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Do Internet Cookies Satisfy Companies' Hunger of Profit Seeking? In the Context of China Retail Industry

Qing Han

Jinan University, China.

Abstract

This academic paper delves into the consequences of internet cookie utilization on the operational proficiency of China retailers, drawing a distinct line between company-deployed and third-party cookies. It examines the varying effects of these cookie types on specialty retailers and platform operators, taking into account external factors such as the legal framework and customer demographics. The research reveals that retail enterprises actively employing third-party cookies demonstrate notably higher success rates. Specialty retailers excel in transforming diverse customer insights gleaned from third-party cookies into tangible profit. Additionally, the study explores the moderating effects of the legal interventions on the aforementioned profit-generating pathways.

Keywords: China retail industry, DuPont ratio, Legal intervention, Third-party cookies.

1. Introduction

With the rapid development of information technology and its continuous integration with the economic operation mode, digital economy has been regarded as a "new engine" of economic growth, Playing a vital role in the advancement schemes of numerous nations on Earth. The calculation results (Xu and Zhang, 2020) show that in year 2017, the value added of China's digital economy reached 5302.89 billion yuan, accounting for 6.46% of gross domestic product; the total output of the digital economy was 14757.41 billion yuan, accounting for 6.53% of the total domestic output. From the perspective of international comparison, China's digital economy value added was about 58.12 percentage of that in the United States, and the proportion of digital economy value added in GDP was lower than the United States by 0.44 percentage points in 2017. From 2008 to 2017, China's digital economy expanded at an average annual growth rate of 14.43%, whereas the real gross domestic product increased at a rate of 8.27%. It is evident that the digital economy plays a significant role in propelling economic growth.

The manner in which digital data is translated into profit can be summarized as follows. On one hand, explicitly, the data Per se could be traded for profit. Bergemann and Bonatti (2015) studied the two distinguishing features of online markets: (1) individual queries (as opposed to access to an entire data base) are the actual products for sale. (2) linear pricing is predominantly use. Advertisers specify which consumer segments and how many total users they wish to acquire, and pay a price proportional to the number of users. On the other hand, implicitly, data are applied to price discrimination for sales promotion. (1) Offering lower price to new customers identified by cookies. (2) By analyzing the geolocation data provided by cookies, if a consumer is in close proximity to a competitor's store, they can be offered a lower price to dissuade them from visiting the competitor and hinder their business growth.

Meanwhile user profiling and personalized recommendation have become more and more common in the network society and posed challenge to the protection of personal information.The commonly used method for tracking and collecting user information on websites is cookie technology. The main reason why cookie technology is widely applied is because it helps the servers run by business entities know what the users' previous actions were, thereby facilitating the functionality of interactive web applications.

With the introduction of relevant regulations (as presented in Table 1), stricter controls have been imposed on the usage of consumer data by companies. These control measures may restrict the competitiveness and growth potential of businesses in the market. However, this could also lead to increased safety and protection of consumer data, thereby enhancing consumer trust and loyalty towards businesses. Therefore, despite the challenges imposed by these regulations, there is a possibility of creating a better business environment for companies, fostering sustainable development. It is crucial for businesses to adapt to these regulations and find compliant ways to utilize consumer data in order to maintain their competitive advantage in the market. Therefore, the actual impact is contingent upon factors such as the company's capacity to effectively integrate and analyze data, as well as the legal environment in which it operates.

Acknowledging the direct implications of personal information acquisition techniques on corporate operations, as well as the intervening effects of diverse constraints, this study systematically presents pertinent examinations in a progressively logical manner as delineated below: firstly, this study conducts an analysis to identify the

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functional advantages of third-party cookies in comparison to self-deployed cookies. Subsequently, it builds upon this analysis to empirically verify the notable influence of third-party cookies on the operational performance of companies within the retail industry. Secondly, this paper categorizes companies in the retail industry into specialists and generalists(as presented in Table 3), emphasizing the former's pathway and privileged standing in leveraging cookies. In addition, this study aims to validate the regulatory role played by legal provisions pertaining to individual privacy protection in shaping the aforementioned approaches. Finally, utilizing mediation effect testing, this paper analyzes the reasons for the inefficient utilization of self-deployed cookies.

In terms of robustness testing, firstly, this study employs the bootstrap method to mitigate the potential impact of sample size on the stability of the findings, thereby validating the primary conclusions. Secondly, a two-stage model is utilized to control for the potential confounding effects arising from self-selection bias within specialists and generalists in the sample.

2. Literature Review and Hypothesis Development

2.1. Information Technology and Business Operation

In general, a significant research effort has gone into examining the output contribution of the IT capital input. Information and Communication Technology(ICT) and R&D are significantly associated with value added for most specifications. IT-based innovations such as increased efficiency, reduced costs of monitoring and coordinating activities, quicker response to demand, superior performance, reduced lead time, custom fit, etc., have been found to reflect on a firm's total factor productivity (Chou et al., 2014). By making a distinction between software and hardware ICT, Edquist et al. (2017) concludes that all industries invest in hardware, but only the ones that successfully invest in and implement software enjoy positive effects from ICT. Khanna et al.(2021) indicate that both IT and R&D have led to total factor productivity （TFP） growth in the manufacturing firms of India. However, firms that invest in developing both IT and in-house R&D capabilities are able to garner superior TFP performance than firms that invest in IT or R&D alone.

Specifically, in the context of exploring the mechanisms by which IT technology augments sales activities, the existing literature provides persuasive evidence to substantiate this assertion.

a. In general, a study by BSA Software Alliance in the United States indicates that big data analytics (BDA) contributes to 10 % or more of the growth for 56 % of firms (Columbus, 2014). with technology-driven innovations ranging from one-click ordering to personalized recommendation to smart speakers to anticipatory shipping, online sales enterprises, such as Amazon, have redefined shopping and displaced many brick-and-mortar retailers(Shanka, 2019). In china, the total output of the digital economy was 14757.41 billion yuan, accounting for 6.53% of the total domestic output (Xu et al., 2020).

b. In terms of the effect on customers, progress in information technology permits a return to an earlier era of hometown service, when customers were treated as individuals, products were often tailored to personal needs, and customer support was provided throughout the product's life cycle (Ives et al., 1990). Customer-facing technologies are used by customers and facilitated by retailers to enhance customer engagement with products, services, or brand. Mobile apps (Narang et al., 2019), and facial recognition technology (Kodra et al. 2013) may have both intended and unintended consequences on the customer relationship and the future of retailing.

c. For retailers, the decision to adopt a technology comprises the following issues: what technologies to adopt at what moment in time, with how much investment, and what path, sequence of action, or execution. These decisions are typically made based on an assessment of risk and cost-benefit analysis （Shankar, 2021). The technological solutions that retail experts identify as enablers of four key competitive strategies: product superiority, enhanced customer experience, frictionless shopping experience and operational excellence(Quinones, 2023).

2.2. Cookies and Information Collection

The commonly used method for tracking and collecting user information on websites is cookie technology. From a technical perspective(Ding, 2019), the following categorizations can be made: as for HTTP cookies, as long as the user enables cookies and does not delete the stored cookie ID in the browser, the website can persistently access cookies and retrieve the information stored in them. However, once the user disables cookies, the website cannot use cookie technology to provide services or collect cookie information. Compared to HTTP cookies, Flash cookies have a larger storage capacity, longer storage time, and are harder for users to detect. These characteristics make Flash cookies more advantageous for tracking and collecting user information. Even if users delete their browsing history or switch to a different browser, websites can still track and collect their personal information if Flash cookies are used. Ever cookies incorporate additional tracking mechanisms apart from cookies. They leverages newer web technologies such as HTML, LocalStorage, Flash cookies, and Web History to store user data. By combining multiple storage options, they becomes even more difficult for users to completely erase their digital footprint. This version can also generate a unique identifier for each user, making it even more challenging to escape its tracking capabilities.

In terms of their origin and related functions, cookies can be categorized as company-deployed cookies and third-party cookies. Their commonalities encompass the following: (a) User behavior tracking - Both company-deployed and third-party cookies are capable of monitoring users' activities on websites, including but not limited to the pages they browse, the duration of their stay, and the keywords they search for. (b) Enhancement of user experience - Through the acquisition of data pertaining to users' preferences and behaviors, enterprises can gain a deeper comprehension of their requirements, ultimately facilitating the delivery of more tailored services and experiences.

The main disparities between the two are as follows: (a) Origin. Company-deployed cookies originate from and are under the purview of the company itself, whereas third-party cookies stem from and are administered by external service providers, such as advertising agencies or data analytics firms. (b) Objective: The primary objective of company-deployed cookies is to elevate the website's user experience and service quality, for example, by retaining users' login statuses or cart contents. Conversely, third-party cookies aim to amass data on users' interests and behaviors, enabling more targeted advertising placements and analytical insights for advertisers.(3)

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Privacy considerations: Given that company-deployed cookies operate within the confines of the company's website, safeguarding user privacy is relatively straightforward. However, the involvement of multiple websites and service providers in the case of third-party cookies elevates the risk of privacy infringements.

2.3. Regulations on Privacy Protection and Enforcement

As various aspects of online activity continue to grow at a rapid pace, online privacy remains a key focus of consumer advocates and public policy makers. According to various economic models （Kahn et al. 2000 , Miyazaki 2008 and Campbell et al. 2015） , implementing a system that collects data for enhanced customer segmentation and targeting might not be mutually beneficial for all stakeholders.

The placement of third-party cookies is often facilitated by the use of "clear GIFs," which are tiny graphic images that measure only one pixel by one pixel in size. Due to their minuscule dimensions, these GIFs are essentially invisible to the consumer, meaning users are typically unaware of their presence on a website(Martin, Wu, and Alsaid 2003). The FTC (2000) described cookies as a "nonobvious" means of information collection and their undisclosed use as a clear violation of the notice aspect of fair information practices. Many firms, from search engines like Google to credit card companies like Capital One, have realized considerable profits on the basis of the ability to analyze massive amounts of customer data in order to improve their offerings.

As for the counter-measures, Kahn et al.(2000) suggested the standard Coasian logic which does not asks for many interventions comes to the mind: given an unambiguous initial assignment of rights and sufficient flexibility in contracting, efficiency in information revelation and operation arrangement will result. However, Coasian bargaining may be impeded by either an inability to make certain commitments between A (customers) and B (firms, who withdraw information from cookies) or by the presence of significant investments by C (outsiders) that must be made before the transaction on data selling occurs. The transaction is socially desirable if and only if the resulting gain in utility by C outweighs any loss of utility suffered by A (from privacy infringement) and B (compensating A's loss) .

Therefore, due to the failure of Coasian bargaining without interventions, the regulations over privacy protection across the major jurisdictions are in Table 1. In general, personal information encompasses any data capable of identifying an individual. Given that cookies have the potential to harbor sufficient data to uniquely identify a user, they may, under specific circumstances, be classified as personal information and thus fall within the scope of personal information protection legislation and regulatory frameworks.

Within the European context, the General Data Protection Regulation (GDPR) mandates that processors must secure user consent prior to the collection, utilization, or storage of non-essential cookies. Furthermore, they are obligated to furnish transparent details concerning the nature and purpose of each cookie's data. Additionally, these regulations necessitate that access to services remains unimpeded irrespective of cookie preferences, while also ensuring that users can effortlessly withdraw their consent and erase their personal information contained within cookies.

In the United States, the regulation of cookies is devoid of federal oversight; however, certain state-level legislation, such as the California Consumer Privacy Act (CCPA), recognizes cookies as personal information. According to the CCPA, while user consent is not a prerequisite for the deployment of cookies, disclosure of their usage is mandatory. Notably, if cookies are utilized for targeted advertising, which might be construed as a sale of personal information, obtaining opt-in consent from users becomes necessary.

In contrast, China's regulatory landscape governs cookies under the Personal Information Protection Law (PIPL). This legislation stipulates that processors must secure explicit consent from users prior to collecting or processing their personal information through cookies. Additionally, processors are compelled to provide users with clear information regarding the data collected, its intended purpose, and its utilization. It is imperative that data garnered through cookies is exclusively employed for the purposes declared during the collection phase. Moreover, users are entitled to access, rectify, delete, or withdraw their consent concerning the data collected.

Table 1. Major Regulations on Privacy Protection.

Published Year/Jurisdiction	Jurisdictions and Title
People's Republic of China	
2016	Network Security Law of the People's Republic of China
2021	Personal Information Protection Law
The United States of America	
1974	Privacy Act
1986	The Electronic Communication Privacy Act
1998	Children's Online Privacy Protection Act
1999	Gramm-Leach-Bliley Act
2003	Fair and Accurate Credit Transactions Act
2020	California Privacy Rights Act
2022	American Data Privacy and Protection Act
Europe	
1997	Bundesdatenschutzgesetz（BDSG，Germany）
2000	Data Protection Act （Britain）
2016	Computer Science and Freedom Act （France）
2018	General Data Protection Regulation (European Commission)

The consequences of the regulation enforcement could be controversial, between theory and practice. As for theory, the idea that regulation designed to protect consumers can entrench incumbents has a long history in industrial organization. For example, Farr et al. (2001) and Clark (2007) argue that advertising restrictions (for cigarettes and children's breakfast cereals respectively) benefited the existing producers. Similarly, an average price cap regime can act as a powerful source of entry deterrence (Armstrong and Sappington, 2007) . To be conclusive,

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Campbell et al. (2015) summarized how regulatory attempts to protect the privacy of consumers' data affect the competitive structure of data-intensive industries. The commonly used consent-based approach may disproportionately benefit firms that offer a larger scope of services, or the generalists. Therefore, though privacy regulation imposes costs on all firms, it is specialists and new firms that are most adversely affected.

However, as for the enforcement practice, Sabatino and Sapi (2022) empirically analyse the effects of the 2009 ePrivacy Directive in Europe on firm revenues. The results point against the results of Campbell et al. (2015) and Jia et al. (2021). While these papers attribute a negative effect to privacy regulation on businesses, the very paper found on average no significant negative effect on revenues, and only large firms were weakly negatively affected by the implementation of the Directive. Meanwhile, the efficacy of legal enforcement exhibits disparities across diverse regions. Jia et al. (2021) provide an early assessment of the European General Data Protection Regulation (GDPR) that came into effect in May 2018. The authors look at the effect of the GDPR on venture capital investment activity, and argue that the regulation reduced EU ventures, relative to their U.S. counterparts.

2.4. Derive Profit from Personal Information Acquired Via Cookies

Given the feasibility and profitability in terms of technology and compensations for utilities from privacy loss, personal information can be monetized through the following channels.

Explicit ways of Cashing from cookies. Ghosh et al. (2012) study the revenue implications of cookie-matching. The two distinguishing features of online markets for data are the followings: (i) individual queries (as opposed to access to an entire data base) are the actual products for sale,and (ii) linear pricing is predominantly use. Advertisers specify which consumer segments and how many total users they wish to acquire, and pay a price proportional to the number of users. These features are prominent in the market for cookies, but are equally representative of many online and offline markets for personal information.

Implicit ways of Cashing from cookies, price discrimination. a. Offering lower price to new customers identified by cookies. At the initial stage of a user downloading an online shopping app, the app usually provides the user with a certain amount of voucher or discount voucher to stimulate initial consumption. This approach effectively attracts new users while enhancing their favorable impression, thus encouraging continued use. This practice also results in other operators losing that user. b. By analyzing the geolocation data provided by cookies, if a consumer is in close proximity to a competitor's store, they can be offered a lower price to dissuade them from visiting the competitor and hinder their business growth. The coverage bias when users search and process information obtained on user-generated content platforms does exists (Kerkhof et al., 2019).

In the context of retail industry, upon a user's submission of a search request through a browser to an e-commerce server, the server proceeds to inscribe the search keywords within a cookie, leading to the generation of a pertinent cookie file. This file, subsequently, becomes stored on the client's computer hard drive. When a user turns on their computer again and accesses the website, the server automatically detects the user's device, interprets the cookie file, searches for any related information with the partner website (third parties, such as supplies and marketing companies), and proceeds to automatically display advertisements based on the collected information.

The percentage of Web sites setting third-party cookies increased substantially. Such "third-party cookies" are often sanctioned by the visited Web site to build consumer profiles by the third-party organization for targeted marketing purposes (Lavin, 2006) .The main disparities between the two are in Table 2:

Table 2. The Comparison between Company-Deployed Cookies and Third-Party Cookies.

	Company-Deployed Cookies	**Third-Party Cookies**
Origin	Originate from and are under the purview of the company itself	Stem from and are administered by external service providers, such as advertising agencies or data analytics firms
Objective	Primary objective is to elevate the website's user experience and service quality (e.g., retaining users' login statuses or cart contents)	Aim to amass data on users' interests and behaviors, enabling more targeted advertising placements and analytical insights for advertisers
Privacy Considerations	Operate within the confines of the company's website, safeguarding user privacy is relatively straightforward	Involvement of multiple websites and service providers elevates the risk of privacy infringements

Noteworthy, marketing companies that utilize third-party cookies have a distinct advantage over retail companies without a strong IT background when it comes to achieving data mining goals. The marketing companies have access to diverse channels for gathering information, enabling them to assemble a vast array of data from multiple companies and continuously enhance their data analysis models to boost partner retailers' sales. On the other hand, retail companies that rely solely on their own cookies have limited capabilities to compare data and improve their models, ultimately hindered in their ability to effectively mine data. Since retail industry companies will reap greater benefits from their collaboration with these marketing data companies compared to struggling alone, the paper proposes:

Hypothesis 1 : In comparison to those with a lesser degree of usage, companies that heavily applied third-party cookies to sales enjoy greater profitability

As for retailers in China, the generalists and the specialists are different in many aspects, and the major ones concerning operation are summarized in Table 3[1]:

[1] Table 1 predominantly enumerates qualitative depictions of various business models, whereas quantitative indicators pertaining to finance and corporate governance are subject to analysis in the subsequent text.

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Table 3. The Comparison between the Generalists and the Specialists.

	The Generalists	**The Specialists**
Types of retail products	A full assortment of general merchandises	Specialized commodity sectors, including but not limited to nuts and juvenile products.
Source of goods	"The procurement strategy is primarily focused on the direct acquisition of finished goods, with a supplementary component of OEM products[2]. As an illustration, consider milk branded under retailers' label."	Some segments of product portfolio consists of OEM products, whereas another segments encompasses goods produced in-house, particularly those carrying substantial value addition.
Supply chain management	Bargaining procurement costs and product quality with the suppliers of finished products as well as the contracted manufacturers in OEM arrangements.	In addition to coordinating with suppliers of finished products and OEM partners, the companies also engage with suppliers of raw materials that are crucial to the production of goods.
Form of Sale	Both on-site sales and internet sales, and the operational paradigm of the latter has been formulated with reference to the precedents set by the former.	Both on-site sales and internet sales, nevertheless, the business model of the latter has been developed in an autonomous manner, distinct from that of the former.
The extent of data dissemination with external third parties (the percentage of third-parties cookies to total cookies set by the retailers)	Relatively narrow	Relatively wide

Campbell et al. (2015) employs the existence or absence of legal enforcement, alongside the superior quality of the products offered by the specialists, to discern the optimal decision-making strategies for both the specialists and the generalists amidst fluctuations pertaining to these two factors. In the absence of privacy protection regulations, both new entrants and existing major platforms would readily introduce products that have been processed with personalized information or location targeting. Meanwhile, consumers may also adopt products from both parties simultaneously.

In the presence of privacy protection regulations, if customers perceive the cost of privacy infringement is within tolerance, both established generalists and new specialists will choose to offer products that have undergone enhanced information processing. On this condition, for both parties, the incremental benefits outweigh the side effects due to customer -information enhanced products. Conversely, if the cost is high, both parties will opt for "original" products that have not been subjected to personal privacy data strengthening.

When the cost is neither high nor low, the product structure is determined by the quality or the service premium provided by the new specialized provider. If the new specialists offers high quality premium, the established generalists may not offer "information-enhanced" products, while the specialized provider will stick to "innovative products" with information enhanced. The reasons: (1) To new specialized retailers as mentioned in Table 3, they demonstrate a deeper level of engagement in the supply chain and manufacturing processes of the products they offer for sale, thus enhancing product premiums within a niche and differentiate themselves from major platforms seems quite plausible. Even costs of privacy infringement which could not be ignored, the premium armed with information-enhanced marketing could secured returns. (2) To established generalists, in the short term, the strong capability and diversified channels of cashing cookies with reasonable costs could still be edges to deter competitors and maintain market share. However, in the long run, if the premium products from new specialized entrants had been highly endorsed by needy customers, the commitments on information-enhanced products in the niche would be compromised.

To sum up, since in most scenarios regarding the costs to customers of privacy infringement (except in cases where such costs are extremely high[3]), specialized retailers, in contrast to general retailers, exhibit a stronger inclination towards utilizing products enhanced through the incorporation of personal information, and they demonstrate a greater propensity to employ third-party cookies (for third-party cookies percentage in Table 7, specialists' 25% versus generalists'12%) as a means of acquiring this information. The paper proposes:

Hypothesis 2 : Compared to general retailers, specialized retailers can generate higher profits from products that have been enhanced using personal information.

Burt（1992）introduced the concept of structural holes in his study. He defines structural holes as a phenomenon in social networks where certain individuals or groups have direct connections with some individuals, however lacking direct connections or experiencing intermittent relationships with some others. This creates gaps or holes in the overall network structure, resembling a network with empty spaces or voids. In enterprise networks with rich structural hole positions, certain nodes act as "bridges" between separate sub-networks. These bridge nodes play an intermediary role by facilitating information communication and exchange between previously disconnected parts of the network.

Corresponding to this paper, the retailers' supply chain is essentially a complex social network that includes multiple nodes such as manufacturers, suppliers, distributors, retailers. Structural holes around the retailers affect

[2] OEM (Original Equipment Manufacturer) production, commonly known as "contract manufacturing" or "private labeling," refers to a business practice where the brand owner does not directly manufacture its products. Instead, it commissions other manufacturers with production capabilities to produce the products according to its requirements and standards, and then affixes its own brand logo onto the products.

[3] Given the relatively recent enactment and implementation of China's Personal Information Protection Law in 2021, it is reasonable to expect that enterprises will be granted a period of adjustment in terms of compliance.

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the stability of the network, whereas possessing more heterogeneous information enhances the leading role of these retailers as key nodes (Yao et al., 2018), which are greatly enhanced by cookies: for the advantages enjoyed by the retailers inside the network, by utilizing cookies retailers can acquire more diverse supply chain information (both downstream and upstream), enabling them to gain control and possess informational advantages in competitions, thus increasing their chances of becoming and remaining vital bridge nodes (Chen, 2015); as for the advantages outside the network, since the third-party cookies encompass various partners within the supply chain, it implies that retailers are engaging in direct sharing of crucial information, thereby mitigating the diminishing effect of information transmission and harnessing the information to facilitate profit generation for the entire network.

In the realm of retailers' downstream operations, the utilization of cookies emerges as a pivotal instrument for acquiring comprehensive clickstream data. The heightened diversity among customers results in an abundance of data, which, in turn, elevates the efficacy and precision of endeavors such as sales forecasting and customer behavior analysis. As Chinese retail landscape undergoes a ubiquitous digital transformation (liu.et al.,2019; Wu et al., 2021), the information procured via cookies can be promptly disseminated to various partners within the supply chain. Specifically, the retailers with rich information enjoy: (1) Predict demand changes: by analyzing historical sales data, market trends, and consumer behavior, they can more accurately forecast future demand, thereby optimizing inventory management and procurement decisions. (2) Innovate business models: based on in-depth market insights and understanding of consumer demands, they can develop new products or services to meet changing market needs and create new growth points

As for upstream operations, the presence of a multifaceted network of suppliers, each with their own sales channels, reinforces the ability of retail enterprises to validate information and align demand, significantly diminishing the potential for information distortion or ineffectual utilization. Specifically, there are: (1) Improve operational efficiency: with real-time insights into every aspect of the supply chain, including production progress, logistics status, and inventory levels, they can reduce delays and stock-outs, enhancing customer satisfaction. (2) Strengthen supplier collaboration: by establishing closer partnerships with upstream suppliers and sharing information and collaborative planning, they can improve the efficiency and responsiveness of the entire supply chain. Sharing market intelligence, trends, and customer feedback helps suppliers better understand demand patterns and adjust their operations accordingly. Therefore , the paper proposes:

Hypothesis 3 : Retail businesses that have access to a wider range of supply chain data are with higher profitability.

3. Methodology

The main research methods employed in this article are as follows :

3.1. Data collection.

1. The study investigated all 80 listed firms from retail industry according to CSRC (China Securities Regulatory Commission) industry classification, for the year of 2022. The category number of cookies files launched by official websites of the retailers have been collected from the Developer Tools in the Google Chrome browser. Financial data for the samples are derived from the from the WIND database which is the market leader in China's financial information services industry.
2. Data Analysis. The study presents empirical examinations in a progressively logical manner as delineated below: firstly, this study conducts an analysis to identify the functional advantages of third-party cookies in comparison to self-deployed cookies. Subsequently, it builds upon this analysis to empirically verify the notable influence of third-party cookies on the operational performance of companies within the retail industry. Secondly, this paper categorizes companies in the retail industry into specialists and generalists, emphasizing the former's pathway and privileged standing in leveraging cookies. Meanwhile, it explores the moderating effects of the legal intervention on the aforementioned profit-generating pathways. Finally, utilizing mediation effect testing, this paper analyzes the reasons for the inefficient utilization of self-deployed cookies.

3.2. Variable Measurement and Sample Description

By referencing the literature (Chen, 2015) on utilizing personal information for promoting companies operational efficiency, this paper utilizes the DuPont analysis formula ROA=Profit Margin × Asset Turnover as the dependent variable in the pooled regressions. The purpose is to capture the impact of utilizing customer personal information on the overall profitability of company assets, as well as its subdivided goals such as operating efficiency and asset use efficiency.

As for the independent variables “thdckiepe”, the number of third-party cookies divided by the total number of cookies is in place. The category number of cookies files launched by official websites of the retailers have been collected from the Developer Tools in the Google Chrome browser.[4]

3.2.1. Adjustments for the Test of Hypothesis 3

To make a distinction between generalist retailers and specialist retailers regarding the efficiency of cookie-based information gathering, it is crucial to categorize companies that exclusively operate within specific product categories as specialists. Concurrently, other companies would be classified as generalists, offering sales across various product categories.

To delve deeper into the incremental impact of cookies on the informational advantage conferred by structural hole nodes (or bridges), this study incorporates the sales share of the top 5 customers. A smaller value for this variable signifies a more dispersed customer base, indicating that the retail company is likely to be located in different nodes within the information structure holes. These nodes could connect third-party companies and

[4] Randomly selected days throughout each week of year 2022 would be chosen to record these variables. The ratio was calculated for the day. Then the data for each day would be added up, and at the end of the year, the total would be divided by the number of recorded days to obtain the average of the ratio.

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customers, or act as a bridge between suppliers and customers. For the convenience of illustration, this study employs reciprocal value of the sales share of the top 5 customers, referring to as "top5reverse". The interaction term between the ratio of third-party cookies and top5reverse, denoted as "thdckiepe*top5reverse".

In the supplemental test, this study aims to examine how the legal enforcement impacts businesses to profit from using cookies. While the Personal Information Protection Law came into effect in China in November 2021, the effectiveness may vary across different regions due to differences in the legal enforcement. Drawing on the Business Environment Index for China's Provinces 2020 Report[5], the study will consider the "rule of law environment index for enterprise operation" in the province where the sample companies are registered[6]. If the ranking of this index in the province is higher than the median of all provinces, a binary variable called "legal" will be assigned a value of 1, which signifies that the company's operating legal environment is characterized by a favorable level of governance, otherwise, 0. Whilst China's Personal Information Protection Law lays the legal groundwork for the safeguarding of personal privacy, exemplified by provisions mandating that processors must procure explicit consent from users before collecting or processing their personal information through cookies, the efficacy of its implementation is directly influenced by the legal environment within which enterprises operate. This influence manifests in the ways:

a. Assurance of judicial remedy: In instances where personal privacy rights are infringed upon, citizens possess the avenue to seek redress through legal means. The courts, adhering to legal provisions, will adjudicate infringements and render decisions, thereby ensuring the protection of citizens' lawful rights and interests.

b. Legal supervision: The legal environment underscores the importance of overseeing the enforcement of laws, encompassing legislative supervision, administrative supervision, and judicial supervision. This comprehensive oversight mechanism serves to guarantee that personal privacy protection laws are executed effectively, precluding any potential for legal vacuity or dilution.

3.2.2. Sample Description

The study includes all 80 listed firms from retail industry according to CSRC (China Securities Regulatory Commission) industry classification, for the year of 2022. Among the group, 43 are categorized as specialists, while 37 are designated as generalists[7]. The specific sales domains in which the specialists concentrate are delineated in Table 4.

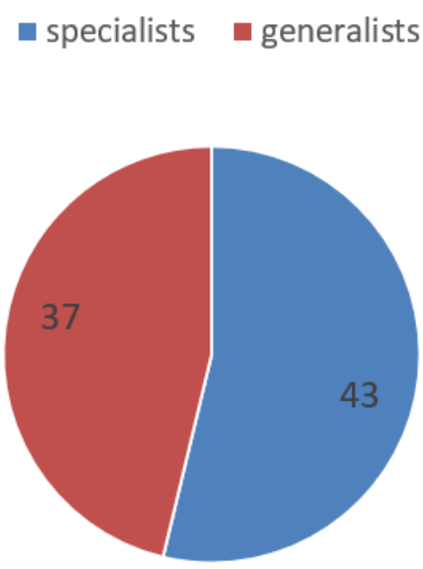

Figure 1. Sample Szie of Specialists and Generailists.

Table 4. The Specialists' Niche in Retailing.

Market Niche	Percentage
Chemical Fertilizer	5%
Children's and Baby Products	5%
Car Sales and Service	8%
Food Retailing	15%
Gold and Jewelry	15%
others[8]	23%
Pharmacy	30%
Total	100%

Bootstrap self-sampling was employed to test the regression results of key hypotheses, thereby verifying the robustness of the regression results under the constraint of a limited sample size. As for the sample period, on one hand, considering the challenges of collecting crucial variables such as cookies, tracking data changes throughout

[5] Wang,Xiao-lu., Fan, Gang.& Ma, Guang-rong.. 2018. Bushiness Environment Index for China's Provinces. Social Sciences Academic Press (China).

[6] This index is primarily constructed based on scores derived from four facets of the legal environment: judicial impartiality and efficiency, fulfillment of corporate contracts, safeguarding of operators' property and personal security, as well as the protection of intellectual property rights. The mean score across these four dimensions forms the basis of the index (ranging from a maximum of 5 to a minimum of 1). The survey (conducted between 2019 and 2020) sample encompasses chairpersons or chief executive officers from 1,891 enterprises in China.

[7] The details in the differences between specialists and generalists are in Table 3.

[8] In category counting for the specialists' niche in retailing , categories that occur only once, exemplified by eyewear, hardware, and outdoor sports equipment, are subsumed under the 'others' category.

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the entirety of year 2022 and manually gathering them would fall within a reasonable range. On the other hand, the Personal Information Protection Law, which was enacted and enforced since November 2021 in Mainland China, will have its first complete year of implementation in 2022. This legislation's influence and interference on companies' utilization of cookies for data collection should be fully apparent.

3.2.3. Control Variables

Control variables serve to minimize the confounding effect of omitted variables on the association between explanatory variables (the cookies) and the dependent variable (profitability) in regression analysis. Kahn et al.(2000) studied distinct strategies employed by incumbents and entrants in response to product launches related to the utilization of personal information, and it incorporates company years of establishment as control variable'during' in the regression analysis. For the remaining control variables and their applications, this paper primarily refers to the following normative and empirical literature on how corporate governance affects business operations: Campbell et al. (2015), Chen (2015), Yao et al. (2018), and Sabatino et al. (2022). SEP, or Separation of Ownership and Control, refers to the disparity between the profit sharing rights and voting rights possessed by the controllers of a company. The larger the value of SEP, the lesser the positive motivation for efforts exerted by the actual controllers (due to the mismatch between the proportion of returns and diligence level), and the stronger their motivation to tunnel company benefits in a negative manner. Top1, the aggregate of the direct and indirect shareholding percentages of the company's controlling entity. The Top3pay denotes the cumulative compensation of the three highest-paid executives within the company, which is an important metric in assessing the executive compensation structure and practices within a company. It provides insights into the company's commitment to attracting and retaining top talent.

The Period Expense Ratio, Periodexpe, determines the proportion of expenses incurred during a specific period relative to the company's revenue. It is calculated by summing up the sales expenses, administrative expenses, and financial expenses, and dividing that sum by the operating revenue. The ratio serves as a control of how effectively a company utilizes its resources in general.

The variable "state" equal one if the company is state-owned, zero otherwise. The variable "dmboth" control behaviors due to managerial opportunism or agency issues. If the chairman of the board simultaneously takes the office of CEO, equal one, zero otherwise.

The "currassetpe" represents the proportion of current assets to total assets in a company , and it serves as a control for ability to convert its current assets into cash. Lnasset is a metric that calculates the natural logarithm of a company's total assets, which control the differences in the size of the companies. Debtratio, the ratio of companies' total liabilities to its total assets, which control the differences in solvency and leverage.

Financial data in the study are derived from the from the Wind database[9]. To control the effect of extreme values on the regressions, the continuous variables are adjusted by a two-tailed 1% winsorized function in STATA software.The complete descriptions of the variables are presented in Table 5.

Table 5. Variables Description for the Sample Companies.

Title	Description
ROA	the net profit/ the average assets, average asset= (the beginning balance for the year+the ending balance for the year)/2
Profit Margin	the net profit/ the sales revenue
Asset Turnover	the sales revenue/ the average assets
thdckiepe	the number of third-party cookies/ the number of all cookies. Randomly selected days (one day for each week) throughout each week of 2022 would be chosen to record these variables. The ratio was calculated for the day. Then the data for each day would be added up, and at the end of the year the total would be divided by the number of recorded days to obtain the average of the ratio.
selfckiepe	1-thdckiepe, measures the proportion of company's self-deployed cookies
During	2022 minus the established year of the company
top5reverse	the reverse of the sales share of the top 5 customers, and the sales share equals the sales from top 5 customers/ the total sales
top5supply	the purchase cost from top 5 suppliers/ the total purchase cost
legal	Given the "rule of law environment index for enterprise operation"[10] in the province where the sample companies are registered, if the ranking of this index in the province is higher than the median of all provinces, will be assigned a value of 1; otherwise, 0.
SEP	the disparity between the profit sharing rights and the voting rights possessed by the controlling entity of the company
Top1	the aggregate of the direct and indirect shareholding percentages of the company's controlling entity
Top3pay	the cumulative compensation of the three highest-paid executives within the company
Periodexpe	the sum of sales expenses, administrative expenses, and financial expenses/ the revenue
RDDLC	which equals 1 if a company incurs and makes disclosures of Research and Development expense, otherwise 0.
RDper	the Research and Development expense/ the sales revenue
Dmboth	if the chairman of the board takes the office of CEO, equal 1, zero otherwise.
State	equal one, if the company is state-owned, zero otherwise.
Currassetpe	the proportion of current assets to total assets
lnasset	the natural logarithm of total assets
Debtratio	the total liabilities/the total assets

[9] The market leader in China's financial information services industry. In China, Wind serves more than 90% of financial institutions. Overseas, Wind serves 70% of qualified foreign institutional investors (QFIIs) in Chinese capital market .

[10] Wang,X., Fan, G.& Ma, G.. (2020). Bushiness Environment Index for China's Provinces. Social Sciences Academic Press (China).

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3.3. Test Results and Analysis

3.3.1. Descriptive Statistics

First of all, VIF test is applied to all variables in the regression. The individual and the mean of VIF are all below 2, which justifies small multicollinearity.

Table 6. The Statistics of DuPont Ratios and Cookies.

Variables	Mean	Standard Deviation	Median	upper quartile	lower quartile
ROA (%)	3.0068	5.3895	3.0235	7.3043	-0.039
Profit Margin (%)	2.3272	16.9727	2.5969	5.5202	-2.4639
Asset Turnover （%）	84.3005	64.3767	80.0664	117.121	32.5144
thdckiepe （%）	18.9938	26.9316	5.7013	19.6550	2.2388

According to Table 6, the mean and the median of ROA, and its secondary indicators Profit Margin and Asset Turnover is 3.01% and 3.02%, 2.33% and 2.60%, 84.30% and 80.07% respectively. In terms of the number of third-party cookies/ the total number of cookie, the mean and the median of annual SG&A cost is 18.99% and 5.70%, respectively.

According to Table 7, Difference-in-Means test is applied to the comparative samples which are grouped by specializing in certain sale territory or not. Compared with the generalists, the specialists see superior performance in DuPont ratios: for ROA and Asset turnover, the specialists dominate the generalists with edges being significant at 1%; as for Profit Margin, the difference is not significant enough, statistically, which results from huge standard deviations in the ratio (see Table 2). With regard to the third-party cookies ratio "thdckiepe", the specialized group are with the significant higher ones, implying critical influence attached to these cookies in the group.

For the remaining control variables, if there are significant group differences, it indicates both that these variables meet the requirements for control variables in ROA analysis regression as per existing literature, and also that the necessity for controlling these variables in the grouped regression. For the generalists, most of them are state-owned and have ran their business for a longer period; given the resources input measured by period expense/operating revenue, they also get more. As for the specialists, the controlling shareholders are with higher percentage of share holding and opt for more current assets.

Table 7. Difference－in－Means Test for the Specialized Group and the General Group.

	Specialized=0 Mean	Specialized=1 Mean	Difference	T value	P value
ROA (%)	1.6118	4.1746	-2.5628	-2.1534	Pr(T < t) = 0.0172
Profit Margin (%)	1.5986	2.9371	-1.3385	-0.3471	Pr(T < t) = 0.3647
Asset Turnover （%）	47.0215	115.5108	-68.4893	-5.5311	Pr(T < t) = 0.0000
thdckiepe （%）	11.5444	25.2305	-13.6861	-2.3113	Pr(T < t) = 0.0117
selfckiepe （%）	88.4556	74.7595	13.6861	2.3113	Pr(T > t) = 0.0117
During	26.3889	21.5581	4.8307	3.2521	Pr(T > t) = 0.0009
State	0.7222	0.2326	0.4897	4.9280	Pr(T > t) = 0.0000
Top1 （%）	35.7611	41.3653	-5.6042	-1.5198	Pr(T < t) = 0.0665
Top3pay （in ten thousand RMB）	412.2203	385.7037	26.5166	0.4229	Pr(T > t) = 0.3368
Periodexpe	0.3501	0.2399	0.1102	3.1110	Pr(T > t) = 0.0013
Currassetpe	0.3828	0.6016	-0.2188	-5.1037	Pr(T < t) = 0.0000
Sales Share of Top 5 Customers （%）	9.9807	12.3438	-2.3630	-0.6626	Pr(T < t) = 0.2546
lnasset	22.7462	22.5933	0.1527	0.5914	Pr(T > t) = 0.2780
Debtratio （%）	54.7330	52.5871	2.1459	0.4129	Pr(T > t) = 0.3404
0bs	37	43			

3.3.2. The Regression Result for Hypothesis 1 and Hypothesis 2

In Table 8, according to the results of regressions 1 and 2, the coefficient of thdckiepe is positive and significant at the 5% level. All retail companies that greatly applied third-party cookies to data-enhanced sales show greater profitability. It is mainly achieved through profitability (using the DuPont analysis). The companies of stakeholders which utilize third-party cookies have distinct advantages over retail companies without strong IT expertise. The collaboration in which sales companies obtain data from customers and share it with third parties (either product manufacturers or data-mining consulting companies) to enhance their business capabilities has a clear value-added effect. Hypothesis 1 is certified.

However, also some negative effects were found. On one hand , the interaction between thdckiepe and during is negative in result 1. In the retail industry, a long-standing company does not necessarily have an advantage in data processing. Table 3 implies that traditional generalists with a longer history (such as department stores) account for nearly half (37 of 80) of the overall sample, which is likely the main reason for this result. According to the study (Campbell et al., 2015), in the presence of privacy protection regulations, if customers have a high tolerance for privacy infringement, both existing large generalists and specialized players entering the market will choose data-enhanced products. However, the generalists lack data processing capabilities, which constrains the improvement.

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Table 8. The Test Result of the Effects of Cookies on DuPont Ratios.

	(1)	(2)	(3)
Variables	**Roa**	**Profit Margin**	**Asset Turnover**
thdckiepe	0.154**	0.388**	-1.1028**
	(2.14)	(2.09)	(-2.22)
thdckiepe*during	-0.0058*	-0.0164	0.0004**
	(-1.91)	(-1.51)	(2.01)
during	0.00747	0.235	-0.0364**
	(0.07)	(0.70)	(-2.42)
Top1	0.0222	-0.0114	-0.00301
	(0.54)	(-0.13)	(-1.36)
seperation	-0.0324	-0.397*	-0.0075*
	(-0.41)	(-1.73)	(-1.68)
state	-0.302	1.266	-0.0913
	(-0.20)	(0.38)	(-0.46)
dmboth	-0.809	-0.0981	-0.541*
	(-0.34)	(-0.01)	(-1.69)
periodex	-11.08**	-32.85*	-1.695***
	(-2.24)	(-1.97)	(-4.44)
currassetpe	3.485	-9.536	1.188***
	(0.85)	(-0.96)	(2.94)
debtratio	-0.109***	-0.402***	0.0011
	(-3.52)	(-2.94)	(0.57)
top3pay	0.0044	0.0167**	-0.0002
	(1.64)	(2.29)	(-1.27)
lnasset	0.482	0.957	-0.0374
	(0.85)	(0.64)	(-0.97)
Constant	-3.199	6.094	2.709***
	(-0.23)	(0.16)	(3.27)
Observations	80	80	80
R-squared	0.370	0.275	0.724
Adj. R2	0.244	0.130	0.669

Note: Robust t-statistics in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table 9. The Grouping Test on the Function of the Cookies.

	The Specialists		**The Generalists**	
	(1)	(2)	(3)	(4)
Variables	**ROA**	**Profit Margin**	**ROA**	**Profit Margin**
thdckiepe	-0.0002	-0.0949	0.0205	0.0155
	(-0.01)	(-1.05)	(0.23)	(0.09)
top5reverse	0.766***	0.839	1.042	-1.553
	(3.17)	(1.03)	(0.29)	(-0.22)
thdckiepe*top5reverse	0.1214**	0.1239*	-0.0564	0.1609
	(2.04)	(1.92)	(-0.60)	(0.94)
periodexpe	-13.72*	2.002	-13.07	-71.52**
	(-1.88)	(0.10)	(-1.05)	(-2.08)
top1	-0.0128	-0.0342	0.0450	-0.256
	(-0.28)	(-0.24)	(0.14)	(-0.41)
state	1.112	8.841	-0.921	5.710
	(0.49)	(1.22)	(-0.23)	(0.78)
currassetpe	7.835	-5.635	-2.165	-5.278
	(1.34)	(-0.26)	(-0.11)	(-0.13)
debtratio	-0.123**	-0.327*	-0.135	-0.163
	(-2.46)	(-1.82)	(-1.31)	(-0.86)
top3pay	-0.0056	0.0077	0.0083	0.0250
	(-0.98)	(0.54)	(0.99)	(1.42)
dmboth	-5.828	-6.264	3.378	14.34
	(-1.61)	(-0.66)	(0.26)	(0.53)
lnasset	-0.0636	0.885	-0.437	2.170
	(-0.05)	(0.35)	(-0.14)	(0.35)
Constant	-1.198	18.41	17.52	-32.97
	(-0.05)	(0.39)	(0.35)	(-0.31)
Observations	43	43	37	37
R-squared	0.458	0.348	0.426	0.648
Adj. R2	0.187	0.0222	-0.201	0.264

Note: Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1.

On the other hand, compared with the effect on ROA and Profit Margin, the variable of third-party cookies ratio with a coefficient of -0.011 in result 3 has a relative small negative impact on Asset turnover, mainly

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attributed to the specialists with higher ratio of Asset Turnover and third-party cookies. The specialists' Asset Turnover has significantly outperformed the generalists (Table 3) , however the ease of asset adjustments (the specialists' higher percentage of current asset) should take the credit. Regarding the effect of cookies on asset management, since there are ceilings of capacity in specialized market, rushed data sharing with third parties may result in inefficient investments. However, it is worth emphasizing once again that the materiality of this backfire seems minor.

In Table 9, the interaction " thdckiepe*top5reverse" is employed to assess the impact of diverse customer information on the exploitation of third-party cookie data. According to the results on Table 9, the specialists are more proficient in converting diversified customers' data from the third-party cookies into operation profit, which is indicated by the significant positive coefficients of the interaction in result 1 and 2. Hypothesis 2 and Hypothesis 3 are certified.

The specialists' operation are highly dependent on internet transactions (Table 4), leveraging cookies to capture a wide range of customer data. Furthermore, its strengthened control over the supply chain significantly increases the efficiency of translating this information into valuable assets for the business. For example, "Three Squirrels Company", which ranked first in China for consecutive five years in terms of nut sales, manufactures products with high added value in-house while utilizing the OEM model for the remaining. Meanwhile, the company's heavy reliance on online sales facilitates the acquisition of diverse online customer information. By enhancing its control over the supply chain, the company can swiftly harness this information to create value aligned with customer expectations in areas such as product quality and logistics. Compared to the generalists which are mostly traditional retailers, the specialists are with sharp edges in the niches.

Generally speaking, specialized retailers demonstrate a deeper level of engagement in the supply chain and manufacturing processes of the products they offer for sale, thus enhancing product premiums within a niche and differentiate themselves from major platforms seems quite plausible. Even costs of privacy infringement which could not be ignored, the premium armed with information-enhanced marketing could secured returns.

In Table 10, the variable "legal" catches the differences on enforcement of law due to the companies' headquarter registered, and the interaction "thdckiepe*legal" is employed to measure the effect of legal regulations on customers' privacy on the profitability of third-party cookies. Compared with Table 7, the generalists which are not quite capable as the specialists in seeking profit from third-party cookies are more influenced adversely by legal terms, in which the coefficient of interaction is -1.103 (significant level: 1%) against -0.1245 (significant level: 10%).

The reason to this mismatch could be as followed. (1) Disparity in supervisory intensity.. There are evidences (Sabatino, 2022) that large companies, the generalists, are more likely supervised to comply with privacy protection regulations; (2) Extra supervision over the process of outsourcing data. Kahn et al.(2000) verified the rationale in a mathematical derivation: if companies are not capable to draw enough profit from information collected from customers, another party or agent should be introduced to make investments on tangible assets and intangible assets, facilitating more utilities for the customers, the companies and the agent. In this case, if the generalists outsource the processing of data from cookies, at least double supervision will step in, one from the retail industry and another from the industry in which the delegated party operates.

Table 10. The Grouping Test on the Function of the Cookies under Legal Intervention.

	ALL	The Specialists	The Generalist
Variables	**ROA**	**ROA**	**ROA**
thdckiepe	0.1648***	0.1543**	1.0767***
	(3.26)	(2.55)	(3.39)
legal	-0.446	-0.370	1.460
	(-0.34)	(-0.13)	(0.69)
thdckiepe*legal	-0.1433**	-0.1245*	-1.1039***
	(-2.62)	(-1.86)	(-3.32)
periodex	-9.472**	-8.727	-11.83
	(-2.05)	(-1.34)	(-1.43)
top1	0.0255	0.0332	-0.0185
	(0.66)	(0.67)	(-0.09)
state	-0.152	-0.127	-1.545
	(-0.11)	(-0.06)	(-0.59)
currassetpe	4.219	6.650	1.952
	(1.30)	(1.24)	(0.34)
debtratio	-0.0866***	-0.0874	-0.144**
	(-2.76)	(-1.56)	(-2.64)
indedirtorpe	-12.36	-19.95	-4.137
	(-1.29)	(-0.93)	(-0.22)
top3pay	0.0038	-0.00167	0.0089*
	(1.61)	(-0.32)	(1.80)
direnumber	0.179	0.264	0.365
	(0.49)	(0.31)	(0.32)
lnasset	0.158	0.326	1.311
	(0.22)	(0.28)	(0.85)
Constant	5.176	3.467	-22.16
	(0.37)	(0.11)	(-0.88)
Observations	80	43	37
R-squared	0.411	0.358	0.483
Adj. R2	0.294	0.0727	0.173

Note: Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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Table 11. The Mediating Effect between the Company-Deployed Cookies and Asset Turnover.

	(1)	(2)	(3)
Variables	**Asset Turnover**	**top5supplype**	**Asset Turnover**
selfckiepe	0.2680	-0.1408*	0.3875
	(1.10)	(-1.81)	(1.60)
top5supplype			0.0085*
			(1.99)
periodexpe	-2.498***	-37.12	-2.183***
	(-4.22)	(-1.61)	(-3.71)
top1	-0.00303	-0.0022	-0.0030
	(-0.50)	(-0.01)	(-0.52)
RDper	-0.456	-476.8	3.591
	(-0.06)	(-1.54)	(0.46)
state	-0.190	6.646	-0.246
	(-1.09)	(0.98)	(-1.46)
currassetpe	1.498***	-3.856	1.530***
	(2.97)	(-0.20)	(3.17)
debtratio	-0.0029	-0.336*	-8.02e-05
	(-0.66)	(-1.95)	(-0.02)
dmboth	-0.357	-2.580	-0.335
	(-1.00)	(-0.18)	(-0.98)
top3pay	-0.0011**	0.0161	-0.00125**
	(-2.23)	(0.82)	(-2.59)
lnasset	0.0635	-11.32***	0.159
	(0.62)	(-2.85)	(1.47)
Constant	-0.0260	329.5***	-2.823
	(-0.01)	(3.70)	(-1.09)
Observations	80	80	80
R-squared	0.683	0.533	0.718
Adj. R2	0.587	0.391	0.621
t-statistics in parentheses			
*** p<0.01, ** p<0.05, * p<0.1			
Sobel-Goodman Mediation Tests			
	coefficient	**Z**	**P**
Sobel	-0.1194	-2.2	0.0278
Goodman-1	-0.1194	-1.76	0.0783
Goodman-2	-0.1194	-3.324	0.0009
Pecent of total effect that is mediated: -34.88 %			

As mentioned above, the differences between third-party cookies and self-deployed cookies lie in their settings and purposes, which bring edges to third-party cookies and imply setbacks of the self-deployed cookies. By repeated testing the effect of self-deployed cookies on Profit Margin and asset turnover (the product of the two ratios is ROA) , the poor performance of the self-deployed cookies on Asset Turnover should be concerned. Moreover, the mediating effect is checked, which is caused by the self-deployed cookies to the level of suppliers concentration (mediating variable) and then to OE. By applying the function of "sgmediation" in STATA, all the negative coefficient of Sobel-Goodman Mediation Tests are significant, as shown in Table 11.

It must be highlight again that self-deployed cookies enhance the feasibility of customers data collection. However, from this point forth, the operation efficiency is not "take for granted". If massive amounts of information is mostly collected and processed by retailers' self-deployed cookies (compared with the efficient information sharing by third-party cookies), it may cause inefficiency in operation. For instance, diversified customer preferences are withdrawn from the cookies. Responding to all or most of those (without sophisticated information sorting and analyzing) will boost the number of suppliers (result 2 in Table 7), whereas the cost of inventories piled up and the expense of supply-chain management may adversely affect Asset Turnover .

3.4. Robustness Test

3.4.1. Bootstrap Test

Due to the frequent changes in cookies on the retailers' official websites, this paper adopts listed companies in the retail industry in 2022 in light of the timeliness and the feasibility of data collection. However, the potential issue is the impact of insufficient sample size on the robustness of statistical results.

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Table 12. The Bootstrap Tests on the Effects of Cookies.

	All		The Specialists	
	(1)	(2)	(3)	(4)
Variables	**ROA**	**Profit Margin**	**ROA**	**Profit Margin**
thdckiepe	0.1766**	0.4093*	0.0034	-0.0960
	(2.05)	(1.91)	(0.06)	(-0.51)
thdckiepe*during	-0.0064*	-0.0168		
	(-1.93)	(-1.43)		
during	0.0033	0.152		
	(0.03)	(0.45)		
top5reverse			0.774	0.827
			(0.09)	(0.03)
thdckiepe*top5reverse			0.1156*	0.1232*
			(1.86)	(1.88)
periodexpe	-10.07**	-28.34*	-13.74	2.039
	(-2.13)	(-1.83)	(-1.61)	(0.07)
top1	0.0208	-0.0344	-0.0120	-0.0322
	(0.41)	(-0.30)	(-0.18)	(-0.14)
state	0.0602	3.191	1.097	8.922
	(0.04)	(0.84)	(0.35)	(1.05)
currassetpe	4.355	-5.531	7.744	-5.917
	(1.08)	(-0.44)	(0.99)	(-0.24)
debtratio	-0.0924***	-0.384**	-0.123	-0.323
	(-2.72)	(-2.40)	(-1.61)	(-1.55)
top3pay	0.00451	0.0159**	-0.00567	0.00775
	(1.41)	(2.03)	(-0.70)	(0.40)
dmboth	-0.629	-0.889	-5.833	-6.007
	(-0.18)	(-0.08)	(-0.07)	(-0.02)
direnumber	0.541	0.452	1.576	-2.035
	(1.35)	(0.25)	(1.46)	(-0.50)
lnasset	-0.0849	0.0127	-0.0495	0.873
	(-0.13)	(0.01)	(-0.03)	(0.26)
Constant	3.026	19.70	-1.578	18.62
	(0.21)	(0.51)	(-0.05)	(0.30)
Observations	80	80	37	37
R-squared	0.386	0.262	0.458	0.347
Adj. R2	0.263	0.115	0.187	0.0204

Note: z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.2.

To address the issue, the bootstrap self-sampling test in STATA is in place to verify the reliability of the results. By the regression results in the self-sampling of 1000 times (Table 12), the conclusions above are verified: on one hand, retail companies that heavily applied third-party cookies to data-enhanced sales enjoy greater profitability（the coefficient of thdckiepe is significant）, and the edge is weakened as company stay longer in business（the coefficient of the interaction between thdckiepe and during is significant); on the other hand, given the value realized from diverse customer information captured by the third-party cookies, the specialists perform soundly（the coefficient of the interaction between thdckiepe and top5reverse is significant).

3.4.2. The Two-Stage Model

Table 13. The Self-Selection Effect of Grouping Verified by Two Stage Model.

	Stage One	Stage Two
Independent Variables	**Generalists**	**ROA**
thdckiepe		0.4092*
		(1.68)
During		-0.0469
		(-0.26)
thdckiepe* during		-0.0160
		(-1.14)
RDDLC	-1.3780**	
	(-2.25)	
top5supplype	-0.0278**	
	(-2.34)	
periodexpe	control	control
top1	control	control
State	control	control
currassetpe	control	control

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debtratio	control	control
top3pay	control	control
dmboth	control	control
Inasset	control	control
Number of Samples	80	80
Wald chi2	25.58	
lambda	-3.7835* (-1.73)	

Note: z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.2.

In order to control contingent self-selection effect, a two stage model of Heckman test on all retailers in the paper is applied in the section. (1) For probit regression in the first stage, the dependent variable is "generalists", if any company in retail industry is a platform with diversified sections (other than the one with specialized section), equals 1, otherwise 0. The first instrument variable is "top5supplype$_{t-1}$", which is the purchase cost from top 5 suppliers/ the total purchase cost in year 2021. Compared with the specialists, more diversified supplies should be corresponding to more diversified sales concerned the generalists. Thus, it also helps to sort out the generalists.The second instrument variable is "RDDLC$_{t-1}$", which equals 1 if a company incurs and makes disclosures of "Research and Development" cost in the year of 2021, otherwise 0. The rationale is as follows: in terms of the existence of R&D expenses to be disclosed, the recent-entry specialized retailers could be more enthusiastic in research activities to promote competence with the platform retailers loaded with "old money"[11]. Therefore, as for the willingness to disclose, the variable helps to sort out the generalists. (2) In the second stage, "RDDLC$_{t-1}$" and "top5supplype$_{t-1}$" could be reasonably ruled out, which provide required externality for the whole two-stage mode[12].

In Table 13, the coefficient of lambda is negative and statistically significant, indicating the rationality of controlling generalists group for their downward effects on ROA. Specifically, in stage one, each of the coefficient of RDDLC$_{t-1}$ and top5supplype$_{t-1}$ is significant, which effectively sorts out the generalists in the probit model; in stage two under the control on the self-selection, the coefficient of thdckiepe is positive significantly, in accordance with the preceding results that all retailers that heavily applied third-party cookies to data-enhanced sales enjoy greater profitability Since the effect of the generalist with longer established year has been controlled, the negative coefficient of thdckiepe* during is not significant here as in the test in Table 7.

4. Discussion on Theory and Management Practice

From a theoretical perspective, this paper delves into the consequences of internet cookie utilization on the operational proficiency of China retailers, drawing a distinct line between company-deployed and third-party cookies.

(1) In the course of demonstrating Hypothesis 1, the paper take into account the diverse acquisition channels that have a bearing on the efficacy of information cross-referencing, coupled with the disparities in the approaches to monetizing information, a conspicuous disparity emerges in the ramifications of company-deployed cookies vis-à-vis third-party cookies on the operational prowess of enterprises. Hence, this study delineates the distinct impact pathways and outcomes of the aforementioned two types of cookies.

(2) Existing scholarly works, notably by Columbus (2014) and Shanka (2019), have largely concentrated on theoretically demonstrating the beneficial effects of personal information acquisition technologies on consumer behavior analysis and corporate profitability. Building on this, the findings provide empirical support for these theoretical claims and further analyze the differences in outcomes resulting from the adoption of distinct technological paths, namely company-deployed cookies versus third-party cookies.

(3) In the course of demonstrating Hypothesis 2, this paper distinguishes between specialty retailers (specialists) and platform operators (generalists), due to differences in diversity of goods, information processing capabilities, and supply chain channels.

Campbell et al,(2015) undertook rigorous mathematical and theoretical derivations to delineate the distinctions between specialists and generalists, primarily hinging on their disparities in market entry sequence and product scope. In the empirical analysis portion of the research, we leveraged data sourced from publicly traded retail firms in China, integrating these factors into regression frameworks both as control variables to account for extraneous influences and as segmentation criteria to facilitate nuanced examination. Building on this foundation, our study incorporated supply chain information and the percentage of third-parties cookies to total cookies set by the retailer as pivotal explanatory variables within the regression models. This augmentation not only broadened the exploration of profit-making avenues via information exploitation by specialists and generalists but also facilitated a comparative analysis of the precise impacts and ramifications associated with these avenues, thereby advancing the scholarly discourse within the pertinent domain.

(4) This paper explores the moderating effects of the legal environment and enforcement factors on the aforementioned profit-generating pathways. The objective of this examination is to furnish a deeper and more granular understanding of the intricate relationships that permeate this field, thereby augmenting our comprehension of its inherent complexities. Notably, while the Personal Information Protection Law (PIPL) was enacted in China in November 2021, its efficacy may exhibit variation across regions due to disparities in legal enforcement. To account for this, the study draws upon the "Business Environment Index for China's Provinces 2020 Report" and considers the "rule of law environment index for enterprise operation" in the provinces where the sample companies are registered. In the context of regression analysis, the interaction term forged by this index variable and the proportion of different cookies serves as a means to scrutinize the impact of judicial intervention on profiting from the utilization of private information.

[11] The specialists are eager to establish the reputation of high quality and customized product by the presence of R&D investments.
[12] In the regression tests with ROA as dependent variable respectively , each of the coefficient of "RDDLC" and "top5supplype$_{t-1}$" is not significant.

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From a practical perspective, the conclusions of the above emphasize the following points, and corresponding reinforcement measures are proposed:

(1) Significant differences between company-deployed cookies and third-party cookies on enterprise operational capabilities.

There are conspicuous differences in the impact of company-deployed cookies versus third-party cookies on enterprise operational capabilities. Enterprises should recognize these distinct impacts of the two types of cookies on operational capabilities and fully consider this difference when formulating business operational and information management strategies to ensure their effectiveness and pertinence. Specifically, they may:

a. Conduct a thorough analysis of the data collected through both company-deployed cookies and third-party cookies to understand the unique insights each type provides and how they contribute to different aspects of the business.

b. Develop tailored strategies for leveraging company-deployed cookies, which tend to offer more accurate and reliable data due to their direct relationship with the user. This may involve optimizing website design and user experience to encourage more first-party data collection.

c. Carefully evaluate the use of third-party cookies, considering their potential benefits and drawbacks. While they can provide valuable insights into user behavior across multiple sites, they also come with privacy concerns and potential restrictions due to regulatory changes.

(2) Influences of legal environment and other regulatory factors.

The paper explores the moderating impacts of the legal environment on the aforementioned pathways. When formulating and implementing strategies, enterprises should closely monitor changes in the legal environment and regulatory factors, particularly laws and regulations related to customer concentration and privacy protection. Specifically, they may:

a. Regularly review and update contracts, agreements, and other legal documents to ensure that they reflect the current regulatory landscape and protect the enterprise's interests.

b. Conducting regular risk assessments to identify potential legal risks associated with changes in the regulatory environment and developing strategies to mitigate these risks.

c. Investing in technology and resources to enhance the enterprise's ability to comply with new regulatory requirements, such as implementing data encryption and other security measures to protect customer data.

5. Conclusion

Consumer preference data acquired on the internet plays a pivotal role in enhancing a company's operational efficiency. In particular, the utilization of cookies constitutes a significant aspect in this regard. This paper endeavors to delve into and examine the impact pathways and outcomes pertaining to the application of cookies. Moreover, first, this study delineates the distinct impact pathways and outcomes of the company-operated cookies and the third-party cookies, highlighting the nuanced differences in their effects on operational capabilities; second, this paper distinguishes between specialty retailers （specialists） and platform operators (generalists) , due to differences in diversity of goods, information processing capabilities, and supply chain channels; third, this paper examines the moderating effects of the legal environment and customer concentration, among other regulating variables, on the aforementioned pathways, further enriching the understanding of the complex relationships within this domain.

The conclusions drawn in this paper predominantly encompass the following facets: (1) all retail companies that greatly applied third-party cookies to data-enhanced sales show greater probability.The collaboration in which sales companies obtain data from customers and share it with third parties (either product manufacturers or data-mining consulting companies) to enhance their business capabilities has a clear value-added effect. (2) The specialists are more proficient in converting diversified customers' data from the third-party cookies into operation profit. The specialists' operations are highly dependent on internet transactions, leveraging cookies to capture a wide range of customer data. Furthermore, its strengthened control over the supply chain significantly increases the efficiency of translating this information into valuable assets for the business. (3) The generalists which are not quite capable as the specialists in seeking profit from third-party cookies, however, are more influenced adversely by legal terms. (4) By repeated testing the effect of self-deployed cookies on profit margin and asset turnover, the poor performance of the self-deployed cookies on asset turnover (OE) should be judged. Moreover, the mediating effect is checked, which is caused by the self-deployed cookies to the level of suppliers concentration (mediating variable) and then to OE.

The conclusions of the study, which delve into the benefits and adverse effects of cookie utilization, offer a foundation for informed decision-making by companies across various industries seeking to leverage personal data in their sales endeavors. Potential avenues for future research could entail: (1) Contrasting analogous empirical datasets from diverse nations against the findings presented herein, with the objective of scrutinizing the impacts stemming from disparities in market institutions and legal stipulations; (2) Augmenting the duration of data acquisition pertaining to corporate cookie utilization, leveraging superior data-gathering software with enhanced search capabilities, thereby bolstering the applicability of pertinent conclusions in practical deployment and widespread adoption.

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