THE EVOLVING LANDSCAPE OF ROBO-ADVISORS IN CHINA: A COMPREHENSIVE ANALYSIS

Li Mingzhu

[1]School of Economics and Management, Guangxi Normal University, Guilin, China
DOI: https://doi.org/10.5281/zenodo.13619729

Abstract: The integration of finance and technology, commonly referred to as fintech, has brought about significant changes in the financial industry. One of the key components of fintech is Robo-Advisor, a technology that offers intelligent and inclusive financial services to a broader range of users. Robo-Advisor has revolutionized investment advisory services by eliminating high investment thresholds and making professional financial advice accessible to individual users and enterprises at lower costs. This aligns with the concept of inclusive finance, which aims to provide financial services to a wider audience, including those who were previously excluded from traditional financial systems.

This paper explores the emergence and impact of Robo-Advisor technology in the financial industry, emphasizing its role in promoting inclusive finance. It delves into the distinctive characteristics of Robo-Advisor investment consulting compared to traditional methods, highlighting its potential to democratize financial planning and advisory services. The study investigates the development of Robo-Advisor in China, recognizing it as a significant step towards enhancing financial accessibility for the masses. Through a comprehensive analysis, this research contributes to a better understanding of the implications and opportunities presented by Robo-Advisor technology in the context of inclusive finance and the broader fintech landscape.

Keywords: Robo-Advisor, fintech, inclusive finance, financial services, investment advisory.

1. Introduction

In 1975, the United States developed the first Intermarket Trading System. This milestone event laid the foundation for the application of IT technology in the financial industry. Since then, the two independent fields of finance and information technology have been closely linked, which promoted the digital and intelligent development of the financial industry. In 2005, the United Nations first put forward the new term "Inclusive Finance", which emphasized the inclusiveness and popularity of finance and sought to make more people benefit from financial services, especially those who were excluded from the traditional financial system in the past. This new term was subsequently introduced in China, which triggered a wide discussion of inclusive finance in the academic circles. In 2016, the artificial intelligence technology developed by Google defeated professional Go players in the Go competition. This event made people begin to realize the huge potential of artificial intelligence

in real application, and further promoted the integration of traditional industries and artificial intelligence, especially in the financial field, where artificial intelligence has developed rapidly. With the rapid development of artificial intelligence in the financial field, fintech has become a hot field with much attention. Intelligent inclusive finance has become the key word of fintech, which realizes the intelligence of financial services and popularizes it to a wider range of people. As one of the technologies representing intelligent inclusive finance, Robo-Advisor has gradually entered the public's vision and provided efficient investment advisory services for individual users and enterprises.

Robo-Advisor investment consulting has different characteristics from the traditional artificial investment consultants. It is no longer sets high requirements for the investment threshold, and is no longer limited to high net worth people, but through low-cost operation to provide professional investment and financial services[1]. This feature is highly compatible with the concept of inclusive finance, opening up new opportunities for the Internet financial planning market. Therefore, in-depth discussion of Robo-Advisor is not only a concrete practice of inclusive finance, but also the urgent need of the masses, which has important research significance for the development of Robo-Advisor in China.

2. Concepts of Robo-Advisor

Robo-Advisor is a new term in the field of financial technology under the background of the gradual development of computer technology and artificial intelligence technology. In 2008, Bettermrnt and Wealthfront, the pioneers of Robo-Advisor, were established, with functions such as fund allocation, stock allocation, real estate asset allocation and so on, thus opening the era of Robo-Advisor[2]. Due to the different degrees and characteristics of financial development in different regions of the world, it seems that there has been no relatively authoritative and unified explanation for the concept of Robo-Advisor in the international and academic circles.

United States Securities and Exchange Commission believes that Robo-Advisor is a kind of discretionary asset management services, using technology such as big data analysis and intelligent algorithms. The Australian Securities and Investment Commission has positioned it as "digital advice" and explained in detail that it uses algorithms and mobile electronic technology to provide automatic investment advice and financial advisory services to users. Robo-Advisor in Europe mainly refers to the fully automated operation of applications in the investment advisory business in the securities market.

For the concept understanding of Robo-Advisor, there are some differences in the domestic academic circles, which have not been unified, but can be roughly divided into three views. The first view is that Robo-Advisor is a kind of securities investment consulting business. It uses big data and algorithms, combined with modern portfolio theory, to analyze real-time data on market reactions and personalized information provided by users, and then gives investment advice[3][4]. The second view is that the main business of Robo-Advisor is asset management, which is a "one-stop" financial service provided by asset management operators to their clients, and that investment consulting is only an auxiliary business[5]. The third view is that Robo-Advisor provides integrated services. It evaluates users' investment information online and uses computer algorithms to provide users with personalized and intelligent investment and financial services, including investment consulting and advice, execution of trading orders and asset management services[6][7][8].

Through combing the definitions of Robo-Advisor by international and domestic scholars, there are different but still two common understandings: Firstly, Robo-Advisor is an online service; Secondly, Robo-Advisor is realized by using programs written by computer code. Based on these consensuses, we can understand the following for

Robo-Advisor: Robo-Advisor provides computer program-based investment services in online form. Using the Internet platform, it uses logical algorithms to calculate an investment portfolio suitable for the customer's investment style based on the user's requirements for the size of investment risk-taking ability, investment preferences and ultimate return goals, and provides personalized and intelligent modern financial technology investment and financial planning services according to the customer's specific needs.

3. The theme and focus of Robo-Advisor research

In recent years, with the continuous growth of personal wealth in China, individual investors have an increasing demand for financial management. As an emerging way of wealth management, Robo-Advisor has risen rapidly in the domestic market and shown great development potential. At the same time, more and more scholars began to study the Robo-Advisor. Most of the domestic research on Robo-Advisor is qualitative analysis, lacking empirical evidence and case studies. Most of the research on it stays at the theoretical level, focusing on the characteristics of Robo-Advisor, the challenges faced by Robo-Advisor, the legal supervision of Robo-Advisor and the influence of Robo-Advisor related parties.

3.1. Research on the characteristics of Robo-Advisor

China's Robo-Advisor has had active development since 2015. Under the background of the era of large capital management, Robo-Advisor has many advantages, such as real-time, dynamic, intelligent and low cost. Banks, securities brokers, funds and Internet start-ups have entered the intelligent investment consulting industry, resulting in a series of Robo-Advisor platforms[9]. At present, China's Robo-Advisor is still in its initial stage. The development degree of various platform institutions is uneven, and Robo-Advisor mode is in a semi-intelligent state. Compared with the international developed countries, there is still a big gap in terms of business scale, intelligence degree, core business and other aspects[10]. However, the scale of domestic Internet financial planning is large and grows rapidly, and the development potential of domestic Robo-Advisor in the future cannot be underestimated.

At the current stage, China's Robo-Advisor shows two remarkable characteristics. First, it draws on the development experience and pattern of Robo-Advisor in developed countries to meet the personalized needs of Chinese investors and form a diversified development model. Secondly, Robo-Advisor has developed a development model with Chinese characteristics on the basis of combining the existing market environment in China[11]. This development trend of localization provides opportunities for the development of Robo-Advisor in the Chinese market. First Steps, Robo-Advisor needs to use big data to comprehensively collect users' risk preference data and personal investment target tendency, or integrate the parameters of salary level, investment time and return on the platform and finally establish a risk portrait in line with the user; The second step, Robo-Advisor need to use algorithmic models to match the user's risk profile based on factors such as past returns and risk characteristics of various existing financial products, so as to obtain humanized investment recommendations. The commonly used algorithmic models are mean-variance model MVO, capital asset pricing model CAPM, arbitrage pricing theory APT and B-L model, etc.[12]; The third step, Robo-Advisor need to capture changes in financial products in real time and then make reasonable adjustments according to the user's personalized investment plan to achieve the optimal investment allocation[5][6][13].

According to the development period of various financial institutions, market position of various financial institutions and the differences of financial technology, there are three main ways for the development of Robo-Advisor. The first route is for the financial institution to take the lead in completing the overall work such as the

development of Robo-Advisor system and the design of the investment strategy. In this model, the financial institution takes the primary responsibility for such aspects as system development and strategy design. The second route is for financial institutions to provide only the user service interface and leave the development of the core algorithms and investment strategies of Robo-Advisor to specialized technology companies. In this mode, financial institutions are mainly responsible for providing users with convenient interface and platform services. The third route is for the technology company to develop the underlying system of Robo-Advisor, but the strategy level is still dominated by the financial institution, and the final service to the client is completed. In this model, technology companies are responsible for the development of the system, while financial institutions play a leading role at the strategic level, providing services to customers.

Financial institutions can adopt different implementation paths according to their own conditions[8].

3.2. Research on the challenges facing Robo-Advisor

The introduction of artificial intelligence in the financial field is a major trend, which brings advantages such as high efficiency and low cost, but also reveals some disadvantages and shortcomings. The challenges faced by Robo-Advisor can be analyzed from both internal and external perspectives.

First, from the internal perspective of Robo-Advisor itself, it is necessary to further improve the algorithmic model and risk control ability of its services. For example, in the analysis of investor behavior, questionnaires are mainly relied on to construct behavioral portraits of investors at present, but the content design of questionnaires is relatively simple, which cannot fully grasp the real risk preferences of users[10][14][15]. In addition, because Robo-advisors use automated trading systems, in which investment decisions and trading operations are executed by algorithms and machines, investors may face the problem of determining account ownership[16].

The second is the external perspective of Robo-Advisor. In terms of investor structure and motivation, compared with foreign developed countries, there are a large number of retail investors in China, with nearly half of the investors being retail investors. These retail investors prefer short-term interests rather than long-term investment, more inclined to speculate rather than invest, and are very sensitive to short-term market fluctuations, most of them pursue excess returns. However, they have weak risk tolerance and lack patience for systematic returns. In contrast, Robo-Advisor pays more attention to systematic long-term returns, and the way of using artificial intelligence to invest needs to be improved among Chinese investors[17][18][19]. In terms of investment market environment, first of all, the domestic investment market environment is relatively immature, and the overall development is relatively lagging behind. Compared with developed countries, there is still a certain gap in our financial asset market, which is mainly reflected in the level of data accumulation. The relatively small data accumulation in the domestic market means that we lack sufficient underlying financial data to form an effective data base to support investment decisions and risk management. Secondly, the structure of domestic asset products is relatively simple. In terms of investment options, our product categories are relatively limited and there is a lack of diversified selection opportunities. In particular, important asset classes such as bonds and commodities are missing, which restricts investors from fully diversified asset allocation. At the same time, the size and depth of exchange-traded funds are relatively weak. This makes investors face certain difficulties in asset allocation and cannot make full use of ETF and other tools to achieve more flexible investment strategies, which has a certain adverse impact on asset allocation of Robo-Advisor[20][21]. In terms of investing in talent majors, it faces the challenge of scarcity of professionals. Especially the positions related to Robo-Advisor require high professional quality and skills. At present, we face a problem that there are relatively few interdisciplinary talents with basic

knowledge of artificial intelligence and quantitative investing. The talents required by Robo-Advisor should have profound theoretical foundation and practical experience, and be able to combine artificial intelligence technology and financial knowledge to provide effective investment advice and asset allocation strategies. However, such talent supply often lags behind market demand, resulting in a lack of sufficient high-quality talents in the industry[22][23].

3.3. Research on the legal supervision of Robo-Advisor

The development of Robo-Advisor in China is later than that in developed countries, and there is no targeted laws and regulations to regulate the development of intelligent advisory service, which leads to the relatively imperfect supervision system of Robo-Advisor and the lack of clear legal guidance and norms. This makes Robo-Advisor face various legal risks in the development process of China[24].

First of all, Robo-Advisor involves portfolios in multiple fields, while China's financial sector adopts separate supervision. Different regulatory authorities may regulate different aspects of Robo-Advisor. However, the lack of overall coordination may lead to inconsistency and lack of supervision, and eventually bring about regulatory duplication and blind spots[25]. Secondly, in the market access stage, Robo-Advisor faces some legal restrictions and regulations. According to China's laws and regulations, securities consulting business needs to hold the corresponding license, and investment consultants are also prohibited from financial management on behalf of clients. This may lead to the risk of illegal operations when Robo-Advisor enters the market; In the operation stage of Robo-Advisor platform, there are operational risks, credit risks of investor information leakage and technical risks caused by algorithm defects in the operation process of Robo-Advisor[1]. Finally, in the intelligent service mode of Robo-Advisor, due to the ambiguity and vagueness of the legal status of the participants, there is a practical problem that the entrusted subject is difficult to determine in the legal relationship of Robo-Advisor, which leads to the difficulty of defining the subject of fiduciary obligation. The content of traditional fiduciary duty can no longer regulate the risks generated by Robo-Advisor, which will lead to the increase of risks borne by investors[26]. Therefore, most scholars are committed to studying the construction of legal supervision system of Robo-Advisor.

Most scholars call on the relevant departments to combine the successful development experience of foreign countries and supervise according to the actual situation of our country. Regulatory authorities need to keep up with the pace of technological innovation, understand and adapt to the characteristics and development trend of Internet finance. Regulatory authorities should adopt new regulatory methods, plan the general regulatory direction of China's Robo-Advisor in the future, and take targeted regulatory measures[27]. To achieve this goal, regulators can take a number of measures. First of all, strengthen the organization and management of investment platforms to ensure that their operations meet standards and protect the rights and interests of investors. Secondly, information disclosure should be carried out regularly to provide transparent information on investment products and services to help investors make informed decisions. In addition, investment appropriateness management should be improved to ensure that investors get products that match their risk tolerance and investment objectives. In order to crack the legal barriers of the access threshold of Robo-Advisor, it can be considered to combine investment consultant and asset management license into one and establish a unified Robo-Advisor access license. At the same time, Robo-Advisor platforms can be required to apply for different licenses for different business types to implement classified regulatory measures[1][9]. Under the framework of separate operation and supervision in China, supervision according to the identity of Robo-Advisor operators can manage and supervise

the Robo-Advisor industry more effectively[28]. In addition, the regulatory authorities need to strengthen the qualification examination of financial practitioners to ensure that they have professional knowledge and ethics, and improve the overall quality and service level of the industry. At the same time, the market information disclosure system should be improved to ensure that investors obtain accurate and timely market information and enhance market transparency. Regulators and Robo-Advisor platforms also need to strengthen investor publicity and education, improve investors' risk awareness and investment knowledge, help them make wise investment decisions, and promote the healthy and stable development of Robo-Advisor.

3.4. Research on the influence of Robo-Advisor on related parties

At present, there are few studies on the influence of relevant parties of Robo-Advisor, mainly focusing on banks, securities firms, and investors.

The emergence of Robo-Advisor has brought an important impact on the traditional banking industry[29][30]. Researchers focus on the impact of Robo-Advisor on banking business models, customer relationships, risk management and profitability. Many domestic banks cite Robo-Advisor. With their own unique advantages, they continue to improve algorithms and models by integrating artificial intelligence technologies such as intelligent customer service, intelligent marketing and intelligent investment consulting, forming the advantage of intelligent technology as their core competitiveness and important assets. Banks apply Robo-Advisor to financial services. Through algorithms, they customize the selection of financial investment products for customers, and improve customers' experience and investment efficiency under the premise of fully considering customers' own conditions. This further promotes the integration of traditional financial services and artificial intelligence of banks, and promotes the development of financial services towards the direction of intelligent and digital.

With the rapid development of intelligent technology, Robo-Advisor, as an automated investment service driven by algorithm and data, has attracted extensive attention and discussion in the securities industry[31]. The emergence of Robo-Advisor enables securities firms to provide personalized investment services at a lower cost, changing the traditional mode of relying on human advisers. Domestic securities firms have a large number of customer bases, high customer loyalty and good brand reputation, which is conducive to expanding the user scale of Robo-Advisor. The development of Robo-Advisor further enables securities firms to provide personalized investment services at lower costs, innovate business models and enhance customer stickiness of securities firms.

Smart advisory has had a great impact on investors[32][33]. First of all, Robo-Advisor uses advanced algorithms and data analysis technology to provide more objective and neutral investment advice and management services. This reduces the impact of investor sentiment fluctuations or behavioral deviations on investment decisions and helps investors make more informed investment decisions. Secondly, the low cost of Robo-Advisor means that investors do not need to pay high investment advisory fees, which lowers the investment threshold and enables more ordinary people to participate in the investment market. The online mode, which is not limited by time and space, greatly improves the convenience and efficiency of investment. Finally, Robo-Advisor can provide more transparent and reliable investment services, so as to enhance investors' confidence in the market and trust in investment advice, and improve investors' participation and satisfaction.

4. Conclusions and Future Prospects

Due to the late introduction of Robo-Advisor in China and the temporary immaturity of its development and the lack of large intelligent advisory platforms, this has limited the research perspective and depth of domestic

scholars on Robo-Advisor to a certain extent. Therefore, there are still great vacancies and research space in the research of Robo-Advisor in China.

Due to the emergence of Robo-Advisor, scholars from all walks of life have not studied it deeply enough, and the practical field has little practice, so the nature and definition of Robo-Advisor are not clear in the academic and practical circles. On the other hand, due to the lack of basic theoretical research, the current research on Robo-Advisor model lacks innovation. In the future, scholars can scientifically understand the definition of Robo-Advisor from multiple perspectives and dimensions. At the same time, scholars should also pay attention to the accurate definition and clear division of relevant concepts, and clarifying the concept of Robo-Advisor is the basis of Robo-Advisor research. While focusing on the analysis of the definition of Robo-Advisor, scholars should pay attention to the analysis of the basic theory of Robo-Advisor and the innovation of theoretical models in the process of Robo-Advisor.

As for the characteristics of Robo-Advisor, scholars at home and abroad have studied and most of the results are the same, agreeing that it has the characteristics of low cost, simple operation technology, more intelligence, more personality and so on. However, due to the different legal environment and investor philosophy, Robo-Advisor products in China cannot fully play these characteristics. The future development direction of Robo-Advisor should focus on the transformation from semi-automated intelligent investment consulting to fully automated Robo-Advisor from the underlying algorithm, so as to promote the development of Robo-Advisor to the direction of diversification. Although the academic circles have studied the relevant theories of Robo-Advisor, they have not made analysis through case study comparison, and lack of detailed research on relevant cases and systematic investigation and application consequences, resulting in the lack of rationality and implementation of relevant policies. In the future, scholars should conduct detailed studies on some typical cases, compare the differences between China and developed countries in Robo-Advisor, further learn from each other and put forward constructive suggestions for the development of Robo-Advisor in China based on their own conditions.

The research on the challenges faced by Robo-Advisor mainly starts from two aspects: the risks of Robo-Advisor itself and the risks brought by external factors. Scholars believe that the foreseeable difficulties of Robo-Advisor are not completely controllable, and internal and external factors bring challenges to the management, operation, risk prevention and innovation of Robo-Advisor.

For the research on the legal supervision of Robo-Advisor, scholars mainly focus on the breaking of relevant legal systems and the improvement of regulatory rules, but lack the research on the subject status of Robo-Advisor, the principle of operator liability and the specific legal supervision of Robo-Advisor in China. Although the relevant research solves the dilemma of domestic citation and supervision by referring to the use experience of foreign Robo-Advisor, it does not combine the actual situation in China and still has certain limitations. Therefore, while drawing lessons from foreign research, scholars should explore the development path of Robo-Advisor that truly belongs to China in combination with the actual domestic policy and legal environment.

As for the impact of Robo-Advisor on relevant parties, it mainly focuses on banks, securities firms and investors, without studying the impact on other social groups, and the scope of relevant parties is narrow.In the future, big data can be used to conduct empirical research on large social groups, and further explore whether Robo-Advisor can play its real role in the new era.

Throughout the domestic research field, the existing literature on Robo-Advisor has some problems, such as insufficient research depth and one-sided research perspective. The research methods are mostly single theoretical

analysis, lacking empirical and case studies. With the application of artificial intelligence and other technological innovations in the wealth field of China's financial market, China's Robo-Advisor should find a development path suitable for China according to its own market environment and development opportunities. It is believed that Robo-Advisor will show broad development prospects in China's wealth market in the future.

References

Yu Wenju (2017). The development status and legal supervision of Robo-Advisor in our country. Hainan Finance, (06), 61-67.

Zhao Yang (2018). Evaluation of Internet securities business development model of securities operating institutions. Financial Regulation Research, 81 (09), 95-109.

Wei Zhaochun, Xu Jiangang (2018). Theoretical framework and development response of Robo-Advisor. Wuhan Finance Monthly, 220 (04), 9-16.

Yuan Miaoying (2018). The construction of market access system of securities Robo-Advisor operator in our country. Journal of SWUPL, 20 (03), 56-64.

Wu Ye, Ye Lin (2018). The nature and regulation path of "Robo-Advisor". Law Science Magazine, 39 (05), 16-28.

Li Qing (2016). Intelligent direction of Internet securities: legal relationship, risk and supervision of Robo-Advisor. Shanghai Finance, (11), 50-63.

Li Miaomiao, Wang Liang (2017). Robo-Advisor: advantages, obstacles and cracking countermeasures. South China finance, (12), 76-81.

Zheng Yudong (2019). Robo-Advisor landing path and process management. China Finance, (10), 61-62.

Jiang Haiyan (2016). Development status and supervision suggestions of Robo-Advisor. Securities Market Herald, (12), 4-10.

[1] Chen Juan, Xiong Wei (2019). Research on business attributes and access regulation of Robo-Advisor. Financial Regulation Research, 88 (04), 46-61.

He Fei, Tang Jianwei (2017). The development status and countermeasures of Robo-Advisor in commercial banks. The Chinese Banker, 193 (11), 11-14.

Ge RuYi, Hu Rong (2021). The impact of Robo-Advisor on investment behavior in the Internet finance environment. Journal of Systems & Management, 30 (01), 94-100.

Zhou Zheng (2017). Comparison of domestic and foreign Robo-Advisor business models. The Chinese Banker, 194 (12), 88-90.

Zhang Yiwen (2018). Reflections and suggestions based on the current situation of Robo-Advisor industry in our country. Modern Business, 491 (10), 144-145.

Lu Ping, Ren Huaifei, Liu Qian, Feng Lei (2022). Research on the development process, risks and challenges and coping strategies of Robo-Advisor. Management & Technology of SME, 691 (22), 62-64.

Xu Huizhong (2016). The supervision difficulties and countermeasures of Robo-Advisor. Journal of Financial Development Research, 415 (07), 86-88.

Liu Bin (2018). The Development of Robo-Advisor and the source of difficulties. China Banking, 50 (02), 83-85.

Wang Bo, Jin Xin (2019). The development dilemma and legal breakthrough of Robo-Advisor in China. Hainan Finance, 364 (03), 32-37+51.

Xu Yalan (2016). Robo-Advisor: The next battleground for new finance. Economy, 248 (32), 44-48.

Zhang Chenghui (2017). Accelerating the Transformation Promoting the financial industry from virtual to real. Tsinghua Financial Review, 48 (11), 55-58.

Wang Yi (2018). Analysis on the application of Robo-Advisor in securities brokerage business. Financial Perspectives Journal, 478 (05), 88-93.

Chen Weiwei, Song Liangrong, Liu Yuxin (2018). Analysis on the Development Status and Driving factors of fintech in China. Productivity Research, 306 (01), 33-38.

Xu Hanwen (2017). The impact of artificial intelligence on the financial industry. Modern Business, 481 (36), 85-86.

Li Ruixue, Yan Zhengxin (2019). Research on the development and supervision of Robo-Advisor under digital inclusive finance. Price: Theory & Practice, 423 (09), 112-115.

Liu Yakun (2017). Construction of Robo-Advisor supervision system in China from the perspective of fintech. Zhejiang Finance, 466 (12), 51-57+50.

Liu Wen, Jiang Shengyang (2021). Fiduciary duty of Robo-Advisor: Practice and institutional remodeling in China. Hebei Law Science, 39 (12), 16-31.

Zhang Shiying (2022). Opportunities and challenges faced by enterprise management accounting in the era of big data. Modern Business, 634 (09), 175-177.

Xia Jun (2020). On the determination of civil liability of Robo-Advisor. Hainan Finance, 376 (03), 38-45.

Xing Guiwei (2017). Artificial intelligence, a new direction of financial digitalization. Financial Computer of China, 334 (05), 15-18.

Dong Shaoguang, Li Zhong (2018). The leapfrog development of bank Robo-Advisor. China Forex, 354 (12), 64-66.

Ma Sugang (2018). American Robo-Advisor development model and the enlightenment for domestic brokerages. Financial Perspectives Journal, 479 (06), 39-47.

Zhang Qiang, Yue Wei (2022). Digital sandbox regulation of Robo-Advisor: computational experimental financial method. Finance Economy, 552 (06), 3-11.

Jiao Yuanyuan (2021, November 29). Huang Yiping, Vice President of the National Institute of Development, Peking University: Improve financial efficiency and strengthen the innovation of digital inclusive financial instruments. China Securities Journal, p. A03.