

A Literature Review on Theories and Empirical Evidence Under Asymmetric Information

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Abstract

This article presents a comprehensive literature review investigating the theories and empirical evidence of information asymmetry and its impact on market outcomes. The article integrates classic theoretical frameworks: adverse selection, moral hazard, signaling and screening, and explores applications in four key areas: the lemon market, the insurance market, corporate governance and the labor market. This review points out that information asymmetry is the main cause of market failure, which can lead to inefficient phenomena such as adverse selection, principal-agent problems, and labor market discrimination. Empirical studies in different contexts have confirmed the importance of these theories in reality and demonstrated impact on pricing, resource allocation, and market structure. In addition, this article explores and illustrates various mechanisms to alleviate information asymmetry, including signaling systems, information disclosure, third-party certification, risk adjustment, and compensation systems. These solutions help enhance market efficiency by reducing uncertainty and aligning the interests of economic agents.

Keywords

information asymmetry, adverse selection, signaling effect, principal-agent problem, market failure

1. Introduction

Information asymmetry, as an important revision of the neoclassical economic framework, is the core theory that explains the deviation of the real market from a perfectly competitive market equilibrium. Its impact on resource allocation efficiency, transaction fairness, and market order runs through multiple economic parties such as labor, consumers, and entrepreneurs. This article provides a comprehensive review of representative research in situations of information asymmetry, focusing on four typical problems: adverse selection in insurance and lemon markets, signal transmission in education markets, and principal-agent problems for corporate executives.

2. Theoretical Background

2.1 Theoretical Construction Level

There are multiple theoretical points with frequent analysis in scholar field. Firstly, scholars focus on the causes of information asymmetry, including differences in information production costs and private information advantages of agents. Secondly, core transmission mechanisms are another aspect to analyze, such as adverse selection, moral hazard, signal transmission and screening. Thirdly, the derivation of equilibrium results establishes the theoretical foundation, represented by Akerlof's "Lemon Model" and Spencer's "Signal Transmission Model" [1, 2, 3].

2.2 Empirical Level

Further verification carried out based on specific market scenarios, which could deepen the value of information asymmetry analysis. Firstly, the effectiveness of education is a typical phenomenon as a productivity signal in the labor market [4]. Secondly, the adverse selection effect in the health insurance market, provide a solid solution in the market [5]. Thirdly, the information asymmetry problem of agent issue, could solve with CEO compensation contracts in corporate governance [6]. Based on the above points, quantifying the impact of information asymmetry on transaction efficiency, price formation, and market structure.

2.3 Governance Level

Regards to the above issues, the author would expect to synthesize corrective tools with practical effects. The following content would cover signal transmission optimization (such as education certification and brand building), information disclosure mechanisms, third-party supervision, and risk adjustment have been explored [2, 5].

3. Literature Review

3.1 Adverse Selection

3.1.1 Conceptual of "Lemon Market"

Adverse selection is a classical market failure problem caused by information asymmetry, and its most classic example is the "Lemon Market" model [1]. This model reveals how quality uncertainty leads to market collapse as sellers have more product quality information than buyers. When low-quality products ("lemon products") drive high-quality products out of the market, adverse selection occurs: since buyers are unable to distinguish the quality differences, buyers are only willing to pay a price equal to the average quality. Therefore, high-quality sellers lose motivation to participate in the market, thus forming a vicious cycle of continuous decline in market quality and scale. Akerlof's (1970) pioneering research, using the second-hand car market as a typical case, constructed a theoretical framework of this phenomenon, proved that information asymmetry not only distorts price signals, but also erodes the basic trust required for market transactions [1].

In the credit markets of developing countries, another research provided key evidence of adverse selection using Chinese manufacturing enterprises as samples [7]. This study used panel data regression to analyze the credit records of 12403 enterprises in the Chinese industrial enterprise database from 2000 to 2006, with a focus on examining the relationship between information asymmetry and credit constraints. Due to the inability of banks to directly observe enterprise productivity (internal information), banks can only charge average interest rates, resulting in low-risk (high productivity) enterprises exiting the formal credit market due to high financing costs, while high-risk enterprises are still willing to accept high interest rates, forming a typical lemon market. The data shows that for every one standard deviation increase in the degree of information asymmetry, the probability of enterprises obtaining formal loans decreases by 18.6%.

3.1.2 Concrete to Insurance Market

Adverse selection is a core concept in insurance economics as well, stemming from information asymmetry – as individuals are more aware of their own health risks than insurance companies. This phenomenon distorts market efficiency and brings suboptimal results to both insurance companies and policyholders. Rothschild

and Stiglitz (1976) first systematically constructed the theoretical basis of adverse selection, demonstrating that information asymmetry in the insurance market can lead to two key conclusions: the absence of pooling equilibrium and the emergence of Pareto inefficient separated equilibrium [3]. In the separating equilibrium, high-risk individuals receive full insurance with higher premiums, while low-risk individuals can only receive limited protection to prevent high-risk individuals from hitchhiking.

Cutler and Zeckhauser (1998) further extended this theory, pointing out that adverse selection can lead to three types of inefficiency problems: individuals being assigned to inappropriate insurance plans, reduced risk-sharing, and insurance companies manipulating insurance product design to avoid high-risk policyholders [5]. The authors also provided strong empirical evidence based on the research of two institutions in the United States - Harvard University and the Massachusetts Group Insurance Council (GIC). After Harvard University adopted the equal payment rule in the 1990s, it quickly fell into an "adverse selection vicious cycle": healthy employees gave up the generous Preferred Medical Institution (PPO) plan due to rising costs, and the proportion of high-risk groups among the remaining policyholders was imbalanced, forcing premiums to further increase. Eventually, the plan was terminated in 1997.

Finkelstein and Macquarie (2006) also empirically verified the objective existence of adverse selection and information asymmetry in the long-term care insurance market in the United States [8]. The study used two types of core data: one was AHEAD survey data on the elderly population (5072 respondents, average age 78, 11% of respondents held long-term care insurance), and the other was proprietary policy data from large insurance companies (144,798 policies). The study uses the probability unit model as the core measurement method, and uses the self-reported 5-year probability of admission to nursing homes (average 18%) by respondents as a measure of personal risk information. At the same time, the actual admission rate (16%) is used as an objective risk indicator for tracking analysis. Research has found that subjective risk judgments of respondents have a significant positive predictive effect on actual nursing home occupancy behavior: for every 10% increase in self-reported risk, the actual occupancy risk increases by 0.9%, and this predictive power remains significant even after controlling for actuarial risk assessment indicators of insurance companies. This result proves that the policyholder holds residual private information that the insurance company is not aware of, and this information is positively correlated with insurance purchase behavior - this is the core feature of pre-selection adverse selection.

3.2 Agent Issue

The principal-agent problem describes a conflict-of-interest situation that arises when the principal delegates tasks or decisions to the agent who acts on their behalf, but the agent's personal goals don't perfectly align with the principals. It can be seen as a representative example that the shareholders (the principal) want to maximize profit or share values, while the CEO (the agent) wants to maximize net utility. At the turn of the early 20th century, more concerns about the principal-agent problem between CEOs and shareholders have been raised as the ownership and control in companies were separated. Due to asymmetric information and high cost of monitoring, it would be difficult for the shareholder to observe the behaviors of the CEO. Under this information asymmetry, the CEO may do things that is detrimental to the interests of shareholders. To be specific, when senior executives divert the funds or assets of a listed company for their own or related parties' use, it directly infrings upon the interests of the shareholders [9, 10]. There is news reported that the CEO was accused of having the company pay him 30 million dollars for his private mansion, jet travel and vacations [11].

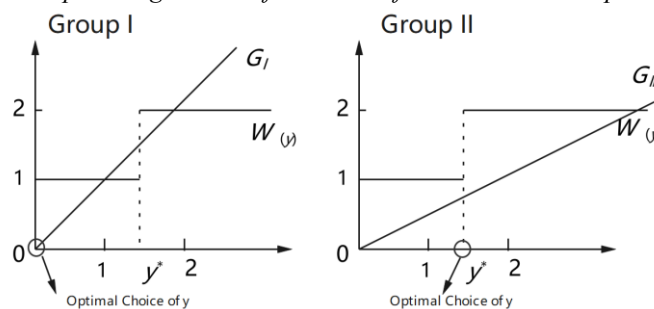
3.3 Information Asymmetry in labor market

Asymmetric information can also be observed in the labor market. The job market signaling model points out that it is impossible for the employer to directly observe the marginal productivity of employees before hiring [2]. Therefore, recruitment is essentially an investment decision made under uncertainty. As a result, the employer may determine one's wage according to indexes like sex, race, nationality and family background. These are defined as observable but unalterable characteristics [2], and this may lead to racial discrimination and sexual discrimination during recruitment. This phenomenon validated by a resume correspondence experiment: the research sent 4870 fictitious resumes to 1300 companies in Boston and Chicago, USA, with differences only in the racial implications of names (white names such as Emily and Greg vs. African American names such as Lakisha and Jamal), while other indicators such as skills and experience were completely consistent [12]. The experimental results show that the callback rate of resumes with white names is 33%

higher than that of resumes with African American names, and even in resumes with African American names labeled with equal or even better skill levels, the employment opportunities for high-quality workers are still 27% lower than those of white people with the same conditions. This data confirms that employers tend to use racial background as a quality substitute indicator when lacking complete information on individual skills, resulting in low employment of high-quality minority workers.

Education can act as an alternative signal as opposed to race or sex. The employers make judgments on the individuals' conditions and estimate their job capabilities based on the level of education of employee attain and determine the wage level accordingly. The employees would choose the optimal level of education by weighing the cost of education against expected wage. When the cost of signals is negatively correlated with an individual's productivity, high-ability individuals are more likely to undertake a higher level of education, while low-ability individuals would find it too costly to imitate, thus the market forms a separating equilibrium, and different ability types are distinguished by different levels of education.

Figure 1: Optimizing Choice of Education for Flatter and Steeper Groups



As Figure 1 shown above [2], the cost curve C_2 shown in the graph for Group II is flatter, indicating that it is easier for high-ability individuals to further studies, thus lowering cost for individuals. Those people can earn high wages if the employee obtain a diploma, so individuals are more willing to choose education. However, the cost curve C_1 for Group I is steeper, which means the cost of low-ability individuals to get educated is higher. Therefore, individuals are more inclined to choose work over education, thus education automatically screens out individuals of different abilities.

4. Key Finding

This article systematically reviews the relevant theories and empirical research on information asymmetry, revealing the core mechanisms that trigger market failures in the four major markets. The Akerlof Lemon Market Model indicates that information differences can drive out high-quality products from low-quality ones, and third-party authentication can significantly improve transaction efficiency and reduce adverse selection risks. In the insurance market, the private information of policyholders triggers adverse selection, and risk adjustment, premium subsidies, and reinsurance can effectively stabilize the market. In corporate governance, the separation of ownership and control leads to agency conflicts. Equity incentives can coordinate the interests of managers and shareholders, but options can easily induce excessive risk-taking, so restricted stocks are gradually replacing options. In the labor market, employers are prone to discrimination due to insufficient information. Education, as an effective signal, can distinguish workers' abilities and achieve market separation and equilibrium. Various mitigation mechanisms improve resource allocation efficiency by reducing information gaps and balancing interests.

5. Discussion

5.1 Adverse Selection Prevention

5.1.1 Countermeasure of Lemon Market

To eliminate this asymmetric information between buyers and sellers, third-party verification process matters. Elfenbein et al. (2015) proposed a third-party authentication badge mechanism through empirical

research on multiple platforms, providing an institutionalized solution to address adverse selection caused by information asymmetry [13]. This study used a double difference model with eBay, Airbnb, and Upwork as samples to track the business data of 12846 new sellers from 2010 to 2013, focusing on the impact of “high-quality seller authentication” on market screening efficiency. Due to the inability of buyers to observe service quality in advance (such as product authenticity, accommodation experience and skill specialization), low-quality sellers in the initial market occupy 63% of the transaction share through low price strategies, while high-quality sellers face exit difficulties due to pricing higher than average expectations, forming a typical lemon market. The authentication mechanism provides verifiable quality signals for high-quality sellers by setting objective thresholds, such as transaction completion rate $\geq 95\%$, buyer rating $\geq 4.8/5.0$, and no complaint records. At the same time, the platform conducts continuous spot checks on the service quality of certified sellers. If any violations occur, the certification will be immediately revoked and publicly announced. The experimental results showed that the average order volume of sellers who obtained certification badges increased by 47%, and the premium ability increased by 23%, while the market share of sellers of unverified low-quality products decreased from 63% to 28%. More importantly, the authentication mechanism reduces buyers' adverse selection risk by 58% and improves overall market transaction efficiency by 31%. This mechanism solves the problem of unobservable quality through third-party endorsement, allowing buyers to obtain trustworthy information and incentivizing sellers to maintain high-quality services, thus breaking the cycle of “bad money driving out good money” and constituting an institutionalized solution for the lemon market.

5.1.2 Implementation of Insurance Market

In the insurance market, scholars discuss potential countermeasures with adverse selection. GIC has avoided similar crashes by subsidizing premiums proportionally and strictly managing its generous compensation-based insurance plan. GIC provides an 85% premium subsidy for all insurance plans, which not only reduces the economic burden on high-risk policyholders but also prevents low-risk individuals from withdrawing on a large scale. In addition, GIC's data reveals a key finding: adverse selection often arises from low-risk individuals withdrawing from generous programs, rather than high-risk individuals actively joining, which challenges the traditional mechanism hypothesis of adverse selection [5].

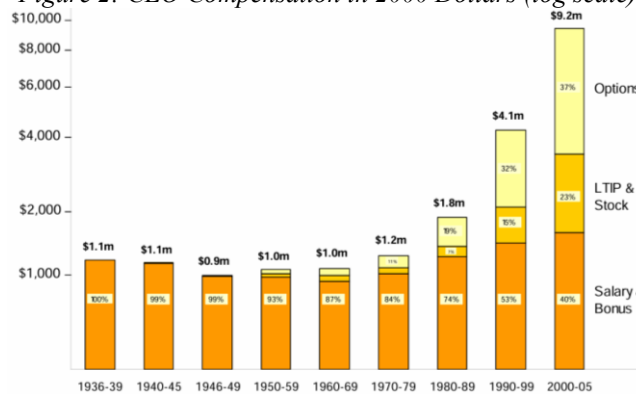
An effective strategy for mitigating adverse selection must directly address the root causes of information asymmetry. Cutler and Zeckhauser (1998) advocate for a combination of prospective/retrospective risk adjustment and mandatory reinsurance for high-cost cases [5]. Risk adjustment calibrates payments to insurance companies based on the health status of policyholders, protecting institutions that underwrite high-risk individuals from losses. Reinsurance has limited impact on moderate expenditure differences - only covering 8% of cost differences above \$25000, but stabilizing the market through centralized sharing of catastrophic risks. The second method is the experience rate system, which prices based on individual risk characteristics but raises questions about fairness due to potential statistical discrimination [3]. These empirical solutions indicate that mitigating adverse selection requires a balance between efficiency and fairness. Reasonable risk adjustment, targeted reinsurance, and non-discriminatory pricing can coordinate the incentives of insurance companies, employers, and insured individuals. With the development of the healthcare system, continuous optimization of these mechanisms and subsidy structures is crucial for maintaining the stability of the insurance market and ensuring that all risk groups could receive affordable comprehensive protection.

5.2 Agent Issue Prevention

Incentive-based compensation is a typical method to partially solve the conflict of the inconsistent goals between the manager and the shareholders in a company. For instance, the company would design the executive compensation, linking the managers' wealth to the company performance. Performance indicators can cover multiple aspects, such as stock price, profit and sales.

As Figure 2 shown above [6], the number of options and stock sharply increased over time. This has shown that significant effort has been put in to resolve the P-A problem. Jensen and Murphy (1990) demonstrated that by linking the wealth of chief executive officers to company performance through equity-based compensation, the sensitivity of compensation to performance would increase, thereby aligning the incentives of management with the interests of shareholders [14].

Figure 2: CEO Compensation in 2000 Dollars (log scale)



Option is a right to buy a share at a pre-determined price often smaller than the market price. Stock options can also directly link a CEO's compensation to the company's performance. Since the value of options only increases when the stock price rises, the condition could provide the CEO with motivation to improve the company's performance and enhance shareholder value. Since the 1980s, the proportion of option has seen a massive increase. It may lead to distorted behavior in business operations by CEOs, causing to take excessive risks. This is because the gains for CEOs from excessive risk-taking behaviors when successful far outweigh the losses when it fails. The reason for this is that the slope of the option price in relation to the stock price is convex.

5.3 Labor Market Information Asymmetry Solution

Empirical evidence shows the value of education as a signal in the labor market does exist. The GED passing standards across U.S. varied from different states [15]. Some states had lower passing standards, while others had higher standards. The authors compared dropouts with identical test scores but different GED attainment due to the varying standards in respective states. Since these individuals had the same test scores, their ability levels (human capital) could be considered similar, and thus the subsequent income differences mainly reflected the impact of the GED signal rather than skill differences. The author used the difference-in-differences strategy, which is a powerful quasi-experimental method that estimates the causal impact of an intervention by comparing the change in outcomes over time between a treatment group and a control group. This method helps to control the inherent regional income differences and filter out the income difference due to the diploma attainment. The research found that for young white dropouts living in low-standard states who just passed the exam, obtaining a GED diploma could increase their annual income by approximately 10% to 19%. Therefore, the diploma itself has a significant impact on labor market outcomes.

However, it is worth noting that this signaling model is a pessimistic view of education, as it regards education as a pure filtering mechanism. An increase in education will not improve the productivity of workers, it will only consume actual or psychological resources and exacerbate inequality among workers. Another contrasting theory to interpret education is human capital, which suggests that if the individual gets more education, it will improve her productivity, hence she will have a higher wage. Therefore, it is possible to conduct some policy changes on education that can truly enhance people's productivity, such as modifying the curriculum to make the impact of education on individual ability improvement more evident.

6. Conclusion

This article reviews the theoretical and empirical research on information asymmetry in four typical economic scenarios: lemon market, insurance market, CEO compensation mechanism, and labor market. Research has found that information asymmetry is a common cause of market failure, manifested as adverse selection in the lemon market and insurance market, leading to principal-agent conflicts in corporate governance, and causing discrimination in the labor market. Classic theories such as Akerlof's Lemon Model and Spence's Signal Transmission Model have laid the foundation for understanding the above issues, while various empirical studies have verified the applicability of these theories in real-life scenarios such as the used

car market, credit market, US labor market, and insurance industry. This article also outlines various effective mitigation strategies, including third-party authentication in online markets, risk adjustment and premium subsidies in the insurance industry, equity incentives in corporate governance, and the use of education as a productivity signal in the labor market. These strategies reduce the degree of information asymmetry by providing verifiable signals or coordinating conflicts of interest. Directions for further research could focus on the question of using big data to construct more effective signal transmission mechanisms in today's digital economy.

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Funding

This research received no external funding.

Conflicts of Interest

The authors declare no conflict of interest.

Acknowledgment

This paper is an output of the science project.

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