The Integrity Crisis in the AI-Based Measurement of Livelihood-Related Consumption

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Abstract

This exploratory case study investigates a significant profit increase observed in a Chongqing gas company after it replaced traditional meters with smart meters in the fourth quarter of 2023, and preliminarily explores its possible correlation with measurement deviations. Based on the financial statement data of a gas company in Chongqing from 2021 to 2023, this paper finds that the company's net profit increased substantially after the large-scale replacement of smart gas meters in the fourth quarter of 2023. After excluding the influences of variables such as unit price and cost, it is confirmed that this abnormal profit growth stems from the rise in sales volume, which is highly correlated with potential measurement deviations in the smart meter system. Natural monopoly enterprises have exploited their advantages in algorithmic black boxes and data interpretation rights to implicitly alter measurement logic for profit-seeking. The underlying causes lie in the failure of market regulation and supervision mechanisms in monopoly industries, as well as the natural lag of administrative regulation behind technological applications. This paper proposes dismantling livelihood consumption sectors such as energy into three distinct fields: supply, pipeline, and measurement, according to their functional attributes, so as to achieve mutual restriction and supervision among the three parties.

Keywords Smart Metering; Natural Monopoly; Information Asymmetry; Algorithm Black Box; Collaborative Governance

1 Research Background

Various AI-enabled metering tools are replacing traditional metering instruments. The data streams they generate serve not only as the traditional basis for trade settlement but also as core assets of public services. However, due to inadequate supervision over technology application and its disconnection from public trust, severe difficulties in practical implementation and a crisis of trust have emerged in real-world applications. Information asymmetry and lagging regulatory measures have led to frequent public opinion conflicts triggered by meter replacement.

2 Research Significance

Existing research on smart metering technologies has mostly focused on engineering and technical fields, with few studies exploring the topic from the cross-perspective of data factors and collaborative governance. This study analyzes the information asymmetry mechanism underlying smart metering, which helps to enrich the regulatory theory of natural monopoly industries in the digital era, clarify the technical and managerial roots of disputes over smart meter measurement, and safeguard the public's right to information and right to fair trade in digital life.

3 Research Status

In recent studies on the digital transformation of public utilities, academic discussions have shown an evolutionary trend from a "single technical perspective" to a "technology-society mutual construction perspective". Early research mainly focused on the engineering application and performance comparison of Internet of Things technology in gas metering, emphasizing solutions to the stability and coverage of

data transmission. However, as digital technology has deeply penetrated into every aspect of social life, the research focus has gradually shifted to deeper issues arising from technological applications, such as data governance, anti-monopoly regulation, and privacy ethics.

In terms of technology implementation and engineering practice, studies have concentrated on addressing the pain points of traditional gas management, such as "difficult household access and low efficiency". Nevertheless, physical variables including temperature fluctuations and aging electromechanical conversion devices may cause metering errors in smart meters, laying hidden dangers for subsequent metering disputes.

In terms of data value and collaborative governance, data, established as the fifth major factor of production, is characterized by non-rivalry and increasing returns to scale. Relying solely on government "hard regulation" or corporate "self-discipline" can no longer address risks in the digital age. Scholars advocate the construction of a collaborative model involving multiple stakeholders: government, enterprises, and the public.

Regarding IoT technology and smart metering, Mekki et al.(2019) compared three mainstream technologies: LoRa, Sigfox, and NB-IoT, and confirmed the high reliability advantages of NB-IoT in public utility scenarios [1]. Wang et al.(2019) further explored analytical methods for smart metering data, pointing out that smart meter data serve as core assets for load forecasting and anomaly detection, providing data support for refined energy management [2].

Regarding data asset management and privacy protection, Laney (2017) put forward the concept of information economics, arguing that enterprises should manage data assets in the same way as physical assets [3]. However, Kitchin (2014) held a cautious stance, warning that although real-time data has improved urban management efficiency, it has also led to unclear ownership of data rights and risks of "algorithmic governance". He cautioned against the impairment of public interests caused by over-reliance on commercial algorithms [4].

In terms of antitrust and algorithmic regulation, in response to the monopoly of tech giants, Khan (2017) pointed out in The Amazon Antitrust Paradox that traditional antitrust laws, which only focus on price increases, have become outdated. Modern monopoly is increasingly reflected in control over market access and critical data [5]. O'Neil (2016) further referred to opaque algorithms as "weapons of math destruction", calling for the establishment of a rigorous algorithmic auditing mechanism to prevent automated discrimination against vulnerable groups caused by algorithmic bias [6].

3.1 Research Method

This study adopts an exploratory case study design. The case was selected because it represents a large-scale public dispute concerning smart metering in a natural monopoly industry, providing a revelatory context for observing the potential mismatch between technological deployment and governance mechanisms.

Data sources. The data used in this study are divided into four categories: corporate financial data, policy documents, technical standards, and public opinion reports. Corporate financial data come from the annual and quarterly reports of Chongqing Gas Group Co., Ltd. for 2020-2024 (disclosed on the Shanghai Stock Exchange website). Policy documents include the Chongqing Development and Reform Commission's natural gas price adjustment notices for 2022 and 2023, and the State Council General Office's Implementation Plan for the Replacement and Upgrading of Aging Urban Gas Pipelines (2022-2025). The technical standard is JJG 577-2012 Verification Regulation of Diaphragm Gas Meters. Public opinion reports include publicly available articles from Caijing Jiubao and TMT Post/JRJJ on the Chongqing gas dispute.

Limitations and inferential nature. This study does not have access to smart meter calibration logs, algorithm audit records, or backend billing system data. Therefore, we cannot directly verify the existence of measurement deviation. Our analysis is inferential: we identify anomalies through financial data and then rule out alternative explanations. The conclusion that measurement deviation may be the cause of profit growth remains an inferential hypothesis, not a confirmatory finding.

4 Economic Phenomena of AI-Enabled Metering

Before investigating how enterprises transform with AI technologies and how to govern the associated risks, it is necessary to clarify how "data" generates value as a factor of production. This

paper selects the representative case of the "dispute over smart gas meter replacement in Chongqing" for research and analysis.

4.1 Event Review

The "dispute over smart gas meter replacement in Chongqing" that occurred between 2023 and 2024 is not only a large-scale consumer dispute concerning people's livelihood but also a typical reflection of public utilities in the deep-water zone of digital transformation. The evolution of this incident shows four distinct stages, which profoundly reveal how the "technical black box" gradually erodes market trust.

Digital Launch Stage

A gas company in Chongqing launched a citywide large-scale meter replacement program. The core measure was to replace traditional membrane gas meters with NB-IoT smart meters featuring remote data transmission free of charge. The initiative aimed to solve long-standing pain points in the gas industry, including difficulties in on-site meter reading, high labor costs, and delayed data feedback, through IoT technology. It demonstrated obvious technical rationality of "cost reduction and efficiency improvement" and received strong policy support at the initial stage.

Latent and Fermentation Stage of Conflicts

With the large-scale deployment of new meters, discrepancies emerged between technical logic and user perception. Numerous residents reported on social platforms that their gas bills had increased significantly in a non-linear manner despite no changes in household size, living habits, or gas appliances. For some users, the bill even rose by more than 50% to 100%. Such a "perceptual divergence" between physical consumption and digital billing broke the long-standing psychological contract of "measurement- payment" established in public utilities. At this stage, scattered complaints began to accumulate in community WeChat groups and online government- consulting platforms, but had not yet triggered nationwide public opinion.

Period of Public Opinion Outbreak and Confrontation

The turning point of the incident came in April 2024, when a viral "bill-sharing" campaign erupted on social media. Faced with widespread public suspicion that "new meters run faster", the company insisted that the meters met metering standards and simply attributed the bill increase to "under-measurement due to aging old meters" and "natural rise in gas consumption in winter". Public concern quickly escalated from "whether the meters are accurate" to an institutional questioning of "data monopoly" and "hidden price hikes", triggering a full-blown integrity crisis.

Period of Administrative Intervention and Final Determination

As public pressure mounted, regulatory authorities stationed personnel at the company to conduct a comprehensive investigation. The final investigation report rejected the simple "hardware failure" argument and defined the problem as serious management dereliction of duty, citing severe violations in the company's back-end data management, including "wrong meter reading, illegal estimated reading, and chaotic billing cycles". This conclusion confirmed the assertion that "risks in the digital age are hidden in algorithms and data flows", indicating that the crisis was essentially a management crisis disguised in technical form.

4.2 Abnormal Deviation in Financial Data

To objectively quantify the anomalies of the incident, this study conducts a visual analysis by combining the enterprise's annual report data and online public opinion data.

First, the smoothing effect at the annual level conceals abnormalities. As shown in Table 1, the annual operating revenue and net profit of the Chongqing gas company have maintained relatively steady growth over the past three years without significant abnormal fluctuations. This easily leads regulators and the public to mistakenly believe that the enterprise is operating on a normal track.

Table 1. Overview of major operating indicators of a gas company in chongqing in the past three years (2021-2023)

Year	Operation Revenue (Hundred Million Yuan)	Net Profit (Hundred Million Yuan)	Net Profit Margin
2021	78.10	4.56	5.84%
2022	87.40	4.02	4.60%
2023	102.60	4.99	4.86%

Sharp Abnormal Changes at the Quarterly Level

Figure 1 shows that in the fourth quarter of 2022, affected by high winter supply guarantee costs, although net profit was still achieved, its trend fundamentally reversed, falling to a low of 240 million yuan. In the first quarter of 2023, the company recorded its only loss in recent years.

This kind of "sudden change" in quarterly data that deviates from the overall annual trend, combined with the significant profit decline in Q4 2022 and the loss in Q1 2023, objectively created a strong financial incentive for the enterprise to make up for the early-year losses in subsequent quarters. The intensive smart meter replacement campaign in the second half of 2023 coincided highly logically with the sharp profit surge in Q4 2023 on the timeline.

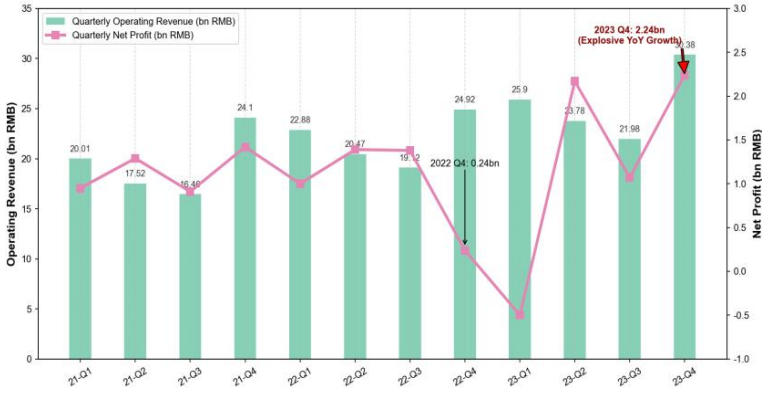

Fig. 1. Comparison of quarterly revenue and net profit of a gas company in chongqing (2021-2023)

4.2.1 The Pattern of "Loss in Winter, Profit in Summer"

To further verify the abnormality of the profit in the fourth quarter of 2023, this paper conducts a statistical analysis of the company's historical quarterly data from 2020 to 2024 (see Table 2). The data reveal a distinct seasonal profit pattern: the second quarter marks the annual peak, with a five-year average net profit margin on sales of 7.55%; the third quarter ranks second, averaging 6.45%; the fourth quarter drops to an average of 4.42%; and the first quarter is the annual low, at only 1.78% on average, with consecutive losses recorded in 2023 and 2024.

However, the net profit margin on sales of 7.37% in the fourth quarter of 2023 was not only significantly higher than the historical average for the same period, but also 7.7 times that of the same period in 2022, even exceeding the historical average of the traditionally profitable second quarter. This deviation further confirms that the sharp profit growth in this quarter cannot be explained by conventional seasonal patterns, and special disturbing factors must exist.

Table 2. Quarterly comparison of net profit margin on sales in the past five years (2020-2024)

Quarter	Season	2020	2021	2022	2023	2024	Average
Q1	Winter	3.58%	4.75%	4.37%	-1.93%	-1.89%	1.78%
Q2	Summer	5.63%	7.36%	6.79%	9.13%	8.82%	7.55%
Q3	Summer and Autumn	9.38%	5.53%	7.22%	4.87%	5.27%	6.45%
Q4	Winter	3.93%	5.89%	0.96%	7.37%	3.95%	4.42%

4.2.2 Analysis of Other Profit Growth Factors

To further identify the root cause of the abnormal growth in net profit in the fourth quarter of 2023, this study rules out the influence of variables including the number of users, sales unit price, unit cost, accounting treatment of meter replacement costs, and changes in accounting estimates one by one.

First, the factor of user volume. As disclosed in the company's annual reports, the total number of customers served by the company showed a steady and moderate growth trend from 2019 to 2024, with an average annual growth rate of approximately 3.5%. Specifically, the number of users increased from 5.6447 million in 2022 to 5.8464 million in 2023, representing a growth rate of about 3.7%. Such natural growth rules out a "surge in user volume" as the main driving factor.

Second, the factor of sales unit price. According to official price adjustment documents issued by the Chongqing Development and Reform Commission, residential gas prices were adjusted five times between 2019 and 2024. Directly relevant to the fourth quarter of 2023 is the price raised on May 26, 2023 (2.196 RMB/m³ for the first tier), representing an increase of approximately 7.7% compared with the price in the same period of 2022 (about 2.039 RMB/m³). This increase can partially explain revenue growth but only constitutes a minor contribution rather than the primary cause.

Third, the factor of cost. Global energy prices remained high in 2023, leading to a general rise in gas source procurement costs for gas enterprises. Rising costs exert a negative impact on profits by eroding earnings. Therefore, "cost reduction" can be excluded as a reason for profit growth. In addition, as disclosed in the company's annual report, smart gas meters are recognized as "machinery and equipment" under fixed assets and depreciated using the straight-line method over a service life of 8 to 10 years. This means that investment in large-scale meter replacement is not recorded as a one-time current cost but amortized over future years.

Based on the above exclusion analysis, after ruling out the significant effects of user volume, unit price, cost, meter replacement costs and other variables one by one, the core driver of the abnormal growth in net profit in the fourth quarter of 2023 can only point to an unusual increase in "gas consumption per household". This inference is fully consistent with the findings of the joint investigation team of Chongqing Municipality, which confirmed "serious violations such as wrong meter reading, illegal estimated meter reading and chaotic billing cycles".

4.3 Analysis of Contradictions and Their Causes

Based on the foregoing analysis of abnormal financial data and the lag effect of public opinion, the Chongqing gas incident essentially reflects the unbalanced development between technological application and institutional construction during the AI-driven transformation of public utilities. Under a natural monopoly market structure, without effective external checks and balances, enterprises with technological advantages tend to use information barriers to obtain excess returns, resulting in an unbalanced distribution of technological dividends between suppliers and consumers.

4.3.1 Algorithmic Black Box and Information Asymmetry in Smart Metering Technology

Although AI technology has achieved an efficient closed-loop of data transmission at the engineering level, in practical cases, such technical rationality has not translated into improved user perception; instead, it has triggered a crisis of trust due to information opacity. Traditional metering tools rely on physical gear rotation for counting, allowing users to verify consumption by directly observing the rolling of digital wheels. This physical visibility forms the most basic trust contract between suppliers and consumers. However, the introduction of smart gas meters has completely transformed this mechanism. A smart meter is essentially an embedded system integrating sensors, microprocessors, and communication modules. Its metering results are no longer simple physical accumulations, but digital outputs revised by back-end algorithms.

The core of the problem lies in the fact that gas volume is significantly affected by temperature and pressure. Yet in the Chongqing dispute, while the company claimed that the meters complied with national standards, it never disclosed to users the internal temperature compensation algorithms and low-flow cutoff thresholds of the smart meters. This severe information asymmetry allows the enterprise to unilaterally hold the right to define metering standards. Measurement shifts from physical mechanical movement to completely confidential code operations. At this point, technology is no longer neutral and becomes a source of public suspicion.

4.3.2 Path Dependence and Communication Failure Under Natural Monopoly

As Khan (2017) pointed out in his classic research, modern monopoly has gone beyond simple price control and is increasingly reflected in control over market access and critical data, which is highly consistent with the behavioral characteristics of natural monopoly enterprises [5]. Gas demand is price-inelastic, and users cannot vote with their feet to choose service providers, resulting in a lack of endogenous motivation for enterprises to communicate proactively and reform themselves in the face of crises.

In the early stage of the incident, the company failed to establish an agile response mechanism similar to that in competitive industries. Instead, it adopted the traditional one-way notification model and simply attributed the problem to under-measurement caused by aging old meters or natural growth in winter gas consumption. This arrogant communication attitude ignored the public's demand for the right to information and participation in digital transformation.

When the company attempted to respond to specific livelihood concerns with standardized compliance inspection reports, the originally simple metering technical dispute quickly escalated into a trust crisis over institutional monopoly. This blockage of communication channels caused significant reputational damage to the enterprise during its digital transformation.

4.3.3 Dilemma of Lagging Regulatory Models

The reason the Chongqing smart gas meter incident evolved into a public crisis lies in the serious structural misalignment of the public utility regulatory system when facing new digital business forms. Current regulatory basis mainly follows the traditional measurement law system, whose core logic is based on physical supervision — focusing on the initial inspection pass rate of physical meters before factory delivery and installation. However, in the IoT era, the accuracy of gas billing no longer depends solely on the precision of hardware sensors, but more on the stability of data transmission, the logical integrity of back-end billing cycles, and the compliance of estimated reading algorithms. Regulators lack legal and technical means to examine back-end codes and audit data flows in AI-enabled scenarios. Taking advantage of this regulatory gap, the enterprise, under the cover of compliant meter hardware, arbitrarily adjusted billing cycles in the background to bypass tiered gas prices, or used high-value estimation algorithms for implicit profit when data transmission failed.

5 Integrity Crisis Arising from AI- Enabled Metering

From the above empirical analysis, it can be seen that attributing this metering integrity crisis merely to the illegal operation of individual enterprises underestimates the complexity of the problem. From a macro perspective of data factors, this crisis profoundly reveals deep-seated structural contradictions among data ownership, information interaction, and regulatory mechanisms in the digital transformation of public utilities.

5.1 Imbalance in Data Ownership and Unilateral Monopoly of Interpretive Power

In the traditional resource consumption service model, data are generated from users' physical meters, and on-site meter reading by meter readers is merely a process of "data handling". Both parties enjoy relative equality and visibility in data confirmation. However, with the full application of AI technology, the power structure of data production and interpretation has undergone a fundamental shift.

First, users have lost control over raw data. As producers of data, users are unable to obtain or verify such raw data in real time and can only passively accept final bills pushed by the enterprise's application. This phenomenon of "data deprivation" grants the enterprise unilateral final interpretive power over metering, breaking the balanced traditional metering contract. It also coincides with the risk of unclear data ownership in smart cities warned by Kitchin (2014) [4].

Second, enterprises exploit "data potential energy" to capture profits. The core logic is that enterprises, relying on their monopolistic position in the data chain, are able to arbitrarily change billing cycles or adopt high-value estimated readings via back-end algorithms when data are missing. Such behavior essentially reduces "data factors" to "capital tools" by enterprises. In a market lacking effective competition, enterprises can achieve excess returns simply by adjusting the calculation logic of back-end data, rather than improving service quality. This is a typical manifestation of "moral hazard" in information asymmetry theory.

5.2 Algorithmic Black Box Effect Caused by the Expansion of Technical Rationality

Although technological upgrading was originally intended for accurate metering, invisible technical processes often lead to "technological anxiety". In this case, the widespread public suspicion that "new meters run faster" essentially reflects deep-seated fear of the "algorithmic black box".

On the one hand, there is a serious perceptual disconnect between physical metering and digital transmission. As emphasized by Ahlgren et al. (2016) interoperability and data openness are prerequisites for ensuring fairness in the application of IoT systems in smart cities [7]. Yet the correction

algorithms and key parameters were kept completely confidential from users. Users could not determine whether their actual consumption had increased or the algorithm had been "tuned to run faster". O'Neil (2016) called such opaque algorithms "weapons of math destruction". In this case, opaque algorithmic decisions may impose hidden discrimination on vulnerable groups [6].

On the other hand, AI-driven transformation has widened the "digital divide" for disadvantaged groups. Many elderly users could not understand why the meter kept registering usage without obvious activity, nor could they skillfully use mobile apps to check detailed electronic statements. The enterprise attempted to impose a highly rational technical system on ordinary households with diverse daily living habits, yet neglected necessary social explanation and age-friendly services. This overreach of technical rationality turned smart meters from a convenience into a trigger for intensified social conflicts.

5.3 Digital Lag of the Traditional Metering Regulatory Model

The fact that this incident continued to escalate and was only halted at a late stage exposes the serious lag of the existing metering regulatory system when facing new AI-driven business forms.

First, there are blind spots in regulatory targets. Current regulation focuses on whether meter hardware is qualified. However, the real problem lies not in the hardware but in the back-end billing system and data flow. The existing regulatory system lacks the means and legal basis for penetrating audits of enterprises' back-end algorithms and billing logic, resulting in the paradox of "qualified meters producing unreasonable bills".

Second, the absence of a collaborative governance mechanism. Resource-based enterprises, with both monopolistic and public welfare attributes, should be subject to the strictest regulatory constraints. Yet in the process of AI transformation, the checks-and-balances relationship among the government, enterprises, and society has failed. Enterprises act simultaneously as meter readers, billers, and rule interpreters. Regulatory authorities still rely on the ex post relief model of "investigating after incidents occur" and have not yet established a new governance system featuring digital-based ex ante prevention and whole-process supervision.

6 Management Improvement Strategies

In the AI-driven process of livelihood consumption metering, integrity crises often stem from enterprises' monopoly on data interpretation power and the hidden risks of algorithmic black boxes. These problems not only erode public trust but also amplify hidden dangers to fairness in technology application. To address this challenge, this paper proposes a management strategy framework combining functional decomposition and collaborative governance. Centered on breaking vertical integrated monopoly, the framework separates energy and other public utilities into three functional modules: supply, pipeline, and metering, forming a multi-party checks-and-balances structure.

6.1 Functional Decomposition: Reconstructing a Market Structure with Tripartite Checks and Balances

Under the traditional model of public utilities, enterprises monopolize the entire industrial chain of resource supply, infrastructure operation, and metering settlement, which easily triggers integrity crises. To address this, it is proposed to decompose the livelihood consumption sector into three independently operated modules: supply, pipeline, and metering, with responsibilities assigned to different entities to form a mutual supervision mechanism and prevent a single enterprise from dominating data flows.

The supply module focuses on the market-oriented distribution of resources. Multiple competitors are introduced through bidding, allowing users to independently select service providers. Service providers only pay pipeline rental fees and metering service fees and have no access to meter data. Similar to the wholesale competition model in the power industry, this can stimulate innovation in pricing and services and ease trust conflicts caused by monopoly pricing.

The pipeline module undertakes the neutral maintenance and transmission of infrastructure. As public assets, it is managed by professional operators that provide fair access to all suppliers. Operators settle rents based on actual flow, only ensuring transmission integrity without involvement in consumption calculation, thus preventing upstream enterprises from manipulating data through infrastructure.

The metering module shall be exclusively operated by a professional third-party institution, responsible for the installation, maintenance and data interpretation of smart meters. Ownership of the

meters belongs to the third party and is independent of both suppliers and users. The institution must adopt national standard algorithms, disclose core parameters and correction procedures, and allow users to view real-time data and algorithm logs through an independent platform, so as to ensure metering neutrality.

Through division of labor, the three modules form a dynamic game. Any deviation in one module can be supervised and exposed by the other parties, driving the industry to transform from administrative closure to market openness.

6.2 Operational Mechanism Optimization: Deepening Collaboration and Transparent Governance

The effectiveness of functional decomposition depends on robust operational mechanisms to bridge information gaps and potential conflicts among modules.

First, establish a unified Livelihood Metering Data Sharing Platform. Led by the government, the platform requires the three parties to submit standardized data in real time, including raw consumption values, transmission records, and algorithm outputs. The public and audit institutions can access desensitized data to achieve end-to-end transparency. For example, in anomaly detection, the platform can automatically compare logs from all three parties and trigger early warnings. This sharing mechanism resolves information asymmetry and prevents enterprises from unilaterally manipulating interpretive power.

Second, strengthen contractual constraints and incentive systems. The three parties sign modular agreements defining responsibility boundaries: suppliers are prohibited from data interference, pipeline operators ensure signal integrity, and metering institutions accept regular calibration. Meanwhile, performance indicators are introduced, such as a metering accuracy rate of over 99% — with financial incentives for high performers and penalties including contract termination or fines for violations. Drawing on the "incentive compatibility" principle in financial regulation, this mechanism internalizes integrity into routine operations.

Third, enhance user participation and dispute resolution channels. Establish a Consumer Metering Supervision Committee composed of user representatives, industry experts, and regulators to conduct routine reviews and mediate complaints. For instance, when users question billing, they may apply to the committee for independent meter verification, rather than being limited to internal appeals within the enterprise. This helps bridge the digital divide, especially by providing clear explanatory services for non-technical users, and ensures social inclusiveness in AI-enabled metering.

6.3 Technical and Regulatory Support: Bridging the Tension Between Institution and Innovation

The implementation of the strategy requires the dual drive of technology and regulation to cope with the complexity of AI applications.Technically, integrate blockchain and distributed computing to strengthen data immutability. For instance, metering devices embed on-chain blockchain records, with each reading verified by multiple nodes, and edge devices locally handle algorithm deviations to reduce centralization dependence. This can directly eliminate the black-box problems seen in the Chongqing incident and improve system resilience. Meanwhile, encourage third parties to develop open-source algorithm frameworks that allow community review, gradually weakening monopoly barriers of proprietary technologies.

7 Conclusion

Based on the single case study of a Chongqing gas company, we find that in this case, although the introduction of AI technology improved metering efficiency, technological upgrading became associated with the emergence of integrity risks due to lagging institutional development. In this case, the enterprise unilaterally held the power of data interpretation without effective checks and balances, and its behavior exhibited a tendency to exploit the opacity of billing rules to obtain excess returns, thereby harming consumer rights.

This study has the following limitations: (1) A single case cannot be directly generalized to other gas companies or other monopoly industries; (2) Due to the lack of direct technical evidence , the conclusions are inferential hypotheses rather than confirmatory findings; (3) The financial data are

aggregated at the quarterly level and cannot precisely match the timing of measurement deviations for each household. Therefore, readers should exercise caution when interpreting the results of this study.

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Conflicts of Interest

The authors declare no conflicts of interest.

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民生消費計量AI化的誠信危機

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摘要：AI化計量過程中存在的客觀演算法偏差與主觀人為幹預是誘發市場誠信危機的核心原因。本文基於重慶市某燃氣公司2021—2023年財務報表數據發現，該公司在2023年第四季度大規模更換智能燃氣表後，淨利潤實現大幅度增長；排除單價和成本等變數影響下，證實該利潤異常增長源於銷量的攀升，與智能表系統潛在的計量偏差存在高度關聯。自然壟斷型企業存在利用演算法黑箱與數據解釋權優勢，隱性篡改計量邏輯實現牟利的行為。其深層成因在於壟斷行業中市場調節和監督機制失靈，以及行政監管天然滯後於技術應用。本文提出將能源等民生消費領域按功能屬性拆解為供應、管網和計量三個不同領域，從而實現三方相互制約和監督。

關鍵詞：智能計量；自然壟斷；資訊不對稱；算法黑箱；協同治理

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