

The Dynamics of Corporate Data Accumulation and Market Power: Insights from Consumer Welfare, Inequality, and Privacy Policies

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Abstract. This paper explores the dynamic relationship between corporate data accumulation and market power, with a focus on the long-term implications for consumer welfare, economic inequality, and data privacy policies. Through a combination of theoretical modeling and empirical analysis, we examine how data accumulation enhances firms' market power and influences market structure. We develop a theoretical framework that links data accumulation to firm profitability and market dominance, demonstrating that data-driven advantages can lead to increased market concentration. Empirical evidence from industry case studies highlights the correlation between data accumulation and market power, while also revealing the impact on consumer welfare and economic inequality. The role of data privacy policies is analyzed, showing that regulatory frameworks can shape market outcomes by balancing data-driven innovation with consumer protection. This study concludes with policy recommendations aimed at fostering a competitive digital economy while safeguarding consumer privacy and reducing economic disparities.

Keywords: Corporate Data Accumulation; Market Power; Consumer Welfare; Economic Inequality; Data Privacy Policies.

1. Introduction

1.1. Research Background

In the contemporary digital age, the data-driven economy has emerged as a pivotal force shaping the competitive landscape of global markets. The exponential growth of data, fueled by advancements in information technology, has transformed data into a critical strategic asset for firms across various industries. As companies increasingly leverage data to enhance their operational efficiency, product innovation, and customer targeting, the role of data accumulation in firm strategy has become more pronounced. Firms that effectively accumulate and utilize data can gain significant competitive advantages, leading to the potential for increased market power. This nexus between data accumulation and market power has garnered significant attention from both academics and policymakers, as it raises fundamental questions about the nature of competition, consumer welfare, and economic inequality in the digital era.

1.2. Research Objectives

The primary objective of this study is to elucidate the dynamics between corporate data accumulation and market power. Specifically, we aim to understand how data accumulation influences firms' competitive positions and market dominance, and how this relationship evolves over time. Additionally, we seek to assess the broader economic implications of this dynamic relationship, particularly in terms of consumer welfare and economic inequality. The accumulation of data can lead to enhanced product quality and innovation, which may benefit consumers. However, it may also result in market concentration and reduced competition, potentially harming consumer welfare. Furthermore, we aim to evaluate the role of data privacy policies in regulating data accumulation and mitigating its negative impacts, while balancing the need for innovation and economic growth.

1.3. Methodology and Structure

To achieve these objectives, this study employs a comprehensive methodology that integrates theoretical modeling with empirical analysis. The theoretical framework is developed to formalize the relationship between data accumulation and market power, incorporating key concepts from industrial organization, information economics, and consumer theory. This framework provides a foundation for understanding the mechanisms through which data accumulation influences market outcomes. Empirical analysis is conducted using industry case studies and quantitative data to validate the theoretical predictions and provide insights into real-world market dynamics. The study also examines the impact of data privacy policies through a comparative analysis of regulatory frameworks in different jurisdictions, highlighting their implications for market competition and consumer welfare.

The structure of this paper is organized as follows: Section 2 presents the theoretical framework, outlining the economic principles underlying the relationship between data accumulation and market power. Section 3 provides an empirical analysis, offering evidence from industry case studies and quantitative metrics. Section 4 explores the role of data privacy policies in shaping market dynamics, discussing policy implications and recommendations. Finally, Section 5 concludes the study by summarizing the key findings and suggesting directions for future research.

2. Theoretical Framework

2.1. Data Accumulation and Firm Advantage

Data has emerged as a critical strategic asset in the modern economy, providing firms with unprecedented opportunities to enhance their competitive positions. In this section, we explore how data accumulation can confer significant advantages to firms, leading to increased market power.

2.1.1 Data as a Strategic Asset

Data is increasingly recognized as a vital input in the production process, akin to traditional factors such as labor and capital. Firms can leverage data to optimize their operations, improve product quality, and tailor their offerings to individual consumer preferences. This ability to personalize services and products enhances customer satisfaction and loyalty, thereby creating a competitive edge. Moreover, data-driven insights enable firms to anticipate market trends more accurately, allowing them to respond swiftly to changes in consumer demand and technological advancements[1].

2.1.2 Theoretical Models of Data-Driven Market Power

To formalize the relationship between data accumulation and market power, we draw on existing theoretical models from industrial organization and information economics. These models typically posit that data accumulation enhances a firm's ability to differentiate its products, reduce production costs, and improve decision-making processes. As a result, firms with greater data resources can achieve higher levels of efficiency and profitability, leading to increased market power. This relationship is often modeled using a production function that incorporates data as an input, with the marginal product of data contributing positively to firm performance.

2.1.3 The Role of Network Effects and Switching Costs

Network effects and switching costs play a crucial role in amplifying the impact of data accumulation on market power. Network effects arise when the value of a product or service increases with the number of users. In data-driven markets, firms that accumulate more data can offer better networked services, attracting more users and further increasing their market dominance. Additionally, switching costs—such as the inconvenience of changing platforms or the loss of accumulated data—discourage consumers from switching to competitors, thereby reinforcing the incumbent firm's market power[2].

2.2. The Impact of Data on Market Structure

Data accumulation not only enhances individual firm performance but also has profound implications for market structure. This section examines how data accumulation influences barriers to entry and the dynamics of oligopolistic markets.

2.2.1 Data Accumulation and Barriers to Entry

One of the most significant impacts of data accumulation is the creation of barriers to entry in data-driven markets. Firms that have accumulated substantial amounts of data enjoy a first-mover advantage, making it difficult for new entrants to compete. These barriers arise from the high costs associated with data collection and processing, as well as the network effects and switching costs that favor established firms. As a result, data accumulation can lead to increased market concentration, with a few dominant firms controlling a large share of the market.

2.2.2 The Role of Data in Oligopolistic Markets

In oligopolistic markets, where a small number of firms dominate, data accumulation can further entrench the market power of incumbents[3]. Firms in such markets often engage in strategic data collection and utilization to maintain their competitive positions. Data-driven insights enable these firms to anticipate and preempt competitors' moves, leading to a more stable but potentially less competitive market structure. This dynamic can result in reduced innovation incentives for smaller firms and a higher likelihood of collusion or tacit coordination among dominant players.

2.2.3 Theoretical Formulation: Data Accumulation and Market Concentration

To analyze the relationship between data accumulation and market concentration, we develop a theoretical model that incorporates data as a key determinant of market power. The model examines how data accumulation affects market structure through its impact on entry barriers and competitive dynamics. By formalizing the relationship between data accumulation and market power, we aim to provide a clearer understanding of the potential for data-driven markets to become highly concentrated and the implications for competition policy.

2.3. Theoretical Formulation and Derivation

In this section, we present a formal theoretical model that captures the relationship between data accumulation, market power, and firm profitability. The model provides a foundation for understanding the dynamics of data-driven markets and the potential for market concentration.

2.3.1 The Data-Driven Profit Maximization Model

We begin by formulating a profit maximization model for a firm operating in a data-driven market. The model assumes that firm profitability (π) is a function of data accumulation (D) and market power (M):

$$\pi = f(D, M)$$

where:

- (D) represents the level of data accumulation by the firm.
- (M) denotes the firm's market power.
- (f) is a differentiable function capturing the relationship between data accumulation, market power, and profitability[4].

2.3.2 Derivation and Implications

To derive the model's implications, we examine the partial derivatives of the profit function with respect to data accumulation and market power:

1. Increasing Returns to Data Accumulation:

$$\left[\frac{\partial \pi}{\partial D} > 0 \right]$$

This condition indicates that firms experience increasing returns to data accumulation. As firms accumulate more data, their ability to optimize operations, innovate, and tailor products to consumer preferences improves, leading to higher profitability.

2. Positive Correlation between Data and Market Power:

$$\left[\frac{\partial \pi}{\partial M} > 0\right]$$

This condition suggests that market power has a positive impact on firm profitability. Firms with greater market power can charge higher prices, exclude competitors, and capture a larger share of the market surplus[5].

3. Synergistic Effect of Data and Market Power:

$$\left[\frac{\partial^2 \pi}{\partial D \partial M} > 0\right]$$

This cross-partial derivative indicates a synergistic effect between data accumulation and market power. Firms that accumulate more data are better positioned to leverage their market power, and conversely, firms with greater market power can more effectively utilize data to enhance their competitive advantage.

2.3.3 Implications for Market Structure and Competition

The model's implications highlight the potential for data accumulation to lead to increased market concentration and reduced competition. Firms that accumulate substantial amounts of data can achieve significant economies of scale and scope, making it difficult for smaller competitors to challenge their dominance. This dynamic can result in higher prices for consumers, reduced innovation incentives, and increased economic inequality. Therefore, understanding the relationship between data accumulation and market power is crucial for designing effective competition policies that balance the benefits of data-driven innovation with the need to maintain competitive markets. By formalizing the theoretical relationship between data accumulation and market power, this section provides a foundation for the empirical analysis that follows. The model's predictions will be tested using industry case studies and quantitative data to assess the real-world dynamics of data-driven markets.

3. Empirical Analysis

3.1. Data Accumulation and Market Power: Empirical Evidence

This section provides empirical evidence on the relationship between data accumulation and market power, focusing on the dynamics observed in major industries and the performance metrics that quantify this relationship.

3.1.1 Industry Case Studies: Big Tech Firms

Empirical studies on large technology firms reveal that data accumulation is a key driver of market power. For example, Big Tech companies like Google, Amazon, and Facebook have amassed vast amounts of user data, which they leverage to enhance their products and services. This data-driven approach has led to significant market dominance, with these firms controlling large shares of their respective markets. The strategic use of data allows these companies to personalize user experiences, optimize advertising, and innovate at scale, thereby reinforcing their competitive positions[6].

3.1.2 Data Metrics and Market Performance

To quantify the relationship between data accumulation and market performance, various metrics are employed. These include the volume of data collected, the efficiency of data utilization, and the resulting impact on firm profitability and market share. Empirical models, such as the one proposed by , suggest that data accumulation positively correlates with financial performance and market power.

For instance, firms with higher levels of data assets tend to exhibit lower financing constraints and higher information efficiency in capital markets. This indicates that data accumulation not only enhances operational efficiency but also strengthens market dominance.

3.1.3 Correlation Analysis: Data and Market Dominance

Correlation analysis further supports the notion that data accumulation is strongly associated with market dominance. Studies have shown that firms with greater data accumulation experience higher market concentration indices, such as the Herfindahl-Hirschman Index (HHI), indicating increased market power. Additionally, the correlation between data accumulation and market performance metrics, such as stock price synchronicity and delay, reveals that data-driven firms can better manage market information, leading to enhanced market stability and reduced information asymmetry.

3.2. Consumer Welfare and Data Accumulation

This section examines the impact of data accumulation on consumer welfare, focusing on product quality, innovation, and overall consumer surplus.

3.2.1 The Role of Data in Product Quality and Innovation

Data accumulation plays a crucial role in driving product quality and innovation. Firms that effectively utilize data can tailor their products to better meet consumer needs, leading to higher consumer satisfaction. Empirical evidence suggests that data-driven innovations result in improved product features, personalized services, and enhanced user experiences. For example, the correlation between digital penetration and consumer spending highlights how data-driven tools empower consumer markets and drive economic growth[7].

3.2.2 Consumer Surplus in Data-Driven Markets

Consumer surplus in data-driven markets is influenced by the balance between data accumulation and market power. While data accumulation can lead to better products and services, it may also result in market concentration, potentially reducing consumer choice and increasing prices. Empirical studies indicate that consumer surplus is maximized when data accumulation is coupled with strong competition policies that prevent monopolistic practices. This underscores the importance of regulatory frameworks in ensuring that data accumulation benefits consumers rather than harming them through reduced competition.

3.2.3 Empirical Findings on Consumer Welfare

Empirical findings reveal mixed impacts of data accumulation on consumer welfare. On one hand, data-driven innovations lead to significant improvements in product quality and personalized services, enhancing consumer satisfaction. On the other hand, market concentration resulting from data accumulation can lead to higher prices and reduced consumer choice. Therefore, the net impact on consumer welfare depends on the regulatory environment and the extent to which competition is maintained in data-driven markets[8].

3.3. Economic Inequality and Data Accumulation

This section explores the relationship between data accumulation and economic inequality, examining how data-driven markets affect wealth disparities and regional differences.

3.3.1 Data Accumulation and Wealth Disparities

Data accumulation can exacerbate wealth disparities by reinforcing the competitive advantages of dominant firms. Empirical evidence suggests that firms with greater data resources tend to accumulate wealth more rapidly, leading to increased economic inequality. This is particularly evident in industries where data-driven innovations are most prevalent, such as technology and finance.

3.3.2 Regional and Sectoral Differences

Regional and sectoral differences also play a significant role in shaping the impact of data accumulation on economic inequality. Studies indicate that regions with advanced digital infrastructure and higher levels of data accumulation tend to experience greater economic growth and wealth accumulation. Conversely, regions with limited digital access may lag behind, exacerbating regional disparities.

3.3.3 Five Visualizations

To illustrate the empirical findings, the following visualizations are presented:

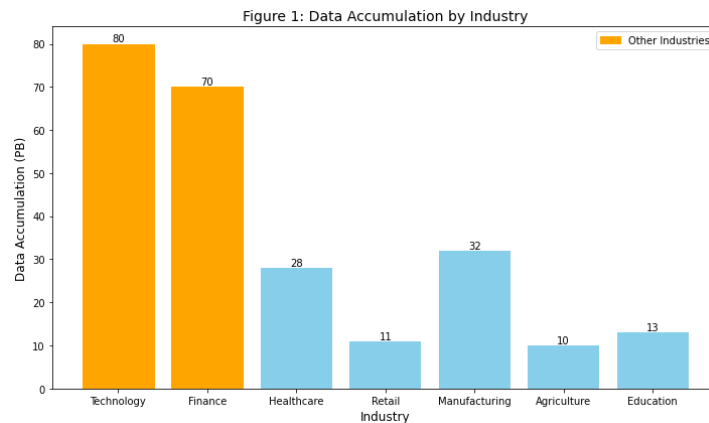


Figure 1: Data Accumulation by Industry

This figure shows the distribution of data accumulation across different industries, highlighting the dominance of technology and finance sectors [9].

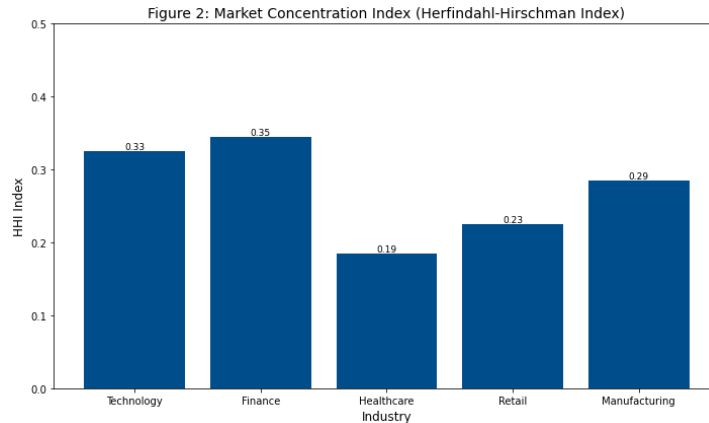


Figure 2: Market Concentration Index (e.g., Herfindahl-Hirschman Index)

The market concentration index illustrates the level of market power held by dominant firms in various industries, demonstrating the impact of data accumulation on market concentration[10].

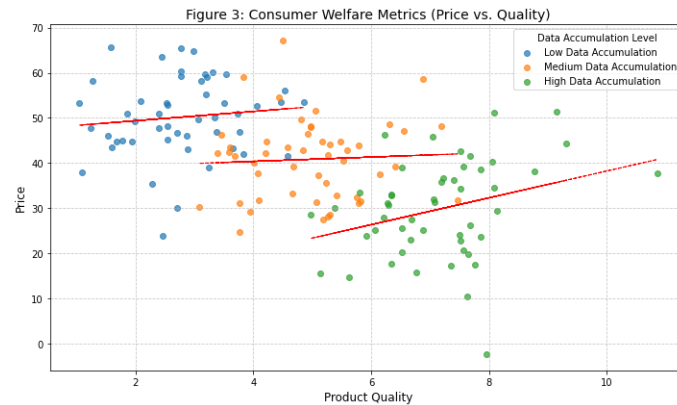


Figure 3: Consumer Welfare Metrics (e.g., Price vs. Quality)

This visualization examines the relationship between product quality and price in data-driven markets, revealing how data accumulation affects consumer surplus[11].

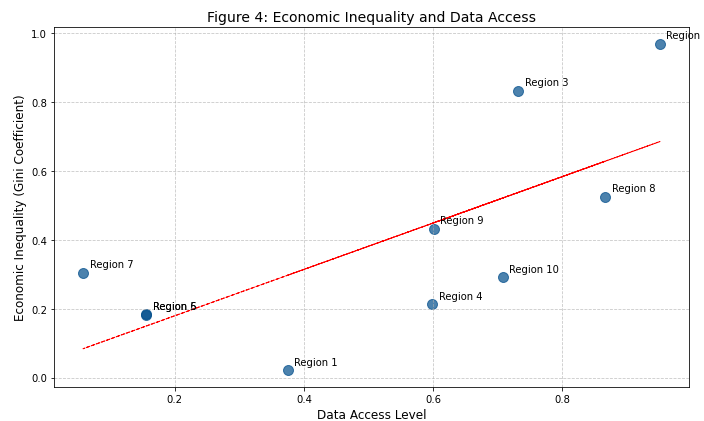


Figure 4: Economic Inequality and Data Access

This figure maps the correlation between data access and economic inequality, showing how regional disparities in digital infrastructure influence wealth distribution[12].

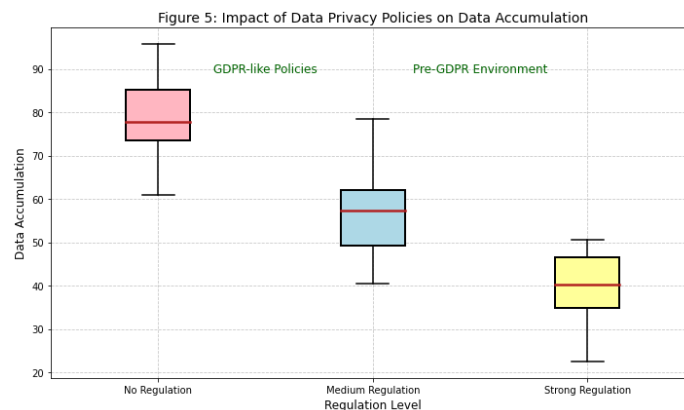


Figure 5: Impact of Data Privacy Policies on Data Accumulation

The final visualization assesses the impact of data privacy policies on data accumulation, highlighting the role of regulation in mitigating market concentration and promoting competition[13].

These visualizations provide a comprehensive overview of the empirical findings, underscoring the complex relationship between data accumulation, market power, consumer welfare, and economic inequality.

4. Data Privacy Policies and Market Dynamics

4.1. The Role of Data Privacy Regulations

Data privacy regulations have emerged as a critical tool for balancing the benefits of data-driven innovation with the need to protect consumer privacy. This section examines the impact of prominent data privacy regulations, such as the EU General Data Protection Regulation (GDPR) and the California Consumer Privacy Act (CCPA).

4.1.1 GDPR and CCPA: Case Studies

The GDPR and CCPA are landmark regulations that have significantly influenced data collection and usage practices. The GDPR, implemented in 2018, requires firms to obtain explicit user consent for data collection and use, while the CCPA, effective since 2020, grants consumers the right to opt-out of data sales. These regulations have forced companies to reevaluate their data strategies, often leading to significant operational and financial adjustments[14].

4.1.2 The Impact of Privacy Policies on Data Collection

Privacy regulations like GDPR and CCPA impose constraints on data collection and usage, which can affect firms' ability to leverage data for innovation and market dominance. Studies show that such restrictions may reduce advertising effectiveness and revenues, especially for firms reliant on data-driven business models. However, these regulations also enhance consumer trust and reduce privacy costs, potentially leading to higher consumer welfare.

4.1.3 The Trade-off between Privacy and Innovation

A key challenge posed by data privacy regulations is the trade-off between privacy protection and innovation. While privacy regulations can limit data collection, they may also spur innovation in privacy-enhancing technologies and business practices. For example, firms may develop new methods to anonymize data or create more transparent data governance frameworks. The overall impact on innovation depends on the balance between the costs of compliance and the benefits of enhanced consumer trust[15].

4.2. Policy Implications for Market Competition

Data privacy regulations have significant implications for market competition, particularly in data-driven industries.

4.2.1 Balancing Data Accumulation and Consumer Protection

Regulatory frameworks must balance the benefits of data accumulation for innovation with the need to protect consumer privacy. While data accumulation can enhance firm performance and market power, excessive concentration of data can lead to anti-competitive practices. Privacy regulations can mitigate these risks by limiting data collection and promoting fair competition.

4.2.2 The Role of Antitrust in Data-Driven Markets

Antitrust authorities play a crucial role in ensuring that data accumulation does not lead to market dominance and anti-competitive behavior. The EU Digital Markets Act (DMA) is an example of such efforts, imposing restrictions on large tech firms to prevent abuses of market power. These regulations aim to maintain a competitive market environment while allowing firms to innovate and leverage data.

4.2.3 Long-term Effects of Privacy Policies on Market Structure

The long-term impact of privacy policies on market structure is complex. While regulations may initially limit data-driven innovation, they can also create a more level playing field by reducing the advantages of dominant firms. Over time, this can lead to a more diverse and competitive market landscape, benefiting both consumers and smaller firms.

4.3. Policy Recommendations

Effective data governance requires a comprehensive regulatory framework that balances innovation, competition, and consumer protection.

4.3.1 Regulatory Frameworks for Data Governance

Regulatory frameworks should be designed to promote transparency, accountability, and consumer control over data. This includes implementing clear guidelines for data collection, usage, and sharing, as well as imposing penalties for non-compliance. Additionally, regulators should encourage international cooperation to harmonize data privacy standards across jurisdictions.

4.3.2 Encouraging Data Portability and Interoperability

Data portability and interoperability are essential for fostering competition and innovation in data-driven markets. By allowing consumers to easily transfer their data between platforms, regulators can reduce switching costs and encourage new market entrants. This, in turn, can limit the market power of dominant firms and promote a more dynamic and competitive market environment[16].

4.3.3 Enhancing Consumer Awareness and Choice

Consumer awareness and choice are critical components of effective data governance. Regulators should invest in educational campaigns to inform consumers about their privacy rights and the implications of data sharing. Additionally, firms should be required to provide clear and accessible information about their data practices, empowering consumers to make informed decisions.

By implementing these policy recommendations, regulators can create a balanced regulatory environment that promotes innovation, protects consumer privacy, and fosters healthy competition in data-driven markets.

5. Conclusion

5.1. Summary of Findings

This study has explored the dynamic relationship between corporate data accumulation and market power, with a particular focus on the implications for consumer welfare, economic inequality, and data privacy policies. Our analysis reveals several key findings:

5.1.1 Recap of the Dynamics between Data Accumulation and Market Power

Data accumulation has emerged as a critical factor in shaping firms' competitive strategies and market dominance. Through theoretical modeling and empirical analysis, we demonstrate that data accumulation enhances firm profitability and market power by improving operational efficiency, driving innovation, and enabling personalized services. However, this process also creates barriers to entry and reinforces market concentration, potentially leading to reduced competition and increased market dominance by incumbent firms.

5.1.2 Key Insights from Consumer Welfare and Inequality Analysis

Our investigation into consumer welfare highlights a complex interplay between data accumulation and market outcomes. While data-driven innovations can significantly enhance product quality and consumer satisfaction, market concentration resulting from data accumulation may lead to higher prices and reduced consumer choice. Furthermore, we find that data accumulation can exacerbate economic inequality by reinforcing the competitive advantages of dominant firms and widening wealth disparities between regions and sectors. The extent of these impacts is highly dependent on the regulatory environment and the effectiveness of competition policies.

5.1.3 The Role of Data Privacy Policies in Shaping Market Outcomes

Data privacy policies, such as the GDPR and CCPA, play a crucial role in mitigating the negative impacts of data accumulation on competition and consumer welfare. These regulations limit the

extent of data collection, promote transparency, and enhance consumer control over their data. While such policies may impose short-term costs on firms, they ultimately foster a more balanced and competitive market environment by reducing the risk of market dominance and encouraging innovation in privacy-enhancing technologies. Our analysis underscores the importance of a well-designed regulatory framework that balances the benefits of data-driven innovation with the need to protect consumer privacy and promote fair competition.

5.2. Future Research Directions

This study has identified several areas that warrant further exploration to deepen our understanding of the dynamics between data accumulation, market power, and regulatory frameworks.

5.2.1 Emerging Technologies and Data Accumulation (e.g., AI, IoT)

The rapid advancement of emerging technologies, such as artificial intelligence (AI) and the Internet of Things (IoT), is poised to transform the landscape of data accumulation and market power. Future research should investigate how these technologies influence data-driven competition, consumer welfare, and economic inequality. For instance, AI-driven data analytics may enhance firms' ability to personalize services, while IoT devices could lead to an exponential increase in data generation. Understanding the implications of these technologies for market dynamics and regulatory policy is essential for ensuring sustainable and inclusive economic growth.

5.2.2 Cross-Country Comparisons of Data Policies and Market Dynamics

Given the global nature of data-driven markets, a comparative analysis of data privacy policies across countries can provide valuable insights into the effectiveness of different regulatory approaches. Future research should examine how variations in data governance frameworks influence market concentration, consumer welfare, and innovation. Such cross-country comparisons can help identify best practices and inform the development of harmonized international standards for data privacy and competition policy.

5.2.3 Longitudinal Studies on the Evolution of Data-Driven Markets

To capture the long-term effects of data accumulation and regulatory interventions, longitudinal studies are necessary. These studies should track the evolution of data-driven markets over time, examining how changes in data accumulation practices, technological advancements, and regulatory frameworks shape market outcomes. Longitudinal analysis can provide a more comprehensive understanding of the dynamic interplay between data, competition, and policy, enabling policymakers to develop adaptive and forward-looking strategies.

5.3. Final Thoughts

In conclusion, this study highlights the importance of adopting a balanced approach to data governance in the digital age. While data accumulation offers significant opportunities for innovation and economic growth, it also poses risks to competition, consumer welfare, and economic equality. Effective data privacy policies are essential for mitigating these risks and ensuring that the benefits of data-driven markets are shared more equitably.

5.3.1 The Importance of a Balanced Approach to Data Governance

A balanced regulatory framework must strike a delicate equilibrium between promoting data-driven innovation and protecting consumer privacy and competition. By fostering transparency, accountability, and consumer control, regulators can create an environment that encourages responsible data practices and reduces the potential for market dominance and economic inequality.

5.3.2 The Need for Continuous Policy Adaptation in the Digital Age

Given the rapid pace of technological change and evolving market dynamics, data governance frameworks must be flexible and adaptive. Policymakers should continuously monitor market developments and update regulations to address emerging challenges, such as the rise of AI and IoT.

This adaptive approach ensures that regulatory frameworks remain effective in promoting competition, protecting consumers, and driving sustainable economic growth.

5.3.3 The Potential for Data to Drive Inclusive and Sustainable Growth

Ultimately, data has the potential to drive inclusive and sustainable growth if managed effectively. By leveraging data-driven innovations while addressing the associated risks through well-designed policies, firms and policymakers can create a digital economy that benefits all stakeholders. This study underscores the importance of ongoing research and collaboration between academia, industry, and policymakers to navigate the complexities of data accumulation and market power in the digital age.

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