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Analysing the determinants of technical efficiency in major Chinese retail firms: a bootstrap data envelopment analysis (DEA) and truncated regression approach

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Abstract: This study examines the technical efficiency of major domestic retail enterprises using bootstrap data envelopment analysis (DEA) and truncated regression analysis. Key findings reveal that large businesses and department stores are more technically efficient than small medium enterprises (SMEs). Technical efficiency positively correlates with operating income-to-sales and interest coverage ratios but negatively with debt and quick ratios. Additionally, firm age, size, and business type positively influence efficiency. Managerially, retail firms should optimise operations and adopt new technologies to enhance efficiency. Policymakers should support firms during economic downturns through fiscal measures like low-interest loans and tax cuts. The study's cross-sectional nature suggests future research should include longitudinal analysis for deeper insights.

Keywords: retail enterprises; bootstrap; DEA; data envelopment analysis; truncated regression; technical efficiency; determinants; SMEs; large enterprises; department shops; china.

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1 Introduction

Due to a decrease in the working-age population, rising store debt, and a loss in customer confidence, the business climate for the domestic retail industry has grown more unstable in recent years. Furthermore, with the rise of new companies, the opening of new stores, and the expansion of existing stores, domestic retailers have faced increased competition in recent years, particularly large retailers. This has increased financial risk as a result of the growth of third-party capital financing. As a result, there is a growing emphasis on the necessity of effective management in these sectors. This study uses Bootstrap data envelopment analysis (DEA) and truncated regression analysis methods to investigate the technical efficiency and determinants of important Chinese retail firms. There has therefore been little research examining the factors that influence efficiency because, up until recently, the majority of studies conducted both in China and internationally measured efficiency using non-parametric techniques like DEA.

To be specific, the major domestic and foreign studies can be categorised as follows: First, studies that measure the technical efficiency of distribution firms by utilising constant returns to scale and variable returns to scale models, which are the basic models of DEA, major studies include Miller and Muir (2020), Amirteimoori et al. (2023), Thomas et al. (1998), Nong (2023), Ablanado Rosas et al. (2024), Lin and Luan (2020). Second, studies that measure the trend change in technical efficiency mainly utilise the Malmquist Productivity Index, a non-parametric approach, and include Andrejić et al. (2021), Lu (2023), Bağcı and Çil Koçyiğit (2023), Zhou et al. (2024). Third, there are studies that examine the determinants using simple regression and Tobit regression models, such as Herath and Thayaparan (2024), Huong et al. (2024), Abdulahi et al. (2023), Alam et al. (2020), Anaba et al. (2022), but relatively few studies have been conducted compared to other research topics.

The methodology used in this work, which is based on truncated regression analysis and bootstrap DEA, sets it apart from previous studies and is anticipated to have a substantial impact on relevant follow-up studies.

The order of discussion is as follows: First, Section 1 is the introduction, Section 2 presents the literature review, 3 describes the methodology, selection of variables, and analysis. Section 2 presents the results of the empirical analysis of the technical efficiency and determinants of the analysed retailers. Finally, Section 5 summarises the conclusion and presents the results and implications of the study.

2 DEA literature review and its use in the retail sector

This section summarises the literature on DEA and bootstrapped truncated regression analysis. To save space, this study does not go into detail about these technologies. Important references are provided to help interested readers. Then, DEA applications in the retail sector during the past few years are examined.

2.1 Data envelopment analysis (DEA)

DEA is a mathematical programming method that calculates the relative efficiency of organisations (typically decision-making units (DMUs)) utilising multiple inputs and outputs (Charnes et al., 1978). DEA is a mathematical programming method that calculates the relative efficiency of organisations (typically DMUs (DMUs)) utilising multiple inputs and outputs.

Scholars have, in recent years, adopted the use of DEA to analyse the technical efficiency and examine if widespread use of evaluations may successfully raise growth efficiency in order to improve efficiency. DEA has clear benefits over other methodologies as a source of information in estimating the efficiency of companies that generate many outputs (Oswin et al., 2019, Tampuri Jnr et al., 2019, Soltanifar et al., 2024).

The approach assesses relative efficiency without making any assumptions about input and output weights. The goal of this paper is to use DEA to evaluate the technical efficiency and determinants of major Chinese retail enterprises in the presence of various inputs and outputs. According to data, DEA has been practically used in over a thousand situations in disciplines ranging from transportation to education, law, forest management, medical, finance, military upkeep, and administration. Because of the plethora of existing research, the current investigation solely examined relevant literature. Our literature analysis indicated that numerous studies use DEA to assess the performance of retail enterprises (Aggelopoulos and Lampropoulos, 2024).

2.2 Bootstrapped truncated regression

The bootstrap method used in this work allows us to draw more relevant results since it controls for bias and serial correlations in efficiency estimates, resulting in reliable inference (Simar and Wilson, 2007). This strategy addresses the limits of evaluating the effect determinants of DEA efficiency, as well as the challenges highlighted by a limited sample size (Marques et al., 2022). However, previous DEA research has indicated that the efficiency scores produced in the first stage are related to the explanatory factors used in the second term, resulting in inconsistent and biased second-stage estimations (Simar and Wilson, 2020, Lai and Hsiao, 2022). Hence, Simar and Wilson (1999) recommended that a bootstrap method be employed to overcome this issue. The bootstrap is a computer-based method for assigning levels of accuracy to statistical estimates. This was previously suggested by Efron (1979), and since then, it has grown in popularity and use as a statistical tool. (Casu et al., 2004). Simar and Wilson (2007) provide further information on truncated regression using bootstrap. In principle, we will conduct a DEA analysis of the technical efficiency of Chinese retail firms in the first stage, followed by a parametric regression using the bootstrap truncated regression (BTR) model to evaluate

the technical efficiency and determinants of important Chinese retail firms in the second stage.

2.3 *DEA applications in the retail sector*

Retailers are increasingly analysing production and efficiency (Shankar et al., 2021, Chopra et al., 2021, Grewal et al., 2021, Gopal et al., 2024). When reviewing recent efficiency measurement research publications (Camanho et al., 2024, Jung et al., 2023, Muniyoor and Pandey, 2024, Amirteimoori et al., 2024), it is obvious that the use of DEA to assess retail efficiency and productivity has grown in recent years. However, it appears that little research has been conducted on the technical effectiveness of Chinese retail firms.

Sellers-Rubio and Mas-Ruiz (2006) used DEA to evaluate the economic effectiveness of supermarket chains in the Spanish retail business. From 1995 to 2001, an empirical study was done on a sample of 100 supermarket chains. The analysis discovered considerable levels of economic inefficiency in the Spanish retail business.

Using a two-stage benchmarking approach, Barros (2006), examined a representative sample of 22 hypermarkets and supermarkets in the Portuguese market. The first phase utilised DEA, whereas the second stage employed the Tobit model to estimate the efficiency drivers. This investigation yielded the following noteworthy findings:

- a larger retail groups are more efficient than smaller retailers
- b scale is important in this market
- c national retailers are on average more efficient than regional retailers
- d hypermarket and supermarket retail companies are efficient in comparison to other sectors
- e regulation has a negative impact on efficiency
- f market share, number of outlets, and location are important efficiency factors.

A two-step analysis of the technical efficiency of a sample of French generalist shops was conducted by Perrigot and Barros (2008). Four DEA models were employed to determine the efficiency ratings in the first phase. In the second phase, they employed a bootstrapping Tobit model to discover the efficiency drivers. In the view of the authors, the efficiency came from having a publicly traded firm, implementing a mergers and acquisitions (M&A) plan, joining a group, and expanding into foreign markets. Other research has examined cost efficiency (Amirteimoori et al., 2024), technical efficiency (Anaba et al., 2022, Top et al., 2020, Zakowska and Godycki-Cwirko, 2020, Tsaples and Papathanasiou, 2021, Mingxing et al., 2019), and scale efficiency (Ngoc et al., 2023, Zarrin and Brunner, 2023).

The bulk of research utilised a static viewpoint (Aparicio et al., 2023, André et al., 2024, Bangarwa and Roy, 2023, Salehzadeh et al., 2024), while Lin and Yu (2023), Barros and Alves (2004) and Sellers-Rubio and Mas-Ruiz (2007) employed a dynamic approach, evaluating the patterns of changes in efficiency utilising MPI. Sellers-Rubio and Mas-Ruiz (2007), for example, the MPI was used to estimate overall productivity change in 96 supermarket chains operating in Spain between 1995 and 2003, and it was broken down into efficiency change and technical change, which was caused by

innovation and the adoption of new technology. They discovered that information and technology have the ability to transform the productive structures of retail businesses, enhancing productivity.

Barros and Alves (2004) used MPI to calculate total productivity change and separate it into technical and technological changes for a Portuguese retail shop chain. The authors graded the shops based on their total productivity change from 1999 to 2000, discovering that certain businesses grew productivity while others dropped production. On the other hand, between 2000 and 2005, Yu and Ramanathan (2008) examined the operational efficiency of 41 retail firms in UK using three related methodologies: DEA, MPI, and a bootstrapped Tobit regression model. The study discovered that the legal structure, ownership, and retail sub-sector all had a significant influence on retail efficiency in the UK.

3 Research model

3.1 Methodology

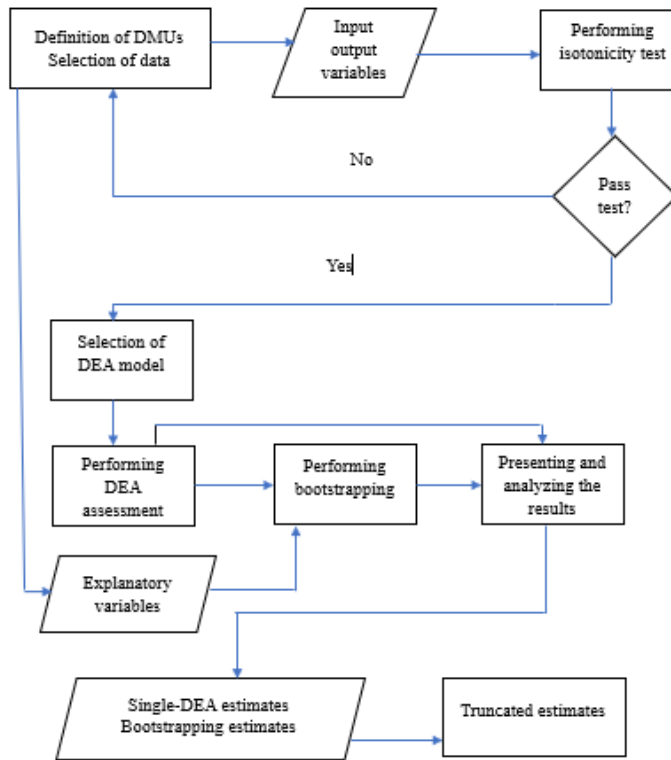
The Bootstrap DEA used in this study is a methodology proposed by Simar and Wilson (1998). According to Simar and Wilson (1998), the bootstrap-DEA approach produces more accurate and bias-corrected efficiency ratings and confidence intervals at a certain α -level compared to traditional data efficiency analysis methods. As a result, the bootstrap-DEA efficiency scores possess measurable accuracy and important statistical features that the DEA method efficiency ratings do not. Figure 1 displays the Bootstrap DEA flowchart.

Some of the advantages in using the Bootstrap DEA is that it has the benefit of being a simple method for estimating standard errors and confidence intervals, as well as being handy because it saves the cost of repeating the experiment to get additional groups of sampled data. The step-by-step Bootstrap DEA algorithm is as follows:

First of all, the efficiency value of the data envelope analysis is calculated $\hat{\theta}_k$ when there are observations of (x_k, y_k) where $k = 1, 2, 3, \dots, n$, and in the second step, $\theta_{1b}^*, \theta_{2b}^*, \dots, \theta_{nb}^*$ is calculated through Smoothed Bootstrap by recovering and extracting n samples from $\hat{\theta}_i$. In step 3, we get the set $X^* = \{(x_{ib}^*, y_i) | i = 1, 2, \dots, n\}$ from $x_{ib}^* = \hat{\theta}_i / \theta_{ib}^*$ $k = 1, 2, 3, \dots, n$, and in step 4, we calculate the efficiency θ_{kb}^* of (x_k, y_k) $k = 1, 2, 3, \dots, n$ with $X^* = \{(x_{ib}^*, y_i) | i = 1, 2, \dots, n\}$ as the change in production. Finally, in step 5, steps 2 through to 4 are repeated B times for each $k = 1, 2, 3, \dots$ and n , and finally the set $\{\hat{\theta}_{kb}^*, b = 1, 2, \dots, B\}$ is calculated. The set $\{\hat{\theta}_{kb}^*, b = 1, 2, \dots, B\}$ obtained by this procedure can be expressed as follows; equations (1) and (2) using $(\hat{\theta}_k^* - \hat{\theta}_k) \hat{P} \sim (\hat{\theta}_k - \hat{\theta}_k) P$ that the difference between the Bootstrap efficiency $(\hat{\theta}_{kb}^*)$ and the calculated efficiency $(\hat{\theta}_k)$ obtained from the randomly sampled set $\hat{P}$ described above converges to the difference between the efficiency (θ_k) and the calculated efficiency $(\hat{\theta}_k)$ of population P

$$bias_{p,k} = E(\hat{\theta}_k) - \theta_k \quad (1)$$

$$bias_{p,k} = E(\hat{\theta}_k^*) - \hat{\theta}_k \quad (2)$$

Figure 1 Bootstrapping DEA flowchart (see online version for colours)

Here, equation (2) can be estimated as in equation (3), bias-corrected θ_k can be estimated as in equation (4), and the standard deviation of $\hat{\theta}_k$ can be estimated as in equation (5).

$$\widehat{bias}_k = \frac{1}{B} \sum_{b=1}^B \widehat{\theta}_{k,b}^* - \widehat{\theta}_k = \overline{\theta}_k^* - \widehat{\theta}_k \quad (3)$$

$$\bar{\theta} = \widehat{\theta}_k - \widehat{bias}_k \quad (4)$$

$$\widehat{se} = \left\{ \frac{1}{B-1} \sum_{b=1}^B \left(\widehat{\theta}_k^* - \overline{\theta}_k^* \right)^2 \right\}^{1/2} \quad (5)$$

In addition, the determinant analysis method utilises a truncated regression model based on the empirical results of Simar and Wilson's (2007) Monte Carlo experiment and derives the determinants that affect the efficiency estimates of the bootstrap DEA.

The truncated regression model is one in which the sample is limited to observations when the dependent variable is positive. A truncated regression model also forecasts an outcome variable limited to a reduced sample of its distribution. A study of the truncated regression model is significant not just in and of itself, but also because it may provide fresh insights into related models.

One advantage of using a truncated regression model is that it can be used to model dependent variables in which certain observations are excluded from the analysis due to the dependent variable's value.

3.2 Selection of analysis target and variables

The choice of input and output variables is crucial to the proper application of DEA. According to Arabmaldar et al. (2024), the input and output variables for DEA should accurately reflect the retail firm's aims and sales scenario.

A total of 102 companies with unqualified audit opinions and no missing variables were collected from the financial statements as of the end of 2022 and selected for the final analysis. Even though this was good, availability and overconfidence bias respectively could have occurred which could influence the final results but that is not the focus of this study. By size, there are 47 large companies and 55 small and medium-sized companies, and by business type, there are 20 department stores, 22 hypermarkets, 30 supermarkets, 6 convenience stores, 4 home shopping, and 20 e-commerce companies. In addition, the output variable for estimating technical efficiency is the sales of distribution companies, and the input variable is divided into inventory and tangible assets to reflect the characteristics of the retail industry, and the number of employees is included to design the final research model. The determinant variables included the profitability and safety of the company, which were further subdivided into debt ratio, quick ratio, and operating interest coverage ratio in consideration of the recent COVID 19 pandemic which affected the finances of the retail industry. Therefore, more specific variables that were considered as determinants were sales gross profit margin, debt-equity-ratio, quick ratio, operating interest coverage ratio, age, size dummy (large 1, small 0), and industry dummy (online 1, offline 0).

3.2.1 Variable explanations

First, the gross profit margin tells you how much your company generated after paying for the direct costs of doing business. A large gross profit margin suggests that a corporation is generating earnings in excess of its costs. The gross profit margin is expected to be higher for companies with high technical efficiency as they stick to their core business activities, but it is included as a determining factor considering that the profitability of the industry has been deteriorating in recent years.

Second, the debt-to-equity ratio compares the amount of debt used to fund a company's assets to the value of its owners' equity. The debt-to-equity (D/E) ratio was included as a determinant to examine the influence between financial stability and efficiency, considering that the proportion of financing from others for new store openings and expansion of existing stores has been increasing in recent years, increasing financial risk in these industries. A high debt-to-equity ratio shows that a firm is borrowing more cash from the market to support its operations, whereas a low debt-to-equity ratio suggests that the company is utilising its assets more effectively and borrowing less money from the market.

Third, the fast ratio assesses a company's capacity to swiftly turn liquid assets into cash to meet short-term financial obligations. A good quick ratio may show the company's capacity to withstand crises or other occurrences that cause temporary cash

flow issues. The quick ratio was included as a determinant to examine the level of a company's ability to pay short-term debts relative to financial risk.

Forth, the interest coverage ratio is an indicator of interest-bearing capacity, which is an indicator of a company's short and long-term solvency, and is expected to increase as a company's profitability and technical efficiency increase. It is also a debt and profitability ratio that determines a company's capacity to pay interest on outstanding debt. Intuitively, a smaller ratio suggests that there are less operational revenues available to cover interest payments, increasing the firm's sensitivity to changing interest rates. Since a result, a greater interest coverage ratio signals better financial health, since the company is better equipped to fulfil its interest payments. The interest coverage ratio is used to estimate the firm's ability to pay interest on existing debt.

Fifth, enterprise age is the period between the first formation of a company and the current moment (in years). Enterprise age is included as a determinant by measuring the age as of 2022 after the date of establishment.

Six, in business studies, firm size refers to a company's operating scale. It is typically determined by a range of indicators, such as total revenue, asset value, employment numbers, and firm volume. The size dummy (1 for large firms and 0 for small firms) is included as a determinant to examine whether differences in size affect technical efficiency.

Last, the industry type variables which is a collection of productive businesses or organisations that manufacture or provide goods, services, or sources of money are included as determinants to examine whether differences in industry (1 for e-commerce and 0 for non-e-commerce) affect technical efficiency, considering that online purchases are expanding due to the recent expansion of internet and mobile users. The items and their definitions are presented in Table 1.

Table 1 Definition of decision-making units (DMUs)

<i>Item or DMU</i>	<i>Definition</i>
Department store	Department stores are retail establishments that provide a broad selection of consumer goods in different areas within the shop, with each area (referred to as a "department") focusing on a certain product category
Hypermarket	A hypermarket is a type of retail establishment that combines a grocery shop and department store
Supermarket	A supermarket is a self-serve store with several departments selling a range of foods, drinks, and home goods
Convenience store	A convenience store is a little, neighbourhood shop that is convenient to go to that carries packaged items and everyday necessities like milk and bread
Home shopping	Home shopping is shopping that people do by ordering goods from their homes, usually either online or through television channels
Ecommerce business	An ecommerce business is a company that generates revenue from selling products or services online

4 Empirical analysis and discussions

The results of the bootstrap DEA to estimate the technical efficiency of major Chinese retail enterprises show that large companies are relatively more efficient than small and medium-sized companies by size as shown in Tables 2 and 3, and by industry, department stores, hypermarkets, and e-commerce are estimated to be more efficient.

Table 2 Management efficiency analysis by size

<i>Category</i>	<i>Large enterprises</i>	<i>Small and medium-sized businesses</i>	<i>All</i>
Mean	0.245	0.096	0.165
Standard deviation	0.198	0.155	0.191

Table 3 Management efficiency analysis results by industry

<i>Category</i>	<i>Department stores</i>	<i>Hypermarket</i>	<i>Supermarket</i>	<i>Convenience store</i>	<i>Home shopping</i>	<i>E-commerce</i>	<i>All</i>
Mean	0.350	0.221	0.061	0.102	0.099	0.106	0.165
Standard deviation	0.206	0.222	0.112	0.078	0.006	0.115	0.191

These findings show that larger retail organisations may often achieve internal economies of scale, cutting costs and raising output levels by acquiring resources in bulk, owning a patent or unique technology, or having access to additional funding (Tampuri Jnr et al., 2021). However, tiny retail enterprises do not receive all of these perks, rendering them inefficient.

Findings from the results reveal that all determinant variables affecting efficiency were found to be significant, and the signs were derived differently depending on each determinant. For example, as can be seen in Table 4, the gross profit margin and operating profit interest coverage ratio were found to have a positive (+) effect on efficiency, but the debt-to-equity ratio and quick ratio had a negative (–) effect on efficiency which was seen to have an impact. In addition, enterprise age, business size, and business type dummy variables were all analysed to have a positive (+) effect on efficiency. The implications of these analysis results can be summarised as follows:

First, the higher the gross profit margin or profitability financial ratio, the higher the technical efficiency of major Chinese retail enterprises, indicating that improving profitability strengthens management efficiency. This study results also implies that major Chinese retail firms may keep more capital and effectively produce profit over and above their expenses (Abdellahi et al., 2017). This suggests that the firms are operating effectively.

Second, the lower the debt-to-equity ratio, the higher the management efficiency, indicating that proper financial risk control strengthens management efficiency. The implication is that major Chinese retail firm's stockholders have more equity, and does not need money to fund its business and operations for development or growth (Seissian, 2024). This result is good since it shows that these firms are performing well as they should.

Third, the lower the quick ratio, the higher the technical efficiency, indicating that the lower the ability to pay short-term debt, the stronger the efficiency. This implies that

since the firms are not able to pay their indebtedness their small capital still remains in the company (Gajdosikova et al., 2023). Hence, the company does not have the ability to spend. The results further suggest that quick ratio is negative and significantly related to technical efficiency however this is mitigated by their interest coverage ratio which makes them able to pay off the interests due on long term loans.

Fourth, the higher the interest coverage ratio, the higher the technical efficiency, indicating that the higher the short-term and long-term interest-bearing capacity, the stronger the technical efficiency. The inference is that retail enterprises have superior financial health, and hence the corporation is better able to meet interest payments. However, a high interest coverage ratio may indicate that a firm is missing out on opportunities to boost its profitability through leverage (Arhinful and Radmehr, 2023).

Fifth, the older the age of the firm, the stronger the technical efficiency, suggesting that management efficiency is strengthened by the accumulation of management know-how, such as sales, after a certain period of time after establishment. This result confirms that businesses become more efficient as a result of their expanding reservoir of expertise in the specific sector (Anaba et al., 2020).

Sixth, for the size and industry dummy variables, the larger the size, the higher the technical efficiency, and e-commerce companies are more technologically efficient than other industries, respectively. This goes to suggest that larger firms enjoy economies of scale thereby resulting in a high technical efficiency which is positive and significant.

Table 4 Determinant factor analysis results

<i>Category</i>	<i>Estimate</i>	<i>Std. Error</i>	<i>t-value</i>
(Intercept)	1.21E-01	9.71E-04	124.31***
Gross profit margin	8.04E-04	4.75E-05	16.95***
Debt-to-equity ratio	-1.89E-07	1.28E-08	-14.739***
Quick Ratio	-5.22E-04	5.22E-06	-100.073***
Interest coverage ratio	1.18E-09	7.84E-11	15.065***
Enterprise age	3.88E-03	4.40E-05	88.017***
Business size	1.89E-01	1.09E-03	173.711***
Business type	4.57E-02	1.22E-03	37.412***
Sigma	1.95E-01	3.36E-04	579.779***

***p-value < 0.001.

5 Conclusion

This study uses bootstrap DEA and truncated regression models to examine the technical efficiency and its determinants of major Chinese retail enterprises. First, the results of technical efficiency estimation using bootstrap DEA show that large firms are relatively more efficient than small and medium-sized firms by size, and department stores, hypermarkets, and e-commerce are more efficient by industry. Second, the results of the determinant analysis showed that among the profitability financial ratios, the operating profit margin, which indicates the performance of a company's fundamental activities, and the interest coverage ratio, which indicates the ability to pay short-term and long-

term debts, have a positive effect on technical efficiency, indicating that companies with higher operating profit as a percentage of sales and superior short-term and long-term debt payment capabilities have higher technical efficiency. On the other hand, the debt-to-equity ratio and quick ratio have a negative effect on technical efficiency, suggesting that highly efficient companies need to strengthen their short-term debt solvency. In addition, the age, size, and industry dummy variables have a positive effect on technical efficiency.

5.1 Implication for managers

This study has significant management ramifications, as discussed above. First, according to the findings, the majority of small and medium-sized businesses were less efficient than larger businesses. This suggests that these retail companies may not have adequately adapted or applied new technology into their operational procedures. Changes in technological is one of the most essential factors of future competitiveness in retailing, and the effective use of new technology delivers considerable competitive benefits to enterprises accomplishing innovation and enhancing retail efficiency. As a result, it is proposed that these Chinese retail firms reassess their operating methods in order to increase technical efficiency and the use of new technologies in retail.

Second, the retail industry is intensely competitive, and employee efficiency is one of the key factors contributing to its success. The more effective your employees are, the greater your retail productivity. Improved efficiency in the Chinese retail firms will lead to improved customer service, more profitability, and the capacity to outperform the competition.

Third, consumers' demands for choice have increased in recent times, specialist shops, particularly supermarkets that specialised in various product, should expand their product offerings. When competing with department stores, they should offer a wide range of items and services to their clients, such as discounted clothing, appliances, electronics, consumer financial services, and consumer telecommunications. Hence making them financially strong to be able to pay their quick ratio.

5.2 Implication for policymakers

From a policymaker's standpoint, there are various consequences that must be examined.

First, Fiscal and monetary policies: Policymakers must devise fiscal and monetary policies that support firm growth and stability. This entails implementing policies that give financial assistance to firms during economic downturns, such as low-interest loans and tax cuts. It also requires policies that encourage consumer spending and investment.

Second, Innovation and technology: Policymakers must encourage innovation and technology to enhance business development and resilience. This entails enacting policies that encourage research and development as well as policies that facilitate the adoption of new technology. For example, encouraging the use of digital technology may help organisations adapt to changing customer behaviour and remain competitive.

Third, Skills development: Policymakers and companies must invest in skill development to guarantee that the workforce is prepared for success in the retail industry. This might include training programs and the recruitment of fresh people with relevant capabilities.

Last, Increased regulation: Policymakers must regulate these retail organisations to safeguard consumers and businesses from possible threats. This may include introducing new legislation or enhancing current rules that regulate these retail enterprises.

5.3 Limitations and recommendations for future research

As our findings are based on cross-sectional data, future research should extend the study to longitudinal data. The study also recommends that future studies need to test other variables other than the ones used in this study, employing different methodologies, and examining different sectors within retail. Since this study only used p. values to indicate statistical significance it is important that in future research additional robustness checks, such as sensitivity analysis should be conducted.

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