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NO WEAL WITHOUT WOE: IMPLEMENTATION OF PERSONAL DATA PROTECTION SYSTEMS AND CORPORATE VALUE

Não há felicidade sem aflição: Implementação de sistemas de proteção de dados pessoais e valor corporativo

No hay resultados faciles: Implementación de sistemas de protección de datos personales y valor corporativo

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ABSTRACT

The commercial exploitation of personal information has raised concerns regarding privacy, illegal data use, and information security, among others. Therefore, personal data protection systems (PDPS) play a significant role, and corporations are the primary enforcers of these systems' regulation. However, PDPS require significant investment from companies, and there is no consensus regarding the economic outcomes of establishing these systems. This study investigates whether the establishment of PDPS affects short-term financial performance and long-term corporate value. After applying the propensity score matching method, a dataset comprising 912 firm-year observations of e-commerce companies listed on the Shanghai and Shenzhen Stock Exchanges from 2008 to 2020 was selected. The results show that PDPS implementation can improve a company's short-term financial performance by a) exploring markets and strengthening internal control and b) increase long-term corporate value by strengthening corporate social responsibility. This study offers insights for companies to proactively implement PDPS and strengthen their management of personal data, thereby boosting the overall corporate value. In addition, this study can help governments to develop legislation on national information security and enhance international cooperation, especially for emerging markets.

Keywords: personal data protection, financial performance, corporate value, corporate soial responsibility, internal control.

RESUMO

A exploração comercial de informações pessoais tem levantado questões como privacidade, uso ilegal de dados e segurança da informação. Nesse sentido, os sistemas de proteção de dados pessoais (SPDP) têm um papel relevante e as empresas são as principais responsáveis pela aplicação das regras que governam esses sistemas. Os SPDP, entretanto, demandam investimentos significativos por parte das empresas, e ainda não há uma conclusão unificada sobre seus impactos econômicos. Assim, este estudo investiga se a implementação de SPDP nas empresas afeta seu desempenho financeiro em curto prazo e seu valor corporativo em longo prazo. Após a aplicação do método de pareamento por escore de propensão, um conjunto de dados composto por 912 empresas de comércio eletrônico listadas nas bolsas de valores de Xangai e Shenzhen entre 2008 e 2020 foi selecionado. Os resultados mostram que a implementação do SPDP pode melhorar o desempenho financeiro de uma empresa em curto prazo, explorando mercados, fortalecendo o controle interno e aumentando o valor corporativo em longo prazo por meio do fortalecimento da responsabilidade social corporativa. Este estudo apresenta esclarecimentos importantes para que as empresas implementem os SPDP de maneira proativa e fortaleçam sua gestão de dados pessoais, aumentando, assim, o valor da empresa como um todo. Além disso, os resultados dessa pesquisa pode ajudar governos a elaborar legislação voltada a segurança da informação nacional e a melhoria da cooperação internacional, especialmente para os mercados emergentes.

Palavras-chave: *proteção de dados pessoais, desempenho financeiro, valor corporativo, responsabilidade social corporativa, controle interno.*

RESUMEN

La información personal se explota comercialmente para crear valor. Sin embargo, surgen problemas como las filtraciones de la privacidad personal, el uso ilegal de los datos y la preocupación por la seguridad de la información. Las empresas son las principales encargadas de aplicar la normativa de los sistemas de protección de datos personales (PDPS). Sin embargo, como el establecimiento de los PDPSs requieren una inversión significativa, muchas empresas tienen dificultades para establecer estos sistemas por iniciativa propia. No existe una conclusión unificada sobre las consecuencias económicas del establecimiento de los PDPSs. Este trabajo investiga si el establecimiento de los PDPSs afecta a los resultados financieros a corto plazo y al valor de la empresa a largo plazo. Después de aplicar el método de emparejamiento de puntuación de propensión, se seleccionó un conjunto de datos que comprende observaciones anuales de 912 empresas de comercio electrónico que cotizan en las bolsas de Shanghái y Shenzhen desde 2008 hasta 2020. Los resultados muestran que la implementación del PDPS puede mejorar el rendimiento financiero a corto plazo de una empresa mediante la exploración de los mercados y el fortalecimiento del control interno, y aumentar el valor corporativo a largo plazo mediante el fortalecimiento de la responsabilidad social corporativa. Este estudio presenta importantes aclaraciones para que las empresas implementen proactivamente los PDPSs y refuercen su gestión de los datos personales, impulsando así el valor corporativo global. Además, para los gobiernos, este estudio puede facilitar activamente la conceptualización de la legislación para mantener la seguridad de la información nacional y mejorar la cooperación internacional, especialmente para los mercados emergentes.

Palabras clave: *protección de datos personales, resultados financieros, valor de la empresa, responsabilidad social de la empresa, control interno.*

INTRODUCTION

As Big Data gradually becomes an important tool, massive personal data has been mined by various industries for economic value, leading to the rise of the digital economy. On the one hand, the data and information elements efficiently used based on networking transform traditional production and operation processes and significantly boost economic efficiency, thus promoting industrial productivity. On the other hand, the Big Data era brought severe and frequent incidents of personal privacy data leakages, violating personal privacy rights and imposing huge losses on companies (Chen et al., 2021).

At present, many laws and regulations have been enacted across the world to protect personal data. For example, the European Union (EU) formally promulgated the *General Data Protection Regulation* (GDPR) in 2018, India announced the *Personal Data Protection Act* in 2018, the United States presented the *California Consumer Privacy Act* in 2018, Thailand implemented the *Personal Data Protection Law* in 2020, and China introduced the *Personal Information Protection Law* in 2021. The GDPR in particular raises the level of data protection, gradually becoming a global standard (Buttarelli, 2016).

Regarding the economic consequences of personal data protection systems (PDPS), at the macro level, the EU has set strict restrictions on the transfer of personal data from non-EU countries that lack adequate privacy protection. This leads to difficulties in the cross-border flow of data, thus inhibiting international trade (Schwartz & Peifer, 2017). Therefore, improving and developing a PDPS will help enhance competitiveness in the data-outsourcing business (Ball, 2010). At the micro level, some scholars have explored the problems posed by PDPS in the business development process. The GDPR imposes the same high standards on all EU companies, exposing them to high business costs and barriers vis-à-vis cross-border trade, thereby complicating market promotion (Mattoo & Meltzer, 2018). Additionally, implementing PDPS allows companies to disclose the uses and channels of their information to consumers, which addresses the problem of discriminatory pricing of Big Data (Steppe, 2017). The system protects personal information from being over-dissected by advanced technologies and enables accountability and transparent services (Politou et al., 2019). However, most of the existing literature focuses on the impact of the GDPR and lacks evidence from emerging markets.

This study chose Chinese enterprises as the research sample representative. This is because, first, China's digital economy is developing rapidly and is globally representative. It is typical to study personal data protection in its digital economy development. *The China Internet Development Report in 2022* shows that China has taken a new step in infrastructure with strategic network power. By the end of 2021, China had built and opened 1.425 million 5G base stations, representing the world's largest 5G network. Meanwhile, China's total IPv6 address resources ranked first in the world, and its scale of computing power ranked second globally.

Second, China has been investing in the national cyberspace security, and the market for network security services is expanding rapidly, with an industry growth rate of approximately 15.8%. Therefore, it provides the foundation and conditions for personal data protection. The Chinese experience provides a reference for other developing countries to develop cybersecurity. Finally, China has been promoting the creation of a digital world led by mutual trust and cooperative governanceand has achieved innovative results in network governance. It has been actively promoting international cooperation with the consensus of building a community of destiny in cyberspace. Therefore, studying the impact of personal data protection on enterprise value in China has important implications for other developing countries to build cyber cooperation, especially between the BRIC countries. Studying China's PDPS can lead to global cooperation around personal data protection.

This study identifies the impact of the implementation of PDPS on corporate financial performance and long-term value at the micro-enterprise level by selecting e-commerce companies listed in China's A-share markets from 2008 to 2020 as the research samples. After screening the samples via the propensity score matching (PSM) method and examining the impact of PDPS implementation on economic consequences, this study finds that such implementation can effectively improve enterprises' short-term profits and enhance their long-term value. The impact on the company's short-term performance is particularly evident through the widening of the market and the strengthening of internal control. The impact on the company's long-term value is mainly through strengthening corporate social responsibility.

This study contributes in two main aspects: first, it expands on the PDPS' economic outcomes. Previous research focused on analyzing the macro impact of PDPS, discussing legal systems (Demetzou, 2019; Ong, 2012; Sullvian, 2019), and analyzing the economic consequences in terms of macro data flows (Ball, 2010; Schwartz & Peifer, 2017). However, these studies mainly focus on the GDPR and lack empirical evidence for developing countries. From a micro viewpoint, some scholars argue that PDPS create cost pressure on firms (Mattoo & Meltzer, 2018; Politou et al., 2019; Taufick, 2021; Zhao, 2021), thus increasing firm risk (Adjerid et al., 2016; Yu & Zhao, 2019). The counter argument is that PDPS enhance corporate governance (Politou et al., 2019), maintain customer relationships (Steppe, 2017), and generate competitive advantage (Gal & Aviv, 2020; Steppe, 2017; Tsai et al., 2011). This study expands the micro perspective in the field of financial performance and corporate value in emerging markets.

Second, this study offers important insights for companies to proactively implement personal data protection mechanisms and strengthen their management of personal privacy, thereby boosting the overall corporate value. In addition, this study can help governments to improve legislation to guarantee national information security. As the legal framework for PDPS in developing countries is not yet well developed, this research may be a reference to accelerate the regulation of PDPS and strengthen international cooperation.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Literature review

The existing literature has formed two main research paradigms related to PDPS. The first stems from the perspective of law, focusing on the concept of privacy, rights system, protection status, and countermeasures. Its research methodologies mainly include comparative, case, and normative studies (Ong, 2012; Sullvian, 2019). Over recent years, many scholars have concentrated their attention on the GDPR (Demetzou, 2019), claiming it will increase the compliance costs of overseas companies operating in Europe, thus hindering the advancement of the EU market. However, Sheng and Yang (2020) believe that it will establish a link for the management of personal data in the open sharing of scientific data in other countries.

The second research paradigm derives from the perspective of the credit investigation system and conducts normative discussions and case studies on financial privacy protection and information disclosure systems. For public interest, privacy protection should give way to credit information sharing; in other words, the disclosure of privacy information is more important than its protection (Bostic & Calem, 2003; Kallberg & Udell, 2003). Financial groups may violate consumers' privacy rights, so systems for protecting and using consumers' privacy information in financial groups' operations should be strengthened (Yan & Zhang, 2013). Ramos and Blind (2020) have explored the impact of data portability on online platforms via public data transfer and transaction methods. Although these studies offer a useful reference for depicting a panoramic view of personal data protection from the legal perspective, few deeply explore the economic consequences on enterprises. This study focuses on the micro-enterprise levels to identify the impact of the implementation of PDPS on corporate financial performance and value.

Hypothesis development

The most direct impact of PDPS on companies refers to the systems' implementation costs (Krämer & Stüdlein, 2019; Libaque-Sáenz et al., 2016), particularly on the organization of internal processes and mechanisms related to obtaining users' permission to use personal information (such as contacting them via e-mail or preparing, printing, and sending disclosure notices) (Seo et al., 2018). As for organizing internal processes, the need of communicating data protection authorities, the lack of specialized professionals in the job market, and cost related to training personnel, are elements that raise costs significantly. Although the deployment of PDPS may impose high costs on companies, they may face even bigger fines and higher corporate compliance risks if a personal data breach occurs (Allen, 2018; Wilson, 2018). For example, the GDPR stipulates a fine of up to 20 million euros or 4% of a company's total global operating income in the previous fiscal year.

Meanwhile, PDPS can help boost corporate profits. First, establishing PDPS is conducive to companies exploring international markets (Negrouk & Lacombe, 2018) because such systems have

become one of the prerequisites for internationalization (Lachaud, 2020). Generally, developing overseas markets is conducive to improving corporate financial performance. According to the theory of comparative advantage and internalization, expanding international markets can reduce transaction costs (Forsgren & Holm, 2021) and facilitate enterprises to avoid structural and transactional market failures. Internationalization helps enterprises transfer their resources to other countries and maximize the use resources received from parent companies to increase overall profits . Meanwhile, PDPS can enhance customers' trust in enterprises, encouraging information subjects to actively share personal data legally, which companies can use for Big Data analytics and bring more earnings.

Second, PDPS are conducive to strengthening internal control. While paying attention to the supervision of the internal personnel of enterprises, PDPS require that, during the process of collecting and processing personal data, enterprises disclose the relevant identity information of data controllers, the use of data, and the legal basis for future accountability (Nyi et al., 2018). Therefore, improving internal control is conducive to addressing the problem of information asymmetry, reducing agency costs, and finally, driving up corporate financial performance (Skaife et al., 2008). Although PDPS bring increased costs in the short term, they simultaneously bring more hidden revenue than costs due to market expansion, increased customer trust, and improved corporate governance. Therefore, we form hypothesis H1:

H1: The implementation of PDPSs can improve corporate profit.

Notably, PDPS concretely manifest corporate social responsibility. At present, personal data leakage has become a public hazard and a common issue. Such leakage can cause damage to citizens' reputations and property by identity theft and reselling and fraudulent use of personal information, resulting in social problems. Meanwhile, the leakage of personal data allows various businesses to analyze massive amounts of messages, obtain unique personal portraits, and finally classify consumers, hence creating consumer discrimination. Stakeholder theory maintains that a company's focus should be on maximizing the interests of shareholders and building good relationships with various stakeholders, such as employees, users, external investors, and governments (Nguyen et al., 2021). As a typical stakeholder-oriented behavior of enterprises, actively assuming social responsibility (Chen et al., 2020) helps enhance corporate value (Li et al., 2020).

First, from the consumers' viewpoint, companies' active assumption of social responsibility is conducive to establishing a good corporate reputation (Özcan & Elçi, 2020; Vázquez et al., 2013), enhancing brand loyalty (Lombart & Louis, 2012), and creating long-term competitive advantages (Chowdhury et al., 2021). Second, enterprises can raise the satisfaction of such stakeholders as suppliers and investors by assuming more social responsibilities (Lins et al., 2017), improving capital allocation efficiency, and enhancing sustainable development capabilities, thereby driving up corporate value (Ghoul et al., 2017). In addition, companies that actively fulfill their social responsibilities can forge a good relationship with the government and enjoy corresponding

policy preferences (Lu, 2020), thus facilitating in the attraction of more high-quality capital investment and bolstering corporate value. Therefore, the following hypothesis is developed:

H2: PDPSs can enhance corporate value.

RESEARCH DESIGN

Data and sample

This study obtains financial data from the China Stock Market and Accounting Research database. The information on companies' personal data protection measures is retrieved through text analyses of annual reports, news, search engines, and prospectuses.

PDPS mainly target e-commerce companies and are particularly important for cross-border e-commerce firms. E-commerce refers to selling goods or providing services through information networks, such as the Internet, and an e-commerce platform provides online business premises, transaction aggregation, information dissemination, and other services for those involved in e-commerce. In China's Internet development, e-commerce is almost the earliest developed and leading Internet application. As of June 2019, the scale of Chinese online shopping users reached 639 million, accounting for 74.8% of the overall Internet users. Compared with traditional trade models, cross-border e-commerce has incomparable advantages such as high efficiency, low cost, wide clientele, and high openness. Along with the rapid development of e-commerce, the commercial value of Big Data technology has been fully reflected, and data have become an important resource for the development of e-commerce, especially as the importance of the e-commerce platform is self-evident. As a service provider connecting buyers and sellers, e-commerce platforms manage substantial data, including users' personal identification information, consumption order records, bank card numbers, sellers' products, and transaction records. User data are a valuable resource to support and optimize business decisions. The utilization of user data for e-commerce has become an irreversible trend, and Big Data has become an important guide for marketing and service innovation of e-commerce platforms. Driven by market interests, e-commerce enterprises attach absolute importance to the use of Big Data and are in the leading position of technology. Therefore, the first voluntary implementation of PDPS in China starts with e-commerce. It is also the reason for choosing the sample in this study.

Because China's Personal Data Protection Law was officially implemented only recently in November 2021, all companies establishing a PDPS were discretionary as of 2020. Accordingly, A-share e-commerce companies listed both in the Shanghai and Shenzhen Stock Exchanges from 2008 to 2020 are selected as samples, which are then further filtered according to the following methods: (1) removing abnormal companies, such as the special-treated ones and particular transfer ones; (2) deleting the firms with asset-to-liability ratios greater than 1 and

other variables with missing values; and (3) winsorizing the continuous variables at the 1st and 99th percentiles to eliminate potential outlier effects.

To further solve the problem of sample selection, this study employed the PSM method to process the sample. This nonparametric matching technique facilitates causal inference in non-experimental settings by constructing a control group similar to a treatment group. There are certain differences in the financial and corporate governance structure of different companies in terms of PDPS implication. Therefore, matching companies to find similar types of research is beneficial to better test the empirical results. Given potential endogenous problems, large-scale companies with high profits are inclined to adopt personal data protection measures (Grover et al., 2018). The PSM method is used to group the samples with similar financial characteristics. Specifically, this study takes the samples with PDPS implemented as the treatment group and the companies without such systems as the control. A probit model is adopted to match the firms based on the following basic financial characteristics: the current ratio (*Curr*), which is equal to the current assets divided by the total assets; the firm size (*Size*), which is equal to the natural logarithm of a company's total assets; the leverage (*Lev*), which is equal to the total liabilities divided by the total assets; the share concentration (*Shrhfd*), which is equal to the proportion of shares held by the largest shareholder; the ratio of institutional investors' shares (*Investor*); the total asset turnover (*Turnover*), which is equal to the net sales revenue divided by the total average assets. The indexes are matched 1:1, and 456 pairs of matched observations are finally obtained. Table 1 displays the detailed steps of sample selection.

Table 1. Sample selection

Step		Procedure	Obs. of companies
1		Initial sample of A-share listed companies in the e-commerce industry of the Shanghai and Shenzhen Stock Exchange from 2008 to 2020	2,669
2	Less:	Obs. with missing PDPS data	712
3		Obs. with missing financial information	291
4		Obs. dropping after PSM	754
5		Final sample	912

Note: This table reports the sample selection procedure. We analyzed the initial A-share listed companies in the e-commerce industry of the Shanghai and Shenzhen Stock Exchange from 2008 to 2020, obtaining 2,669 firm-year observations. We then drop samples with missing PDPS data, and observations with missing financial information and do the PSM process.

Source: Elaborated by the author.

The matching results are displayed in Table 2. The absolute value of normalized deviation (% bias) for each variable after matching is less than 10%, and the *p*-value is not significant, indicating that variables after matching are balanced between the treatment and the control group.

Table 2. Sample Comparison after PSM

	Unmatched	Mean			%reduct	t-test	
Variable	Matched	Treated	Control	%bias	|bias|	t	p>|t|
Curr	U	0.624	0.592	17.4		3.24	0.001
	M	0.624	0.612	2.4	63.4	1.13	0.259
Size	U	22.440	22.245	17.5		3.40	0.001
	M	22.440	22.241	-0.1	99.5	-0.01	0.988
Lev	U	0.418	0.447	-13.8		-2.62	0.009
	M	0.418	0.410	4.2	69.6	0.60	0.582
Shrhfd	U	0.367	0.348	13.3		2.50	0.013
	M	0.367	0.376	-5.9	55.7	-0.51	0.813
Investor	U	0.441	0.396	19.5		3.73	0.000
	M	0.441	0.434	2.7	86.4	0.62	0.554
Turnover	U	0.876	0.865	1.6		3.28	0.000
	M	0.876	0.834	5.9	-274	1.21	0.194

Source: Elaborated by the author.

Research design

This study uses the following staggered difference-in-difference model to test the hypotheses:

$$Performance_{i,t} = \beta_0 + \beta_1 Treat_i + \beta_4 Control\ Variable_{i,t} + \sum Industry + \sum Year + \varepsilon_{i,t} \quad (1)$$

where *Performance* represents the short-term corporate financial performance for testing H1 and the long-term corporate value for H2: the former is measured by the actual total assets

earnings before interest and taxes (EBIT) margin minus the manipulated accrual margin (*UnEBIT*); the latter is measured by the Tobin's Q firm value (*TobinQ*).

The short-term financial performance indicators chosen in previous empirical studies are usually EBIT or return on equity (*ROE*). They and may encompass the impact of earnings management, which produces "noise" and affects the results' reliability.. Therefore, this study follows Cornett et al. (2009) and selects the EBIT ratio of total assets after excluding earnings management as the financial performance indicator, eliminating this "noise." First, the normal accrual margin is estimated according to Jones (1991), as shown in Model (2). After that, the manipulated accrual margin is obtained by subtracting the normal accrual margin from the actual accrual margin according to Model (3). Finally, the total asset EBIT margin after excluding surplus management is obtained by subtracting the manipulated accrual margin from the actual total asset EBIT margin according to Model (4).

$$\frac{TA_{i,t}}{Assets_{i,t-1}} = \beta_0 + \beta_1 \frac{1}{A_{i,t-1}} + \beta_2 \frac{\Delta Sales_{i,t-1}}{Assets_{i,t-1}} + \beta_3 \frac{PPE_{i,t}}{Assets_{i,t-1}} + \varepsilon_{i,t} \qquad (2)$$

$$\mathrm{DA}_{i,t} = \frac{TA_{i,t}}{Assets_{i,t-1}} - (\widehat{\beta_1} \frac{1}{A_{i,t-1}} + \widehat{\beta_2} \frac{\Delta Sales_{i,t-1}}{Assets_{i,t-1}} + \widehat{\beta_3} \frac{PPE_{i,t}}{Assets_{i,t-1}}) \qquad (3)$$

$$UnEBIT_{i,t} = \frac{EBIT_{i,t}}{Assets_{i,t}} - \mathrm{DA}_{i,t} \qquad (4)$$

where *TA* represents accrued profit, which is equal to net income minus net cash flow from operating activities; *Asset* represents total assets. *ΔSales* represents the difference between the current year's sales revenue and the prior year's sales revenue; *PPE* represents the total fixed assets; *DA* indicates manipulated accrued profit margin; *EBIT* indicates earnings before interest and taxes; *UnEBIT* represents total assets EBIT margin after excluding earnings management.

The use of Tobin's Q as a measure of long-term corporate value can be traced back to Demsetz and Lehn (1985). Wernerfelt and Montgomery (1988) also argue that Tobin's Q implicitly considers a reasonable risk discount rate based on equilibrium returns because it captures the market value of the firm, which minimizes the valuation distortions caused by tax and accounting measures. Therefore, it is a more reasonable measure of a firm's long-term value than the accounting rate of return. Therefore, Tobin's Q theory provides the best description of the intrinsic relationship between investment and stock prices, and Tobin's Q is an important proxy for the long-term value of firms (Lang & Stulz,1994). Specifically, we calculate Tobin's Q to be equal to the sum of the value of outstanding shares, non-marketable shares, and total liabilities, divided by total assets.

Treat is a dummy variable: if a company has implemented a PDPS, it will be set to 1; otherwise, 0. Based on Xu et al.'s (2005) research, this study controls for the following variables: current ratio *(Curr)*, firm size (*Size*), leverage ratio (*Lev*), turnover ratio (*Turnover*), institution shareholder's ratio (*Shrhfd*), and largest shareholder's ratio (*Investor*). Meanwhile, we control for both industry (*Industry*) and year (*Year*) fixed effects.

EMPIRICAL RESULTS

Before performing the panel data regression analysis, post-estimation tests of the residual assumptions, including normality, absence of serial autocorrelation, and homoscedasticity, are performed on the sample. To alleviate the problems of intra-group autocorrelation and heteroscedasticity, subsequent regression tests are performed using cluster robust standard errors to correct for heteroscedasticity and autocorrelation. The Hausman test is used to determine the use of the fixed effects model.

Table 3 illustrates the results of the descriptive statistics. The mean of *Treat* is 0.5, indicating that after PSM, the sample companies with and without personal data protection measures in place are balanced. The means of *UnEBIT* and *TobinQ* are 0.269 and 2.034, respectively. This means that the average EBIT margin after excluding the earnings management practices of the sample is 26.9%. Both the standard deviations of *UnEBIT* and *TobinQ* are 0.647 and 1.333, respectively, indicating significant differences in financial performance and corporate value between the observations.

Table 3. Descriptive statistics

Variable	Obs	Mean	Std	5%	25%	Median	75%	95%
Treat	912	0.500	0.487	0.000	0.000	0.500	1.000	1.000
UnEBIT	912	0.269	0.647	-0.404	-0.157	0.089	0.515	1.413
TobinQ	912	2.034	1.333	0.886	1.246	1.573	2.291	8.912
Curr	912	0.603	0.194	0.124	0.470	0.610	0.750	0.971
Size	912	22.287	1.108	20.154	21.497	22.238	22.971	25.444
Lev	912	0.437	0.207	0.049	0.266	0.438	0.608	0.852
Shrhfd	912	0.356	0.144	0.107	0.238	0.340	0.456	0.626
Investor	912	0.412	0.231	0.003	0.238	0.422	0.590	0.766
Turnover	912	0.856	0.761	0.088	0.411	0.671	1.105	1.982

Source: Elaborated by the author.

Table 4 shows the Pearson correlation analysis of the variables. The correlation coefficients among other control variables are less than 0.4, indicating no serious multicollinearity problem. The last column reports the variance inflation factors (VIFs) of all the variables. The VIF values are all less than 3, which means there is no serious multicollinearity problem.

Table 4. Pearson Correlation

	UnEBIT	TobinQ	Curr	Size	Lev	Shrhfd	Investor	Turnover	VIF
UnEBIT	1								
TobinQ	0.155	1							
Curr	0.212	0.081	1						1.82
Size	0.143	0.299	-0.157	1					1.02
Lev	0.366	0.293	-0.082	0.484	1				1.21
Shrhfd	0.041	0.063	0.065	0.048	-0.068	1			1.79
Investor	0.097	0.129	-0.077	0.301	0.138	0.518	1		1.58
Turnover	0.417	0.106	0.221	0.107	0.342	0.033	0.069	1	1.32

Note: This table reports the Pearson correlation among major variables of interest. In bold, those with a significant level of at least 5% .
Source: Elaborated by the author.

Columns (1) and (2) of Table 5 show the regression results of the short-term financial performance of the enterprises. The coefficients of *Treat* are 0.029, which is significant at 0.05 level, indicating that the financial performance of these companies has been greatly improved since they implemented PDPS. In economic terms, after applying PDPS, the firm's EBIT margin, excluding earnings management, improves by 3%. This finding proves H1.

In column (2), the coefficient of *Treat* is 0.135, which is significantly positive at the 0.05 level, indicating that implementing PDPS by these companies, their corporate value will be strengthened significantly in the long term. From the economic point of view, after PDPS implementation, the firm's Tobin's Q value will improve by 13.5%. Therefore, H2 is verified.

The adjusted R-squared values are 0.748 and 0.232 in both models, similar to the result from Huang et al. (2009) and Zhang et al. (2013), which also use *UnEBIT* and *TobinQ* as dependent variables. This indicates that the explanatory power of the overall model is good. The explanatory power of the short-term performance model (1) is 74.8%, and the second long-term performance model (2) has an explanatory power of 23.2%. The long corporate value model is lower than the short-term financial performance because of the complexity and higher uncertainty of the factors affecting the firm's long-term value. However, both models have good explanatory power, thus proving their validity.

Table 5. Main Regression Result

	(1)	(2)
VARIABLES	UnEBIT	TobinQ
Treat	**0.029****	**0.135****
	(2.01)	**(2.15)**
Curr	0.096***	0.383**
	(2.60)	(2.31)
Size	0.009	0.231***
	(1.11)	(6.58)
Lev	0.156***	1.266***
	(3.80)	(6.91)
Shrhfd	0.038	0.609**
	(0.67)	(2.50)
Investor	0.037	0.003
	(0.97)	(0.02)
Turnover	0.721***	-0.032
	(77.01)	(-0.76)
Constant	-0.685***	7.207***
	(-4.07)	(9.73)
Observations	912	912
Adj.R-squared	0.748	0.232

Note: Standard errors are clustered at both firm and year level. Industry fixed effect and year fixed effect are both controlled. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Source: Elaborated by the author.

ROBUSTNESS TESTS

Heckman self-selection

As there is a self-selection problem in whether to deploy a PDPS, this study employs the Heckman two-step method to deal further with the endogeneity issue. *Treat* is used as a dependent variable in the first step of this method, and a probit model is used to estimate the treatment effect to calculate the probability of a company deploying a PDPS. By adding all the control variables in Model (1), this study calculates the inverse Mills ratio (*IMR*) for each firm-year observation. In the second step, *IMR* is added to Equation (1) as a control variable.

As seen in columns (1) and (2) of Table 6, for the results after the samples' self-selection problem is considered, the coefficients of *Treat* are still significantly positive above the 5% level, indicating that the implementation of PDPSs by these companies still has a significantly positive impact on their financial performance and corporate value. Both coefficients of *IMR* are not significant, which means that the samples do not have serious selective bias. Thus, the original hypotheses are still consistent.

Variable substitution

First, we use *ROE* and net income (*Profit*), equal to the total profit divided by the operating income, as substitution variables for short-term performance. After replacing *UnEBIT* in model (1), columns (3) and (4) of Table 6 show the result, and both coefficients of *Treat* are still significantly positive after using substitution variables. It means that after using PDPS, both *ROE* and *Profit* will significantly improve, which supports H1.

Second, we use the cumulated abnormal return (*CAR*) as a substitution variable for long-term corporate value. Based on the method proposed by Froot et al. (2017), this study defines the *CAR* as the cumulative excess return in the (*t*-1, *t*+3) window time relative to the market return. After replacing *TobinQ* in Model (1), column (5) of Table 6 shows the result. The coefficient of *Treat* remains significantly positive at the 1% level, indicating that after a company implements a PDPS, its value will go up significantly. Therefore, H2 is still valid.

Table 6. Endogenous Problem Test

	(1)	(2)	(3)	(4)	(5)
VARIABLES	UnEBIT	TobinQ	ROE	Profit	CAR
Treat	0.030**	0.150**	0.021***	0.004**	0.015***
	(2.06)	(2.39)	(4.56)	(2.34)	(6.01)
Curr	-0.114	4.111***	0.027**	-0.010	0.022***
	(-0.51)	(4.22)	(2.21)	(-0.64)	(3.32)

Continue

Table 6. Endogenous Problem Test

Concludes

	(1)	(2)	(3)	(4)	(5)
VARIABLES	UnEBIT	TobinQ	ROE	Profit	CAR
Size	-0.048	0.775***	0.025***	0.031***	0.012***
	(-0.80)	(2.97)	(9.74)	(8.90)	(8.92)
Lev	0.460	6.640***	0.087***	0.238***	0.119***
	(1.44)	(4.76)	(6.41)	(13.32)	(16.65)
Shrhfd	0.029	0.457*	0.027	0.069***	0.025***
	(0.50)	(1.86)	(1.49)	(2.88)	(2.60)
Investor	-0.094	-2.326***	-0.006	-0.057***	-0.012*
	(-0.67)	(-3.76)	(-0.51)	(-3.64)	(-1.96)
Turnover	0.713***	0.119**	0.002	0.035***	0.003
	(54.84)	(2.06)	(0.50)	(8.38)	(1.54)
IMR	-0.268	4.780			
	(-0.96)	(0.88)			
Constant	0.944	-21.656***	-0.458***	-0.425***	-0.191***
	(0.55)	(-2.90)	(-8.30)	(-5.88)	(-6.58)
Observations	912	912	912	912	912
Adj.R-squared	0.748	0.240	0.606	0.216	0.218

Note: Standard errors are clustered at both firm and year levels. Industry fixed effect and year fixed effect are both controlled.
*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Source: Elaborated by the author.

One-period lagged method

The current financial variables of a company may be highly correlated with financial performance and corporate value. Further tests were conducted to mitigate the endogeneity problem using model (1) with lagged control variables. Specifically, all control variables are deferred for one year to avoid short-term effects. As shown in columns (1) and (2) of Table 7, both coefficients of *Treat* are significantly positive, indicating that the results are consistent.

Table 7. One-period lagged test

	(1)	(2)
VARIABLES	UnEBIT	TobinQ
Treat	**0.017****	**0.127***
	(2.18)	**(1.83)**
$Curr_{i,t-1}$	0.116***	0.649***
	(3.17)	(3.62)
$Size_{i,t-1}$	0.016**	0.255***
	(2.01)	(6.59)
$Lev_{i,t-1}$	0.143***	1.464***
	(3.44)	(7.26)
$Shrhfd_{i,t-1}$	0.037	0.540**
	(0.65)	(2.01)
$Investor_{i,t-1}$	0.002	0.109
	(0.05)	(0.60)
$Turnover_{i,t-1}$	0.770***	0.088*
	(76.94)	(1.76)
Constant	-0.943***	8.623***
	(-5.58)	(10.61)
Observations	912	912
Adj.R-squared	0.766	0.253

Note: Standard errors are clustered at both firm and year level. Industry fixed effect and year fixed effect are both controlled. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Source: Elaborated by the author.

CONCLUSION

Theoretical implications

Existing studies have debated the economic consequences of PDPS. One side argues that these systems entail more labor expenses and operating costs, thus leading to diminished economic profits for companies (Mattoo & Meltzer, 2018; Zhao, 2021). When possessing a data protection system, companies are required to maintain a breakdown of their processing activities and incorporate data protection into their technical design (Taufick, 2021), which undoubtedly increases costs. Additionally, in self-regulation, companies are uncertain about the level of personal data protection that should be provided to consumers, and this uncertainty is costly (Adjerid et al., 2016). Furthermore, disputes over the commercialization of personal data are complicated in the long run (Yu & Zhao, 2019); this is because the balance between the economic and social benefits of Big Data and the costs of personal data protection is difficult to maintain (Politou et al., 2019). However, some scholars believe that the establishment of PDPS can showcase a company's positive attitude toward privacy protection and generate competitive advantage (Ball, 2010; Politou et al., 2019; Tsai et al., 2011), which will help it strengthen its market position (Gal & Aviv, 2020; Steppe, 2017). Therefore, it is important to study the economic consequences of personal data protection on enterprises to promote PDPS. By exploring the impact of implementing PDPS, this study finds that such implementation would benefit the improvement of corporate financial performance and corporate value. This provides a useful complement to the economic consequences of using PDPS in emerging market countries.

Practical implications

This conclusion offers insights and references for both governments and enterprises. Governments, on the one hand, should actively promote legislation on protecting personal data. Although many developing countries have introduced relevant legal systems to protect personal data, these systems are often too general to provide precise guidance in practice. Governments shall implement and refine their management systems and requirements while setting forth detailed specifications and standards for each component of corporate data security by collaborating with the industries. On the other hand, governments should establish personal data regulatory agencies to strengthen the enforcement of data security laws. In many emerging markets, their current systems do not have strong supervision over data controllers and fail to play the effect of laws related to personal data protection. They should establish a data protection regulator to supervise relevant organizations to comply with personal data protection laws through specialized agencies to guide enterprises to regulate the handling of personal data and continuously improve the awareness and ability to protect user data security.

Enterprises should develop and implement systematic PDPS. First, they must clarify the rules on personal data utilization and reach a consensus with both their employees and managers, and relevant agreements must be signed for future accountability. From a technical perspective, companies should adopt encryption, corruption isolation, and de-normalization to secure data and disclose the process in the company's report. Second, it is necessary to establish a response mechanism for data-breaching events. Once personal data are disclosed illegally, companies should report the events properly, while taking appropriate measures to minimize potential losses. Third, regarding human capital management, companies should actively recruit relevant talent and create special positions, such as personal data protection officers and data protection specialists, to achieve dedicated supervision in procedures involving personal data (e.g., collection and processing). Finally, companies should conduct regular risk assessments of their internal PDPS, and such assessments should include identifying risks, calculating the probability of occurrence of breaches, identifying possible consequences, and remediating serious risks promptly.

Limitations and future research

This study has some limitations and suggestions for future studies. At present, due to the lack of awareness of personal data protection, many enterprises' PDPS mechanisms are not perfect. This study only examined whether PDPS were established, but it was impossible to observe the degree of these systems' implementation in each enterprise in detail. Future research can obtain first-hand information through visits to companies, case studies, and other methods while using more dimensional scoring systems and text analysis to evaluate PDPS. In addition, we used Chinese data, which has certain significant points for other developing countries. In the future, we can explore data from other countries to enrich the universality of the conclusions. Finally, we explored the impact of PDPS on Chinese e-commerce companies. Future research can consider the heterogeneity of the industry and further explore the impact of companies in other industries.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

AUTHOR'S CONTRIBUTION

Wanyi Chen: Project Administration-Formal Analysis - Conceptualization - Data Curation - Writing - First Writing - Writing - Review and Editing - Investigation - Methodology - Obtaining Financing - Resources - Software - Supervision - Validation - Visualization.