4.720	-15.843	21.705
Tobin's Q	495	0.390	0.177	0.046	0.843
Maturity					
ROE	654	10.572	8.955	-40.405	29.601
ROA	654	8.078	6.183	-15.843	21.705
Tobin's Q	654	0.278	0.182	0.046	0.843
Decline					
ROE	38	5.069	15.710	-40.405	29.601
ROA	38	3.964	7.423	-15.843	21.705
Tobin's Q	38	0.474	0.261	0.062	0.843
Shake-out					
ROE	209	7.785	10.736	-40.405	29.601
ROA	209	5.970	6.836	-15.843	21.705
Tobin's Q	209	0.294	0.175	0.046	0.843
χ^2_{ROE}	55.330***				
χ^2_{ROA}	152.370***				
χ^2_{TobinQ}	180.480***				

χ^2 is the *Chi*² tests. It tests the null of the means of the outcome variable is the same for all stages of firms' life cycle against the alternative that the means of outcome variable differ across the stages of firms' life cycle. We report the test statistic for each measure of performance indicated by the subscript. (***), (**) and (*) refer to the rejection of the null at 1%, 5% and 10% levels of significance.

and Tobin's Q, respectively. Each of the tables report estimates using six specifications denoted by the columns (1) to (6) representing models employing alternative measures of CSR. The specification reported in column (1) refers to the model where the CSR measure is defined as the overall CSR score of firms. Specifications (2) to (5) refer to models connected to stakeholder-related CSR, which include SCR, ECR, CCR and UCR, respectively. Specification (6) refers to the model employing all of the CSR score components in the same model.

Table 5 reports the estimated effects of CSR on ROE. The overall CSR score is estimated to have a positive and statistically significant effect on ROE. Our estimates indicate that a one unit increase in the CSR score leads to an increase in the firms' performance by about 0.19%. This, however, is an overall effect of CSR. Columns (2) to (5) offer a further insight on the stakeholder dimensions that are most influential in driving firms' performance. In this context, our findings suggest that SCR and UCR have a positive and statistically significant impact on firms' performance. While SCR is estimated to increase ROE by about 1%, the estimated effect of UCR is about a 0.6% increase in ROE. Finally, specification in column (6) allows for all four CSR components in the same model. According to our findings, the estimated effect of SCR is about 1% and of UCR is about 0.3%, both of which are statistically significant. In contrast, the estimated effect of CCR is negative and statistically sig-

Table 4 Pairwise correlation between outcome and impact variables

Table 4. Univariate correlation between outcome and impact variables																							
Variables	Full Sample			Introduction			Growth			Maturity			Decline			Shake-out							
	ROA	Tobin's Q	ROE	ROA	Tobin's Q	ROE	ROA	Tobin's Q	ROE	ROA	Tobin's Q	ROE	ROA	Tobin's Q	ROE	ROA	Tobin's Q	ROE					
CSR	0.490***	0.500***	-0.220***	0.570***	0.610***	-0.240***	0.430***	0.430***	0.430***	-0.130***	0.450***	0.450***	0.450***	-0.210***	0.800***	0.780***	-0.150	0.550***	0.580***	-0.230***			
SCR	0.730***	0.790***	-0.470***	0.770***	0.850***	-0.480***	0.680***	0.760***	0.760***	-0.370***	0.720***	0.720***	0.720***	-0.490***	0.720***	0.720***	-0.400***	0.760***	0.800***	-0.380***			
ECR	0.190***	0.200***	-0.030	0.090	0.110	0.010	0.220***	0.210***	0.220***	-0.030	0.160***	0.160***	0.150***	0.010	0.190	0.380***	0.260	0.240***	0.260***	-0.020			
CCR	0.170***	0.180***	-0.060**	0.140	0.170*	-0.060	0.180***	0.170***	0.180***	-0.040	0.150***	0.150***	0.160***	-0.050	0.260	0.400***	0.240	0.190***	0.220***	-0.100			
UCR	0.270***	0.170***	0.050**	0.380***	0.330	0.030	0.130***	0.050	0.130***	0.210***	0.230***	0.230***	0.130***	0.010	0.520***	0.260	-0.080	0.350***	0.320***	-0.020			

(**), (*), (°) refer to 1%, 5% and 10% levels of significance respectively

nificant at about 0.2%. The joint CSR test reported in the output suggests that all estimated slopes of CSR components are jointly significant. Furthermore, the overall effect of CSR components estimated in specification (6) has the sum of about 0.3, which is significantly above the estimated effect of CSR (i.e., 0.19) as suggested by the LM test statistic.² The individual dimensions do not fully capture the impact of CSR as a whole. This implies that there may be complementary effects between components or other unmodeled factors influencing the aggregate CSR coefficient. Therefore, specification (1) can be used in conjunction with specification (6) to capture the overall effect of CSR and individual effects of its defined components.

In Table 6 we report the estimated effects of CSR measures on ROA. The overall CSR score has a positive and statistically significant impact on ROA. Our estimates show that a one unit increase in the CSR score leads to a 0.104% increase in ROA. This represents the total effect of CSR engagement on firm financial performance.

When CSR components are examined individually only SCR and UCR are found to have a positive and statistically significant effect on ROA, as portrayed in specifications (2) and (5), respectively. The estimated effect indicates that, when SCR increases, ROA increases by about 0.6%. The estimated effect of UCR on ROA is about 0.3%. In contrast, the effects of ECR and CCR are found to be statistically insignificant albeit positive, as shown in specifications (3) and (4), respectively.

After all four CSR components are included together in specification (6) we find that SCR remains highly significant while UCR becomes weakly significant. The overall effect of the CSR dimensions is approximately 0.15, which exceeds the 0.10 estimate for aggregate CSR in specification 1, as suggested by the LM test statistic. This signifies potential complementary effects between CSR components not fully captured when estimated individually. Finally, the joint CSR test confirms that the CSR component coefficients are jointly significant.

Finally, Table 7 presents estimates from mixed linear models examining the impacts of overall CSR and its components on Tobin's Q as a measure of firm value. The aggregate CSR score has an insignificant effect on Tobin's Q, as reported in specification (1). However, the individual CSR dimensions exhibit varying effects. For example, SCR has a significant negative association with Tobin's Q, as shown in specifications (2) and (6), indicating that SCR reduces firm value. This could be explained by the priorities set for the pharmaceutical firms in China, such as meeting the state needs, which may be counterproductive when it comes to enhancing firm value.

Moreover, ECR shows a positive and significant coefficient of 0.002 and 0.015, as reported in specifications (3) and (6), respectively, suggesting the employees' dimension does enhance firm value. In contrast, CCR and UCR have no statistically significant effect on firm value.

When all four components are integrated into the model in specification (6), the results remain largely similar, SCR has a negative impact, ECR is positive, CCR is mixed, and UCR has no effect. Jointly, the CSR components are significant predictors of valuation based on the joint CSR test. The lack of CSR summation or consensus implies potential complementarities between the individual measures.

² This is computed as the average of the sum of all slopes assuming that the components are additive and linear. LM stands for Lagrange Multiplier test statistic.

Table 5 Estimated impact of CSR and components on ROE

	(1)	(2)	(3)	(4)	(5)	(6)
Fixed Effects Part						
CSR	0.187*** (0.018)					
SCR		1.042*** (0.039)				0.996*** (0.039)
ECR			0.158 (0.127)			0.137 (0.210)
CCR				0.033 (0.050)		-0.160* (0.083)
UCR					0.626*** (0.072)	0.322*** (0.058)
Intercept	-12.484 (7.932)	1.535 (6.175)	-20.198** (8.553)	-21.179** (8.528)	-23.343*** (8.118)	-0.932 (5.993)
Random Effects Part						
Ownership	-17.520	-16.530	-16.380	-16.380	-16.428	-16.662
Firms	1.079***	0.795***	1.181***	1.187***	1.129***	0.704***
Residuals	1.714***	1.480***	1.765***	1.765***	1.726***	1.469***
Observations	875	875	875	875	875	875
Joint CSR						776.4***
LM Statistics						55.3***
Wald Statistics	474.9***	1311.9***	323.3***	321.6***	426.2***	1420.9***
LR Statistics	59.7***	55.2***	63.8***	65.6***	65.4***	42.3***
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes

Robust Standard errors are in parentheses. *** $p < .01$, ** $p < .05$, * $p < .1$. Specification (1) refers to the model with the CSR as the main explanatory (impact) variable. Specification (2) refers to the model with the SCR as the main explanatory (impact) variable. Specification (3) refers to the model with the ECR as the main explanatory (impact) variable. Specification (4) refers to the model with the CCR as the main explanatory (impact) variable. Specification (5) refers to the model with the UCR as the main explanatory (impact) variable. Specification (6) refers to the model with SCR, ECR, CCR and UCR as the main explanatory (impact) variables. All models estimated using Maximum Likelihood Estimator applying Expectation – Maximisation optimisation approach. The set of control variables in all models includes State, Foreign, Size, Lev, CS, Independ, Gender, Share, Bsize, Age, Listing, MV, Grant and RD. Joint CSR: refers to the Wald test statistic of the null that SCR, ECR, CCR and UCR are all jointly insignificant against the alternative of joint significance. This test applies to Specification (6). LM test statistic tests the null of the sum effect of CSR components estimated in Specification (6) is the same as the effect of total CSR estimated in Specification (1). This test is implemented only on Specification (6). Wald Statistics tests the null of the joint insignificance of all slopes against the null of joint significance. LR Statistics tests the null that the mixed linear model is no different from the linear model – in other words, the mixed linear model does not improve the model – against the alternative that the mixed linear model is superior and group effects captured by the random effect components affect the outcome – or the dependent variable

The mixed linear modelling approach accounts for unobserved heterogeneity at the firm and ownership levels through random effects. This handles omitted variable bias and provides more efficient estimates compared to standard linear models. According to the likelihood ratio (LR) statistics, the mixed model specification is preferred over standard linear specifications. This applies to all models without any exceptions.

The results in Tables 5 and 6 reveal that embracing CSR has a positive impact on accounting profitability measures like ROA and ROE, whereas Table 7 shows an insignifi-

Table 6 Estimated impact of CSR and components on ROA

	(1)	(2)	(3)	(4)	(5)	(6)
Fixed Effects Part						
CSR	0.104*** (0.010)					
SCR		0.617*** (0.022)				0.610*** (0.022)
ECR			0.081 (0.072)			-0.057 (0.124)
CCR				0.026 (0.028)		-0.014 (0.048)
UCR					0.256*** (0.041)	0.059* (0.032)
Intercept	-6.421 (4.869)	2.929 (3.673)	-10.822** (5.268)	-11.225** (5.243)	-12.467** (5.133)	1.985 (3.703)
Random Effects Part						
Ownership	-14.785	-19.293	-18.540	-18.870	-18.639	-19.302
Firms	0.734***	0.422***	0.844***	0.844***	0.826***	0.412***
Residuals	1.108***	0.846***	1.155***	1.155***	1.133***	0.844***
Observations	875	875	875	875	875	875
Joint CSR						815.3***
LM Statistics						4.3**
Wald Statistics	753.2***	1942.2***	567.3***	566.7***	628.7***	1964.4***
LR Statistics	131.6***	125.6***	147***	148.2***	154.3***	122.2***
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes

Robust Standard errors are in parentheses. *** $p < .01$, ** $p < .05$, * $p < .1$. Specification (1) refers to the model with the CSR as the main explanatory (impact) variable. Specification (2) refers to the model with the SCR as the main explanatory (impact) variable. Specification (3) refers to the model with the ECR as the main explanatory (impact) variable. Specification (4) refers to the model with the CCR as the main explanatory (impact) variable. Specification (5) refers to the model with the UCR as the main explanatory (impact) variable. Specification (6) refers to the model with SCR, ECR, CCR and UCR as the main explanatory (impact) variables. All models estimated using Maximum Likelihood Estimator applying Expectation – Maximisation optimisation approach. The set of control variables in all models includes State, Foreign, Size, Lev, CS, Independ, Gender, Share, Bsize, Age, Listing, MV, Grant and RD. Joint CSR: refers to the Wald test statistic of the null that SCR, ECR, CCR and UCR are all jointly insignificant against the alternative of joint significance. This test applies to Specification (6). LM test statistic tests the null of the sum effect of CSR components estimated in Specification (6) is the same as the effect of total CSR estimated in Specification (1). This test is implemented only on Specification (6). Wald Statistics tests the null of the joint insignificance of all slopes against the null of joint significance. LR Statistics tests the null that the mixed linear model is no different from the linear model – in other words, the mixed linear model does not improve the model – against the alternative that the mixed linear model is superior and group effects captured by the random effect components affect the outcome – or the dependent variable

cant or mixed effect on firm valuation through Tobin's Q. One explanation that Tobin's Q shows different results could be that the market does not fully value CSR activities in terms of share price and market capitalisation, even if CSR improves operational efficiency and bottom-line profits (McWilliams and Siegel 2000). Additionally, investors may view CSR spending as a diversion of resources away from value creation and hence it can be viewed as an agency problem (Friedman 1970) and is often seen as window dressing to appease certain stakeholder groups, such as nongovernmental organisations (Sprinkle and Maines 2010).

Table 7 Estimated impact of CSR and components on tobin Q

	(1)	(2)	(3)	(4)	(5)	(6)
Fixed Effects Part						
CSR	-0.0002 (0.0002)					
SCR		-0.002*** (0.001)				-0.003*** (0.001)
ECR			0.002* (0.001)			0.015*** (0.004)
CCR				0.0002 (0.001)		-0.005*** (0.001)
UCR					0.0002 (0.001)	0.001 (0.001)
Intercept	-0.073 (0.131)	-0.110 (0.130)	-0.043 (0.132)	-0.063 (0.131)	-0.066 (0.131)	-0.040 (0.130)
Random Effects Part						
Ownership	-23.022	-23.934	-24.076	-23.150	-23.124	-24.369
Firms	-2.473***	-2.488***	-2.458***	-2.464***	-2.466***	-2.496***
Residuals	-2.876***	-2.884***	-2.880***	-2.877***	-2.876***	-2.895***
Observations	877	877	877	877	877	877
Joint CSR						37.9***
LM Statistics						13.5***
Wald Statistics	1383.9***	1431.1***	1381.2***	1377.0***	1378.1***	1480.0***
LR Statistics	559.5***	560.1***	584.4***	566.6***	585.3***	539.4***
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes

Robust Standard errors are in parentheses. *** $p < .01$, ** $p < .05$, * $p < .1$. Specification (1) refers to the model with the CSR as the main explanatory (impact) variable. Specification (2) refers to the model with the SCR as the main explanatory (impact) variable. Specification (3) refers to the model with the ECR as the main explanatory (impact) variable. Specification (4) refers to the model with the CCR as the main explanatory (impact) variable. Specification (5) refers to the model with the UCR as the main explanatory (impact) variable. Specification (6) refers to the model with SCR, ECR, CCR and UCR as the main explanatory (impact) variables. All models estimated using Maximum Likelihood Estimator applying Expectation – Maximisation optimisation approach. The set of control variables in all models includes State, Foreign, Size, Lev, CS, Independ, Gender, Share, Bsize, Age, Listing, MV, Grant and RD. Joint CSR: refers to the Wald test statistic of the null that SCR, ECR, CCR and UCR are all jointly insignificant against the alternative of joint significance. This test applies to Specification (6). LM test statistic tests the null of the sum effect of CSR components estimated in Specification (6) is the same as the effect of total CSR estimated in Specification (1). This test is implemented only on Specification (6). Wald Statistics tests the null of the joint insignificance of all slopes against the null of joint significance. LR Statistics tests the null that the mixed linear model is no different from the linear model – in other words, the mixed linear model does not improve the model – against the alternative that the mixed linear model is superior and group effects captured by the random effect components affect the outcome – or the dependent variable

Furthermore, the benefits of CSR may accrue over a longer term rather than being quickly observed in short-term market valuation. As matter of fact, prior research finds that it can take time for the positive effects of CSR on intangible assets like reputation to materialise in financial outcomes (Orlitzky et al. 2003). The market may also underreact to CSR due to limited information disclosed by firms on their CSR activities (Dhaliwal et al. 2012). Also, CSR components linked to environmental practices could be subject to conflicting stakeholder demands, which makes market valuation uncertain (Barnea and Rubin 2010).

Investors may have difficulty quantifying the value implications of CSR activities through metrics like Tobin's Q.

In summary, while CSR improves profitability, the market may not immediately price these gains through higher valuation due to uncertainty, information asymmetries and divergent shareholder perspectives on CSR (Gregory et al. 2014). More research is, therefore, needed on the mechanisms linking CSR to financial performance over different time horizons. Additionally, an in-depth research investigation of how CSR improves stakeholder relationships would make an excellent companion to this study because, as asserted by Kao et al. (2018), we believe that an improved stakeholder relationship can reduce social costs, which ultimately enhance firm financial performance.

5.2.2 Addressing endogeneity: Two-stage least squares Estimation

To address potential endogeneity concerns and strengthen our empirical results, we employ two-stage least squares (2SLS) estimation. This approach helps mitigate issues such as reverse causality or omitted variable bias that could affect the relationship between CSR and firm financial performance. Table 8 presents the results of both Fixed Effects 2SLS (FE-TSLS) and Random Effects 2SLS (RE-TSLS) estimations for our three dependent variables: ROE, ROA, and Tobin's Q.

The results from our 2SLS estimations largely support our main findings, with some notable differences. For the FE-TSLS estimations, we observe that the overall CSR measure does not show a significant effect on ROE or ROA, contrary to our main results. However, individual components of CSR, particularly SCR and UCR, show significant positive effects on ROE in the full model (column 6). For ROA, SCR maintains a significant positive effect across specifications. In contrast, the RE-TSLS estimations show more consistency with our main results. The overall CSR measure shows a significant positive effect on both ROE and ROA. Individual CSR components, especially SCR, maintain their significant positive effects across most specifications.

Interestingly, the results for Tobin's Q show some differences between FE-TSLS and RE-TSLS estimations. The FE-TSLS results suggest a positive effect of overall CSR on Tobin's Q, while individual components show mixed effects. The RE-TSLS results, however, do not show a significant effect of overall CSR on Tobin's Q, but do show significant effects for individual components.

These results³, while broadly supportive of our main findings, highlight the complexity of the relationship between CSR and firm financial performance. They suggest that the nature of this relationship may vary depending on the specific measure of financial performance used and the estimation method employed. Moreover, they underscore the importance of considering both aggregate CSR measures and individual CSR components when analysing these relationships.

³ While these 2SLS estimations help address endogeneity concerns, we acknowledge that they may not eliminate all potential sources of endogeneity. Therefore, we interpret these results as strong evidence of a relationship between CSR and firm financial performance, while being cautious about making definitive causal claims.

5.3 Potential outcomes and causal effects

This is the first study to examine the relationship between CSR and FFP within life cycle stages of firms. Table 8 reports two estimates based on the potential outcome model in Eq. (3). Panel A reports the estimated average treatment effect (ATE) where the treatment is the stages of CLC⁴ for all three outcome variables. For each outcome variable, we estimate Eq. (3) using various estimators including efficient-influence function (EIF) (Cattaneo 2010; Cattaneo et al. 2013), regression adjustment estimator (RAE), and augmented inverse probability weighting (Wooldridge 2002). We report EIF only, since the conclusions with the other two estimators are qualitatively the same.

In Table 9, Panel A, we find that CSR has a positive impact on firm ROE when the firm moves to the 'shake-out' stage from all other stages. Our findings suggest that, when firms move to growth and maturity stages, they have a positive impact on ROA. Also, Tobin's Q is found to be higher for firms moving to stages 4 and 5. Overall, our findings suggest that firms have a better chance of maximising returns in stage 4. Panel B reports that the CSR effect is positive and statistically significant in all CLC stages when using ROE and ROA, negatively and statistically significant in CLC stages 1, 3 and 5, and positive in CLC stage 4 when using Tobin's Q. We also note that the effect of CSR is at its peak in stage 4 for ROE, stage 1 for ROA and stage 4 for Tobin's Q. We find that there are differences in magnitude of profitability across life cycle stages. Similar to our results, Cho et al. (2019) found a positive and significant correlation between CSR and profitability measures of ROE and ROA. The difference in the results between profitability measures and Tobin's Q (market measure) can possibly be due to markets not fully capturing firms' actions in their share price or valuation in the same way as profitability measures. Also, previous literature demonstrates that CSR is more closely associated with accounting-based measures of firm performance rather than market-based indicators such as Tobin's Q (Orlitzky et al. 2003). Additionally, Tobin's Q measurement can be affected by factors such as intangible assets (Villalonga 2004). The ATE estimates are only significant on four occasions when using SCR. Our findings suggest that firms maximise ROA in CLC stage 3 and Tobin's Q in CLC stages 2 and 5. The effect of SCR, however, is found to have a statistically significant role in explaining firms' outcomes in most of the stages. The effect is consistently positive in all stages for ROE and ROA. Furthermore, the effect of SCR on Tobin's Q is only statistically significant in stages 1, 2 and 4. The effect in stage 4 is positively similar to when using CSR. This suggests that the role of CSR on Tobin's Q is not linear and depends on CLC stages.

When using ECR, we find that firms maximise their ROE in CLC stage 4, ROA in CLC stage 3 and Tobin's Q in CLC stage 4. The effect of ECR is statistically significant in CLC stages 2 and 4 for ROE and ROA and consistently positive. Similarly to CSR and SCR, the effect of UCR on Tobin's Q is positive in CLC stage 4. This again confirms the nonlinearity of the CSR-Tobin's Q relationship.

The ATEs when using CCR and UCR yield similar outcomes with firms maximising their ROE and ROA in CLC stage 4 and Tobin's Q in CLC stage 2. We also find that CCR is statistically significant in CLC stages 2 for ROE, stages 2 and 3 for ROA and has a negative effect on Tobin's Q in stages 3 and 5. In contrast, UCR is statistically significant in all stages for ROE, stages 3 to 5 for ROA and statistically insignificant for Tobin's Q.

⁴ CLC = 1, 2, 3, 4, and 5, referring to 'Introduction', 'Growth', 'Maturity', 'Shake-out' and 'Decline', respectively.

Table 8 (continued)

	FE-TSLS Estimator			RE-TSLS Estimator		
	(1)	(2)	(3)	(4)	(5)	(6)
UCR			(0.297)	(0.137)	-1.60423** (0.75952)	(0.195) -0.483 (0.325)
Intercept					1.10972 (7.465)	9.029** (3.715)
Observations	880	880	880	1.775 (4.808)	907	907
Joint CSR						99.2***
LM						0.2
F/Wald-stat	18.9***	65.9***	22.8***	1218.4***	936.8***	2170.5***
Dependent Variable: Tobin						
CSR	0.004** (0.002)			0.0004 (0.001)		
SCR		-0.012* (0.007)				-0.005* (0.003)
ECR			0.024*** (0.008)		0.013*** (0.005)	0.049*** (0.016)
CCR			0.008** (0.003)		0.002 (0.002)	-0.020*** (0.007)
UCR						0.0197*** (0.007)
Intercept					0.026*** (0.009)	0.144 (0.262)
Observations	881	881	881	-0.036 (0.212)	0.037 (0.218)	908
Joint CSR						908
LM Statistics						33.7***
F/Wald Statistics	14.0***	24.5***	25.2***	845.6***	652.9***	18.6***
			14.4***	570.3***	799.0***	1481.3***

Table 8 (continued)

	FE-TSLS Estimator						RE-TSLS Estimator					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust Standard errors are in parentheses. *** $p < .01$, ** $p < .05$, * $p < .1$. Specification (1) refers to the model with the CSR as the main explanatory (impact) variable. Specification (2) refers to the model with the SCR as the main explanatory (impact) variable. Specification (3) refers to the model with the ECR as the main explanatory (impact) variable. Specification (4) refers to the model with the CCR as the main explanatory (impact) variable. Specification (5) refers to the model with the UCR as the main explanatory (impact) variable. Specification (6) refers to the model with SCR, ECR, CCR and UCR as the main explanatory (impact) variables. All models estimated using Maximum Likelihood Estimator applying Expectation – Maximisation optimisation approach. The set of control variables in all models includes State, Foreign, Size, Lev, CS, Independ, Gender, Share, Bsize, Age, Listing, MV, Grant and RD. Joint CSR: refers to the Wald test statistic of the null that SCR, ECR, CCR and UCR are all jointly insignificant against the alternative of joint significance. This test applies to Specification (6). LM test statistic tests the null of the sum effect of CSR components estimated in Specification (6) is the same as the effect of total CSR estimated in Specification (1). This test is implemented only on Specification (6). Wald Statistics tests the null of the joint insignificance of all slopes against the null of joint significance. LR Statistics tests the null that the mixed linear model is no different from the linear model – in other words, the mixed linear model does not improve the model – against the alternative that the mixed linear model is superior and group effects captured by the random effect components affect the outcome – or the dependent variable. The set of instruments include one lag of each of endogenous variable and one lagged dependent variable

Overall, we find some supporting evidence showing the variations in the CSR effects in stakeholder groups when moving across CLC stages. Although the results are not perfectly in line with our expectations in H1 and H2, the findings confirm our argument on CSR's financial effects that firms respond to important CSR concerns, issues and needs of stakeholders with CSR initiatives and performance through effective resource allocation and prioritisation in the context of their development stages. For shareholders who have stronger contractual and financial relationships compared to other stakeholders, we find that their relationship with FFP is positive and significant in stages 1, 2, 3 and 5. This supports previous research, for example, Cantrell et al.'s (2015) assertion of the strong association between CSR engagement and contractual/financial positioning within the firm(s).

5.4 Ownership stages as treatment effect

In Table 10, we report CSR and FFP estimates across the two types of ownership ('Private' and 'State'). We also report the ATE estimates based on Eq. (6). These estimates capture the average difference between the outcome estimated for privately owned firms and state-owned firms.

Using the full sample, the results indicate that ATEs are all statistically insignificant for all measures of performance. In other words, our results suggest that the type of ownership is not significantly associated with any advantage in terms of ROE, ROA and Tobin's Q. We find that CSR, SCR, ECR and UCR have a statistically significant effect on private firms' ROE and ROA, while, in the state-owned firms, ROE and ROA are affected positively and significantly by CSR, SCR and UCR.

There is also strong evidence that CSR, SCR and CCR are statistically relevant to explain Tobin's Q for both private and state-owned firms. In this context, the CSR marginal effect for private firms is higher than that for state-owned firms. Furthermore, the marginal effects of SCR and UCR on private firms' ROE are higher than their state-owned counterparts. In contrast, our estimates report higher SCR and UCR marginal effects on ROA for state-owned firms compared to private firms. We can deduce that state-owned firms may have a higher level of investment in CSR, which may not translate to market performance, denoting lower operational efficiency or not using resources adequately in state-owned pharma firms.

The panel 'Stage 1', in Table 10, reports the same estimates as above but using the sub-sample of the firms in their CLC stage 1. Our findings suggest that the type of ownership is associated with different outcomes for firms. According to our ATE estimates, there is a statistically significant difference between the average ROE, ROA and Tobin's Q between privately owned firms and state-owned firms. In general, the estimates show that, at the introduction stage, the state-owned firms have lower ROE, ROA and Tobin's Q. The only exception that results in higher performance for state-owned firms is when the CSR measure is SCR, showing that even in stage 1 the shareholders are important. In contrast, the outcomes of privately owned firms are less than those for the state-owned firms, as shown by the ATEs in 'Stage 2'. We note that, in those cases, the CSR marginal effect on firms' performance is higher for private firms.

The ATEs reported in 'Stage 3' are only statistically significant when using ROE and Tobin's Q. The estimated differences suggest that, at this CLC stage, state-owned firms perform worse than private firms. This could be due by inefficient use of financial resources

Table 9 Average treatment effects estimates and FFP (Treatment variable: CLC)

CLC Stages	ROE			ROA			Tobin's Q		
	Estimates	Std.Err.	Wald	Estimates	Std.Err.	Wald	Estimates	Std. Err.	Wald
Panel A: ATE Estimates by CLC Stage									
Impact Variable: CSR									
Growth vs. Introduction	0.102	0.867	0.014	0.825	0.389	4.498**	0.016	0.011	2.116
Maturity vs. Introduction	0.382	0.879	0.189	1.537	0.412	13.917***	0.005	0.011	0.207
Shake-out vs. Introduction	10.065	1.223	67.729***	-0.049	1.412	0.001	0.165	0.078	4.475***
Decline vs. Introduction	-0.189	1.040	0.033	1.094	0.527	4.309**	-0.009	0.013	0.479
Maturity vs. Growth	0.280	0.387	0.523	0.712	0.252	7.983***	-0.011	0.007	2.469
Shake-out vs. Growth	9.963	1.093	83.088***	-0.874	1.337	0.427	0.149	0.077	3.744*
Decline vs. Growth	-0.291	0.715	0.166	0.269	0.433	0.386	-0.025	0.010	6.250**
Shake-out vs. Maturity	9.682	1.079	80.517***	-1.586	1.363	1.354	0.160	0.077	4.318***
Decline vs. Maturity	-0.571	0.730	0.612	-0.443	0.445	0.991	-0.014	0.009	2.420
Decline vs. Shake-out	-10.253	1.193	73.862***	1.143	1.426	0.642	-0.174	0.078	4.976**
Impact Variable: SCR									
Growth vs. Introduction	-0.804	0.674	1.423	0.262	0.266	0.970	0.021	0.011	3.645*
Maturity vs. Introduction	-0.468	0.679	0.475	1.019	0.282	13.057***	0.010	0.011	0.826

Table 9 (continued)

CLC Stages	ROE			ROA			Tobin's Q		
	Estimates	Std.Err.	Wald	Estimates	Std.Err.	Wald	Estimates	Std.Err.	Wald
Shake-out vs. Introduction	7.435	6.983	1.134	-0.091	3.358	0.001	0.127	0.244	0.271
Decline vs. Introduction	-1.122	0.809	1.923	0.515	0.360	2.046	-0.003	0.013	0.053
Maturity vs. Growth	0.337	0.307	1.205	0.758	0.200	14.364***	-0.011	0.007	2.469
Shake-out vs. Growth	8.240	7.008	1.383	-0.353	3.343	0.011	0.105	0.243	0.187
Decline vs. Growth	-0.317	0.539	0.346	0.253	0.308	0.675	-0.024	0.01	5.760**
Shake-out vs. Maturity	7.903	7.000	1.275	-1.111	3.359	0.109	0.116	0.243	0.228
Decline vs. Maturity	-0.654	0.55	1.414	-0.504	0.317	2.528	-0.013	0.009	2.086
Decline vs. Shake-out	-8.557	7.023	1.485	0.607	3.367	0.033	-0.129	0.244	0.280
Impact Variable: ECR									
Growth vs. Introduction	4.859	0.994	23.896***	2.969	0.452	43.146***	-0.008	0.011	0.529
Maturity vs. Introduction	5.142	1.010	25.919***	3.689	0.479	59.313***	-0.019	0.011	2.983*
Shake-out vs. Introduction	10.417	1.861	31.332***	3.437	0.852	16.273***	0.027	0.027	1.000
Decline vs. Introduction	4.247	1.216	12.198***	3.028	0.635	22.739***	-0.031	0.013	5.686**

Table 9 (continued)

CLC Stages	ROE			ROA			Tobin's Q		
	Estimates	Std.Err.	Wald	Estimates	Std.Err.	Wald	Estimates	Std. Err.	Wald
Maturity vs. Growth	0.283	0.408	0.481	0.720	0.264	7.438***	-0.011	0.007	2.469
Shake-out vs. Growth	5.558	1.590	12.219***	0.469	0.767	0.374	0.036	0.026	1.917
Decline vs. Growth	-0.612	0.811	0.569	0.059	0.502	0.014	-0.023	0.010	5.290**
Shake-out vs. Maturity	5.275	1.597	10.910***	-0.252	0.793	0.101	0.047	0.026	3.268***
Decline vs. Maturity	-0.895	0.823	1.183	-0.661	0.514	1.654	-0.012	0.010	1.440
Decline vs. Shake-out	-6.170	1.762	12.262***	-0.409	0.915	0.200	-0.059	0.028	4.440*
Impact Variable: CCR									
Growth vs. Introduction	4.596	0.991	21.509***	2.920	0.452	41.734***	-0.004	0.011	0.132
Maturity vs. Introduction	4.865	1.007	23.340***	3.625	0.478	57.512***	-0.015	0.011	1.860
Shake-out vs. Introduction	5.217	3.044	2.937*	4.909	1.439	11.638***	-0.097	0.088	1.215
Decline vs. Introduction	4.049	1.217	11.069***	3.034	0.636	22.757***	-0.029	0.013	4.976***
Maturity vs. Growth	0.269	0.410	0.430	0.705	0.265	7.078***	-0.011	0.007	2.469
Shake-out vs. Growth	0.621	2.802	0.049	1.989	1.421	1.959	-0.093	0.088	1.117
Decline vs. Growth	-0.547	0.815	0.450	0.113	0.504	0.050	-0.025	0.010	6.250**

Table 9 (continued)

CLC Stages	ROE			ROA			Tobin's Q		
	Estimates	Std.Err.	Wald	Estimates	Std.Err.	Wald	Estimates	Std.Err.	Wald
Shake-out vs. Maturity	0.352	2.769	0.016	1.284	1.453	0.781	-0.082	0.088	0.868
Decline vs. Maturity	-0.816	0.826	0.976	-0.592	0.515	1.321	-0.014	0.009	2.420
Decline vs. Shake-out	-1.167	2.868	0.166	-1.875	1.521	1.520	0.068	0.088	0.597
Impact Variable: UCR									
Growth vs. Introduction	3.840	0.957	16.100***	2.589	0.438	34.939***	0.001	0.011	0.008
Maturity vs. Introduction	4.168	0.972	18.388***	3.330	0.463	51.728***	-0.010	0.011	0.826
Shake-out vs. Introduction	7.529	2.351	10.256***	3.612	0.768	22.119***	-0.011	0.033	0.111
Decline vs. Introduction	3.280	1.134	8.366***	2.675	0.588	20.696***	-0.023	0.013	3.130*
Maturity vs. Growth	0.327	0.399	0.672	0.741	0.263	7.938***	-0.011	0.007	2.469
Shake-out vs. Growth	3.689	2.151	2.941*	1.023	0.670	2.331	-0.012	0.031	0.150
Decline vs. Growth	-0.561	0.731	0.589	0.087	0.458	0.036	-0.024	0.010	5.760**
Shake-out vs. Maturity	3.361	2.154	2.435	0.282	0.693	0.166	-0.001	0.031	0.001
Decline vs. Maturity	-0.888	0.744	1.425	-0.654	0.469	1.945	-0.013	0.010	1.690

Table 9 (continued)

CLC Stages	ROE			ROA			Tobin's Q		
	Estimates	Std.Err.	Wald	Estimates	Std.Err.	Wald	Esti- mates	Std. Err.	Wald
De- cline vs. Shake- out	-4.249	2.248	3.573*	-0.937	0.819	1.309	-0.011	0.032	0.118
Panel B: FFP Estimates by CLC Stage									
ROE	Introduction		Growth		Maturity		Shake-out		Decline
CSR	0.696***		0.153***		0.132***		1.554***		0.336***
SCR	1.627***		0.804***		0.877***		2.255		1.103***
ECR	0.044		0.492***		0.153		13.506***		0.492
CCR	0.416		0.124**		0.035		-0.000		0.016
UCR	0.720*		0.499***		0.448***		7.935***		1.220***
ROA									
CSR	0.318***		0.081***		0.095***		0.047***		0.235***
SCR	0.785***		0.470***		0.587***		0.069***		0.753***
ECR	0.084		0.286***		0.142		0.413***		0.296
CCR	0.131		0.070*		0.060*		-0.000		0.058
UCR	0.294		0.133		0.225**		0.243***		0.786***
Tobin's Q									
CSR	-0.003**		-0.000		-0.001**		0.006***		-0.001*
SCR	-0.007***		-0.000		-0.001		0.009***		-0.003
ECR	0.009		-0.001		-0.002		0.055***		-0.004
CCR	-0.0003		-0.001		-0.002***		0.000		-0.004**
UCR	-0.004		0.003		0.002		0.032		0.003

The Wald Statistics test the null of equal means against the alternative of different means. The critical values are obtained from χ^2 distribution with degrees of freedom equal to 1. The 10%, 5% and 1% critical values are 2.71, 3.83 and 6.63, respectively. The Reported Estimates of CSR, SCR, ECR, CCR and UCR are the Efficient-Influence Function based on the regression in Eq. (3). The estimates of one CLC stage vs another are the Average Treatment Effects estimated using Eq. (6). All models are estimated using the set of control variables including: Own, State, Foreign, Size, Lev, CS, Independ, Gender, Share, Bsize, Age, Listing, MV, Grant, RD and Intercept. We also account for year effect

including misallocation of the resources. We note that state-owned FFP is affected by CSR, which is either higher or of a similar magnitude to private firms. Similar findings are reported in 'Stage 5' in terms of ATE estimates, which suggests that privately owned firms outperform state-owned firms. The magnitude of marginal effects of CSR on firms' performance is, however, mixed across firms based on their type of ownership. The findings further show that in 'Stage 5', the effects of CSR measures are often statistically significant for state-owned firms than for privately owned firms. Finally, 'Stage 4' does not report any statistically significant difference in firms' performance. Hence, the effect of ownership (public versus private) by CLC stages is inconclusive.

We also extend the analysis to compare the CSR scores focusing on the comparative advantages between private and state-owned firms using the same methods as above. Table 11 reports the estimated ATEs for CSR and each stakeholder responsibility using the full sample and across CLC stages. The results show only one case of CSR measures, which is average SCR, where the estimated average effect of private firms is higher than that of

Table 10 Average treatment effects estimates and FFP (Treatment variable: Ownership) – Stakeholder perspective

ROE				ROA				Tobin's Q						
Full Sample				State	ATE	Wald	Private	State	ATE	Wald	Private	State	ATE	Wald
	Private			0.149***	-0.623	1.0	0.125***	0.074***	-0.036	0.0	-0.001***	-0.001***	-0.008	1.3
CSR	0.185***			1.269***	-0.631	2.0	0.628***	0.531***	0.027	0.0	-0.003***	-0.005***	-0.009	1.7
SCR	0.950***			0.080	-0.154	0.0	0.176**	0.093	0.181	0.4	-0.003	-0.004*	-0.01	2.0
ECR	0.199**			0.067	-0.184	0.0	0.045	0.080	0.126	0.2	-0.003***	-0.003**	-0.012	2.9*
CCR	0.010			0.789***	0.316	0.2	0.290***	0.175**	0.335	1.3	0.002	-0.000	-0.006	1.0
UCR	0.611***													
Stage 1: Introduction														
CSR	0.972***			0.005	-377.286	17.4***	0.514***	-0.020	-124.889	17.5***	-0.006***	-0.004***	-5.471	16.7***
SCR	1.399***			0.022	99.51	6.6***	0.755***	-0.090***	31.262	6.3***	-0.011***	-0.019**	2.064	6.8***
ECR	0.849			0.037***	-182.608	8.8***	0.666	-0.155***	-61.031	9.1***	-0.000	-0.033***	-2.415	5.8***
CCR	0.000			0.011	-231.851	14.2***	0.000	-0.044	-77.026	14.4***	0.000	-0.009***	-3.198	11.6***
UCR	0.610**			-0.346	-151.662	15.2***	0.286*	1.431**	-50.775	15.4***	-0.001	0.302***	-1.93	17.8***
Stage 2: Growth														
CSR	0.143***			0.076*	0.218	0.1	0.089***	0.035*	0.682	4.4**	-0.000	-0.000	0.029	13.1***
SCR	0.755***			1.378***	-3.691	37.6***	0.488***	0.542***	-0.827	12.5***	-0.001	-0.000	0.03	14.1***
ECR	0.446***			0.041	0.18	0.1	0.325***	0.104	0.795	5.4**	-0.002	-0.003	0.025	9.8***
CCR	0.095*			0.061	0.36	0.2	0.066	0.042	0.801	5.6**	-0.001	-0.000	0.029	13.1***
UCR	0.400**			-0.084	0.412	0.3	0.137	-0.131	1.028	8.3***	0.003	0.001	0.027	11.4***
Stage 3: Maturity														
CSR	0.128***			0.114***	-1.84	8.4***	0.091***	0.105***	-0.875	6.0**	-0.000	-0.002***	-0.024	9.0***
SCR	0.894***			0.867***	-1.239	6.9***	0.608***	0.516***	-0.117	0.2	0.000	-0.007***	-0.038	22.6***
ECR	0.086			0.504*	-1.333	4.0**	0.079	0.596***	-0.597	2.4	-0.003	-0.014***	-0.026	10.6***
CCR	-0.002			0.167*	-1.234	3.4*	0.025	0.229***	-0.603	2.4	-0.002**	-0.005***	-0.028	12.3***
UCR	0.434**			0.154	-0.641	1.0	0.233**	-0.094	0.18	0.2	0.002	0.001	-0.045	31.6***
Stage 4: Shake-out														
CSR	1.267***			1.119***	3.495	1.2	0.595***	0.353***	-1.037	0.5	-0.002	-0.011*	0.004	0.0
SCR	2.053***			1.274***	1.038	0.1	1.006***	0.471***	-2.086	1.8	-0.022***	-0.013	0.029	0.1

Table 10 (continued)

	ROE			ROA			Tobin's Q					
<i>ECR</i>	1.866	0.930	4.048	0.6	1.756***	0.541	-0.603	0.1	0.055***	0.025	0.02	0.1
<i>CCR</i>	1.526***	0.000	3.952	0.6	1.020***	0.000	-0.726	0.1	0.020***	0.000	0.01	0.0
<i>UCR</i>	2.685***	0.778	3.115	0.5	0.688	0.086	-1.119	0.3	0.002	-0.009	0.005	0.00
Stage 5: Decline												
<i>CSR</i>	0.508***	0.057***	-13.244	22.3***	0.349***	0.113***	2.803	5.0**	-0.002*	-0.004***	0.057	4.5***
<i>SCR</i>	1.154***	0.907***	-20.532	27.8***	0.791***	1.801***	6.552	6.4**	-0.003	-0.058***	-0.092	1.5
<i>ECR</i>	0.421	0.566***	52.672	31.5***	0.269	1.125***	-26.705	25.7***	-0.011	-0.036***	1.293	35.8***
<i>CCR</i>	-0.162	0.118***	-11.43	16.7***	-0.045	0.234	4.241	19.2***	-0.009***	-0.008***	0.144	19.0***
<i>UCR</i>	1.428***	0.912***	-6.356	16.0***	0.893***	1.811***	1.842	3.87**	0.003	-0.059***	0.055	3.9**

The Wald Statistics test the null of equal means against the alternative of different means. The critical values are obtained from χ^2 distribution with degrees of freedom equal to 1. The 10%, 5% and 1% critical values are 2.71, 3.83 and 6.63, respectively. The Reported Estimates of *CSR*, *SCR*, *ECR*, *CCR* and *UCR* are the *Efficient-Influence Function* based on the regression in Eq. (3). The estimates of one CLC stage vs. another are the Average Treatment Effects estimated using Eq. (6). All models are estimated using the set of control variables including Own, State, Foreign, Size, Lev, CS, Independ, Gender, Share, Bsize, Age, Listing, MV, Grant, RD and Intercept. We also account for year effect. CLC stage 4 has a very small sample size and adding all control variables leads to perfect multicollinearity. We therefore estimated the models for this stage using only *CSR* measures

Table 11 Average treatment effects estimates of CSR (*Treatment variable: Ownership*) – Life cycle stages

	Sample	ATE	Wald	Advantage
CSR	Full	4.781	14.2***	State
	Introduction	3.754	1.0	–
	Growth	3.910	2.7*	State
	Maturity	4.629	5.9**	State
	Shake-out	-0.016	0.0	–
	Decline	10.798	10.0***	State
SCR	Full	-1.568	13.7***	Private
	Introduction	-2.579	4.7**	Private
	Growth	-2.799	15.2***	Private
	Maturity	-1.294	4.7***	Private
	Shake-out	1.566	0.5	–
	Decline	1.062	0.9	–
ECR	Full	1.268	45.0***	State
	Introduction	1.205	6.1**	State
	Growth	1.255	11.4***	State
	Maturity	1.322	22.0***	State
	Shake-out	-0.450	1.0	–
	Decline	1.715	10.5***	State
CCR	Full	2.315	27.8***	State
	Introduction	2.861	5.3**	State
	Growth	2.602	9.9***	State
	Maturity	1.757	6.9***	State
	Shake-out	-0.857	1.1	–
	Decline	4.066	10.7***	State
UCR	Full	0.961	17.2***	State
	Introduction	0.12	0.0	–
	Growth	0.973	6.1**	State
	Maturity	1.151	11.8***	State
	Shake-out	0.246	0.0	State
	Decline	1.391	5.3**	State

The Wald Statistics test the null of equal means against the alternative of different means. The critical values are obtained from Chi^2 distribution with degrees of freedom equal to 1. The 10%, 5% and 1% critical values are 2.71, 3.83 and 6.63, respectively. The Reported Estimates of CSR, SCR, ECR, CCR and UCR are the *Efficient-Influence Function Estimator* based on the Average Treatment Effects estimated using Eq. (6)

state-owned firms. In fact, our findings from Table 11 suggest that firms' performance for private firms is on average higher than that of state-owned firms. According to our estimates in Table 11, the marginal effects of the CSR measures for private firms are – mostly – higher than those for state-owned firms. In other words, while state-owned firms have a better CSR score on average, they are less efficient at generating a higher effect on performance. A study by Li et al. (2022) indicated that a number of Chinese private firms are acquiring equity in the public sector with the aim of improving their CSR and, hence, their economic and political status. The finding is consistent with our expectation in H3 and supports Zhang's (2016) argument that firms' ownership could be associated with financial investment efficiency and performance.

6 Conclusions and study implications

The study employs a robust methodological approach to investigate the CSR–FFP relationship across the main CLC stages and by type of ownership, for the pharmaceutical sector in China. The results reveal that the relationships between CSR activities for these firms are positively and significantly related to FFP using profitability measures of ROA and ROE. This is true across all stakeholder CSR dimensions of SCR, ECR, CCR and UCR. The study finds that SCR and UCR have a positive and statistically significant effect on firms' performance, measured by ROE and ROA, signifying that shareholders and community have a close contractual and financial relationship with firms. These findings are different from Lee et al. (2013) who found that employee-related CSR activities boost productivity. Our findings show a negative and statistically insignificant effect of CSR on Tobin's Q. This is possible since Tobin's Q, unlike ROA and ROE, is a financial measure of a firm's growth potential or value rather than profitability. The findings support the first hypothesis that pharmaceutical firms' investment in CSR-related activities would result in enhanced FFP. The improvement in financial performance could be attributed to better engagement of stakeholders, possibly due to improved perception of firms as they invest more in CSR-related activities, and the handling of the normative issues associated with the Chinese pharmaceutical industry.

Unlike Zhao and Xiao (2019) who examined CSR engagement in life cycle stages and financial constraints, our study is the first to show that there is a positive and significant relationship between CSR and FFP, across all CLC stages, when ROE and ROA are used. The estimates based on the overall sample show a negative relationship between CSR and Tobin's Q, indicating that CSR does not increase firms' value as accounted for by the market. Tobin's Q for our samples has an average of 0.33 and a range from 0.04 to 0.84, which shows that all firms have their total assets higher than the market value. It is possible that these firms are undervalued, possibly because the market may not be appreciating the value of the company's intangible assets (e.g., brand, goodwill or intellectual property), implying that CSR efforts may not show direct influence on the pharmaceutical firms' actual market value. However, when accounting for CLC stages when using firms' market value, unlike ROE and ROA, we find that CSR has different association depending on the firm's life cycle. Out of the four stages, the shake-out stage emerges as the most influential in terms of CSR's impact on Tobin's Q. In other words, we report a positive relationship in the shake-out stage and a negative and significant relationship in the introduction, maturity and decline stages. These findings could be attributed to the firms' strategic priorities, financial and non-financial, and their governance structure in each CLC stage.

In addition, as the first study that tests the CSR–FFP relationship in private and state-owned pharmaceutical firms, we find that private firms perform better in CSR than state-owned firms using ROE and ROA. However, in state-owned firms, profitability is still impacted positively and significantly by CSR, with shareholders and community groups emerging as the most important stakeholders. Taking into account the CLC stages, the state-owned firms have lower profitability at the introduction stage, although they perform better than private firms at the growth stage. Instead, at the maturity stage, the state-owned firms perform worse than private firms. In the decline stage, there is no significant difference in firms' performance. Private firms outperform state-owned firms in the shake-out stage. Overall, state-owned firms have better CSR performance but are less efficient in terms of

market and financial performance. This can be attributed to the influence of regulation and market forces on the two types of firms with those that are state-owned, embracing government CSR initiatives and priorities, while privately owned firms focus more on satisfying their shareholders.

These findings have particular significance in the Chinese pharmaceutical industry context as, due to the rapid growth of this sector, firms face increasing pressure to demonstrate financial resilience while complying with strict regulatory CSR mandates. CSR in this sector is an important mechanism for balancing financial performance with ethical or social obligations. Unlike other sectors, pharmaceutical firms face distinctive stakeholder pressures across their life cycle - from managing clinical trials ethics and regulatory compliance in early stages of product development to addressing drug pricing and accessibility concerns in mature stages. The stronger CSR-FFP relationship in certain life cycle stages reveals that pharmaceutical CSR investments should be strategically timed to maximise both social and financial returns. Managers and policymakers can recognise the differential impacts of CSR across life cycle stages, potentially providing unique insights useful to managers in allocating of CSR investments at the right stage in the firm life cycle, while acknowledging the distinctions between shareholder-focused and broader stakeholder-focused initiatives. Furthermore, the significant influence of ownership structure on CSR-FFP relationships highlights the unique institutional context of China's pharmaceutical sector, where state-owned enterprises must balance national healthcare objectives with market performance. Our study finds that while state-owned firms invest more in CSR, they achieve less efficient financial returns or market value, SOEs can use this information to balance national healthcare objectives with market-based performance incentives to improve CSR efficiency. Policymakers could develop more targeted approaches that encourage specific CSR dimensions (particularly shareholder and community-focused initiatives) and those showing the strongest positive associations with financial performance.

Our research provides valuable insights beyond the current CSR literature (e.g., Zhao and Xiao 2019) extending the body of knowledge in this field. The study's focus on China's pharmaceutical industry offers context-specific findings that future research could be expanded upon by examining pharmaceutical sector in another country. This could reveal how institutional and regulatory environments beyond China shape the stakeholder, firm life cycle, and ownership dynamics that this study has identified.

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