A Feasibility Study on the Application of Artificial Intelligence in Central Bank Monetary Policies: Money Creation and Liquidity Management in Focus

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ABSTRACT

In the contemporary economic landscape, the implementation of monetary policies constitutes one of the primary responsibilities of central banks, aimed at objectives such as money creation, liquidity management, inflation containment, and recession prevention. With the emergence of advanced technologies, Artificial Intelligence (AI) has gradually evolved into a powerful instrument for enhancing the efficiency and effectiveness of these policies. The adoption of intelligent data processing and analytical techniques enables central banks to monitor liquidity flows, calibrate money supply levels, and forecast economic behaviors more accurately. This study, employing a descriptive-analytical methodology and grounded in legal and economic sources, seeks to address a central question: To what extent can AI contribute to improving the processes of money creation and liquidity control within central banks, and what challenges and considerations are involved in its implementation? The findings suggested that strategic integration of AI into monetary policymaking—particularly in the domain of money creation—can lead to more informed decision-making, mitigation of financial risks, and increased policy effectiveness, thereby fostering greater public confidence in central banking institutions. Nevertheless, such integration necessitates adherence to specific prerequisites and regulatory frameworks, as the application of AI in the field of economics still requires consistent human oversight due to the limited specialized expertise at the intersection of economics and technology.

KEYWORDS

Artificial Intelligence (AI), Central Bank, Liquidity Management, Monetary Policy, Money Creation.

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Introduction

The transition to a digital economy over the past two decades has been one of the most significant transformations in the global economic landscape. This dynamic process goes beyond traditional methods and models of economic analysis, exerting rapid and wide-ranging impacts on economic structures and institutions. More precisely, financial and economic institutions in the contemporary era are undergoing continuous change, with innovations being implemented at an unprecedented pace. Like other sectors, the financial domain has also been deeply affected by digitalization. One of the major outcomes of this transformation is the dramatic increase in the volume of financial data, which has heightened the need for real-time and precise analytical capabilities. The analysis of such data—commonly referred to as "big data"—requires the deployment of tools such as AI and machine learning. These technologies have been proven to be effective in forecasting market behavior, assessing financial risks, and informing monetary policy decisions (Kahyaoğlu, 2021).

Amid the rapid transformations in economic structures and the evolving nature of financial systems, the integration of advanced technologies into the banking sector has become a fundamental necessity. Within this context, banks—as key components of the financial system—play a vital role in maintaining financial health and ensuring economic stability (Begenau & Landvoigt, 2015). In the new framework of the digital economy, the operations of central banks—recognized as the primary institutions of monetary governance—have also undergone significant changes. As the nature of monetary assets evolves, the central bank's traditional yet essential roles in areas such as money creation, liquidity management, and the execution of monetary policies now require redefinition. Traditional instruments are no longer sufficient for effectively monitoring and controlling circulating liquidity, particularly in a context where the continuous exchange of information among individuals, corporations, and institutions generates a constant flow of financial data. Consequently, the central bank's decision-making increasingly depends on real-time data analytics and predictive modeling.

In this context, AI is a branch of computer science that focuses on the design and implementation of systems capable of performing tasks that typically require human intelligence. These tasks include pattern recognition, situation prediction, natural language understanding, and effective interaction with the environment (Veloso et al., 2021). As one of the most groundbreaking technologies, AI has enabled machines to simulate human cognitive behaviors and capabilities with unprecedented accuracy, significantly expanding the boundaries of technological potential. This advancement has led some experts to regard AI as the driving force behind the "Fourth Industrial Revolution", as it fundamentally transforms production methods and information management by automating conventional industrial processes, analyzing complex data patterns, and fostering greater creativity and productivity (Njoroge, 2024).

One of the most critical challenges and key policy areas for central banks in preserving economic stability is the issue of money creation and liquidity control—two fundamental

pillars of monetary policy. These components serve as essential instruments in the management of macroeconomic dynamics and consistently require timely and precise decision-making. In this context, using AI can serve as a novel tool for analyzing data and forecasting economic processes. Despite the wide-ranging capabilities of this technology, there remains a need for deeper examination of AI's capacities and limitations specifically in the domains of money creation and liquidity management. In other words, the application of AI in central bank monetary policy calls for a thorough assessment of the relevant conditions, opportunities, and challenges. The central research question addressed in this study is: How can AI play a significant role in improving the processes of money creation and liquidity control in central banks, and what considerations and challenges are associated with its implementation? Accordingly, the hypothesis underlying this research suggests that the integration of AI into the analysis and execution of monetary policies—particularly in the areas of money creation and liquidity control—can enhance the efficiency and predictability of these policies within central banks. However, its implementation is confronted by challenges related to model accuracy, data availability, and technological acceptance.

To achieve the research objectives and address the central question, the study begins with a review of the theoretical foundations and literature, including the conceptual framework, background, and research methodology. This is followed by an evaluation of the redesign of money creation and liquidity control through the application of AI, structured around defined principles. The final section of the paper is devoted to assessing the effectiveness and risk-related considerations of AI in the formulation of monetary policy.

Theoretical Foundations and Literature Review

This section first outlines the theoretical and conceptual framework of the study, followed by an examination of the research background and methodology.

Theoretical and Conceptual Framework

Analyzing the role of AI in controlling liquidity and implementing the monetary policies of central bank—particularly in the domain of money creation—requires a clear understanding of the key concepts in this field. Terms such as "money creation", "liquidity", and "liquidity management", each hold a distinct position within the framework of monetary policy and central bank regulation. Accordingly, in this the concept of oversight is defined first, followed by an in-depth examination of liquidity and its management, in order to pave the way for further discussions.

1. Money Creation

Money creation—or credit creation—is a process through which a country's money supply expands, resulting in generation of new credit in addition to the existing one (Akbari et al., 2020). There are two main types of money creation: exogenous (external) and endogenous (internal). Exogenous money creation refers to the issuance of high-

powered money by the central bank, which can take various forms such as lending to commercial banks, purchasing government securities from them, providing credit to the government, or altering the bank's foreign asset holdings. Endogenous money creation, on the other hand, occurs through the processes of deposit-taking and credit issuance by commercial banks within the framework of fractional reserve banking or through changes in the required reserve ratio (Arabi & Meysami, 2019). From certain perspectives, money creation is considered as one of the most important innovations of humanity and the central function of modern banks. Some even regard it as the "miracle" of contemporary banking (Arabi & Meysami, 2019).

Throughout the money creation process, various agents and decision-makers interact and influence the outcomes. The central bank, commercial banks, and the public are considered the primary stakeholders in this process. Some scholars (e.g., Jafarzadeh & Akbarifard, 2013) identify the central bank as the most influential actor, followed by commercial banks. According to their view, the central bank plays a pivotal role in money creation by issuing banknotes, providing credit and loans to commercial banks, and enforcing regulatory frameworks that govern commercial banking activities. Commercial banks contribute to this process by accepting deposits from customers and extending loans based on those deposits. Meanwhile, the public participates by making decisions regarding how to hold money—whether in the form of cash or bank deposits—thus enabling commercial banks to issue loans. These interactions collectively shape the mechanism of money creation.

In contrast, some scholars argue that, in coordination with the central bank, the majority of money in a modern economy is created by commercial banks that extend loans (McLeay et al., 2014). These banks are, in fact, responsible for creating most of the new money through lending (Ingham et al., 2016). Others view the money creation process as a dual-entry accounting process. According to this perspective, when the central bank prints new banknotes and circulates them within the banking network, the newly issued currency is considered as a claim on the central bank and is recorded as a liability on the central bank's balance sheet. To maintain the balance in the central bank's balance sheet, new liabilities must be backed by new assets. In modern times, to support the issuance of banknotes or liabilities on its balance sheet, the central bank uses them to purchase new assets such as government securities (e.g., treasury bills or domestic bonds), foreign currencies, foreign government securities, or even gold (Moenjak, 2021). Next, we will discuss the meaning of liquidity and its management.

2. Liquidity and Liquidity Management

Liquidity refers to a government's ability to meet its matured financial obligations. This capacity depends on the availability of financial resources and the speed at which they can be converted into cash to cover short-term debts. If the government's financial management can fulfill its liabilities on time without incurring additional costs or imposing financial stress, it is considered to possess sufficient liquidity. A decline in liquidity levels may expose the financial system to crises or hinder its ability to repay

obligations (Kolb, 1983). Some define liquidity as the pool of capital readily available to swiftly finance operations and meet obligations to creditors. Today, a significant portion of this capital circulates in the form of credit rather than physical cash. In financial institutions, liquidity is strictly defined as the ability to maintain sufficient financial resources to meet their maturing obligations. This includes complying with reserve requirements, facilitating interbank payments and financial settlements, managing cash flows, and covering other withdrawal-related liabilities.

Maintaining a certain level of cash to address emergencies and seize financial opportunities is associated with the concept of liquidity in economic literature (Bierman & Hass, 1963). Since individuals' bank balances in accounts' savings and time deposits can quickly be converted into purchasing power, the total of these funds is economically referred to as "quasi-money". Accordingly, liquidity refers to the total sum of money and quasi-money, which is commonly represented by the symbol M2 in economic resources. From the perspective of the European Central Bank, despite the widespread use of the term liquidity in financial and economic contexts, establishing a single, precise definition remains challenging. Economic theory offers at least two distinct interpretations of liquidity. The first is monetary liquidity, which is related to the amount of cash assets in the economy and is closely tied to levels of interest rate. The second is market liquidity, which measures the ability of market participants to conduct secure transactions without causing significant price fluctuations (European Central Bank, 2007).

Liquidity management is currently considered as one of the most important duties of central banks worldwide, encompassing the primary policy objectives of these banks. Through conducting this responsibility, other functions of the central bank are carried out, and its goals in liquidity management are achieved (Hashemi Dizaj, 2010). According to the regulations of the Bank for International Settlements, often referred to as the central bank of central banks, it is stated that: "A central bank is one that has the responsibility of regulating credit and controlling the volume of money in circulation". According to the International Encyclopedia of Finance and Banking, "central banks are government institutions that have legal authority over the issuance of national currency and the control of its supply" (Shim & Kontas, 2009).

Given the growing importance of liquidity and money creation in achieving the macroeconomic objectives, exploring the mechanisms that affect these two areas has always been a central focus for economists and monetary policymakers. Classical and neoclassical monetary theories primarily analyze money creation through the mechanism of bank lending and controlling interest rates by the central bank. In modern approaches, the role of expectations, the structure of financial markets, and even behavioral interactions have also been examined in explaining how liquidity is managed and how monetary policies affect the economy. In line with these discussions, it is clear that using new technologies, especially in data analysis, can lead to a deeper understanding of monetary behavior and identifying hidden patterns in liquidity fluctuations. The introduction of novel concepts such as data-driven approaches and machine learning

models in contemporary economic literature reflects the reality that the analysis and implementation of monetary policies are no longer limited to traditional tools. This is especially true in environments where the complexity of markets, the speed of economic changes, and the changing behavior of economic agents have made policymakers in need of more precise and faster tools. Therefore, this research study aims to examine the integration of AI capabilities with monetary policy processes in light of the theoretical literature on liquidity, money creation, and the role of central banks in these areas. This effort primarily seeks to bridge classical foundations with emerging capacities and assess their alignment with the needs of modern monetary policy in today's economic environment. Following this, a brief review of the research literature will be provided.

Literature Review

In recent years, research related to the application of AI in financial systems, macroeconomic data analysis, economic indicator forecasting, and even financial regulation has been on the rise. These studies have shown that under certain conditions, modern technologies can play a significant role in economic decision-making.

Efuntade and Efuntade (2024) examined the application of AI in liquidity management within Nigeria's financial system and showed that AI can play a key role in optimizing resource allocation, predicting liquidity needs, and enhancing monetary stability. The author, utilizing discourse analysis, identified the advantages, challenges, and implementation requirements of AI. Key factors for successful implementation included data infrastructure, collaboration with technology companies, establishment of legal frameworks, and human resource training. Additionally, the importance of launching pilot projects and leveraging international experiences in the process of integrating AI into monetary policy was emphasized in the results. Njoroge (2024), Director of the monetary institution COMESAK, explored various aspects of AI implementation in monetary policymaking. He emphasized that key factors such as data quality, the selection of optimal algorithms, and ethical considerations play a crucial role in the success of this process.

According to his findings, AI should not be seen as a replacement for human resources in central banks, but rather as a complementary tool to enhance the quality of analysis, improve risk management, and increase efficiency in decision-making. Njoroge further identified the need for investment in data infrastructure, training of specialized human capital, and establishing robust oversight frameworks over the ethical and legal dimensions of the technology as essential prerequisites for effective AI deployment in liquidity management. In alignment with this perspective, Milana and Ashta (2021) also argued that the emergence of AI in financial sector has triggered a fundamental transformation. They believed that this technology can significantly contribute to improving efficiency, generating new types of data, and enhancing risk management, thereby playing a vital role in optimizing the performance of financial systems.

Ozili (2024) investigated the advantages and risks of using AI in central banks and indicated that AI can enhance the performance and efficiency of monetary policy by

strengthening the central bank's capacity to analyze data, detect financial risks, and support macro- and micro-level data-driven policymaking. However, risks such as data privacy breaches, algorithmic biases, inaccurate outcomes, lack of transparency in AI-based decision-making, and cyber security threats have also been identified. In line with this view, Lin (2019) argued that despite the known applications of AI in financial systems, the cyber-security risks associated with its use remain significant. In another study in 2024, Ozili also explored the role of AI in the domain of central bank digital currencies (CBDCs) and its associated challenges. He emphasized that AI algorithms can assist central banks in improving efficiency, identifying risks, enhancing user services, combating financial crimes, and managing the supply and demand of digital currencies. Nevertheless, challenges such as privacy preservation, cyber-security concerns, and data bias persist. The author stressed that with responsible and ethics-oriented use of AI, alongside appropriate regulations, these challenges can be mitigated to pave the way for the sustainable development of CBDCs. Similar studies by Kahyaoğlu (2021), Qian (2019), and Lopez-Corleone et al. (2022) have also examined the use of AI and machine learning in improving performance, increasing security, and enhancing the efficiency of central banking tools, including digital currencies.

The review of the existing literature reveals that most of the referenced applications in previous studies are primarily related to areas such as risk management, digital currencies, market forecasting, and the associated challenges. However, there has been relatively little focused attention on the processes of monetary policymaking, particularly at the level of money creation instruments and liquidity management. This overlooked aspect in prior research highlights the need for a study that analytically explores the potential of leveraging AI in the realms of money creation and liquidity management, while also clarifying its effectiveness, challenges, and practical considerations.

Methodology

This study employs a descriptive-analytical approach, and the method of data collection is library-based. Given the novelty of the subject and the lack of comprehensive printed resources on the application of AI in monetary policy, the primary focus has been on the analysis of scholarly articles, reports published by specialized institutions in the field of money and banking, and credible electronic sources. These references offer the most recent perspectives and analyses regarding the role of AI in money creation and liquidity management, providing an up-to-date and analytical framework for examining the topic.

Findings

Redesigning Money Creation and Liquidity Management Using AI

Recent developments in digital technologies have opened new pathways for leveraging innovative tools in monetary policymaking process. Among these advancements, AI stands out as a key element, with the potential to significantly enhance the effectiveness of central bank decisions in two major domains of money creation and liquidity

management. This section aims to extract and present the relevant content within a structured set of fundamental principles, in order to achieve more effective outcomes in redesigning money creation and liquidity management mechanisms under the influence of AI. Considering these principles helps bring coherence and organization to the analysis and provides a systematic framework for evaluating upcoming opportunities and challenges.

1. Transparency and Accountability

One of the most critical governance principles in redesigning money creation and liquidity control using AI is transparency and accountability, both of which are essential for maintaining public trust and the legitimacy of monetary institutions. The advanced algorithms currently employed to analyze cash flows, forecast monetary needs, or regulate money creation by commercial banks are highly complex. Decisions made through these systems can have wide-ranging implications for financial and monetary stability. In this context, it becomes imperative to clarify how these models operate, document their development and training phases, and precisely define the responsibilities associated with their outputs. These are unavoidable requirements of intelligent monetary governance.

For instance, when designing and deploying AI models to analyze interbank liquidity or make decisions on interest rates—one of the tools for liquidity control—it is crucial to maintain detailed records of model modifications, data sources used, validation mechanisms, and review procedures. This level of documentation ensures that the decision-making path remains fully traceable, thereby facilitating independent evaluations and internal audits. It also allows supervisory bodies to hold decision-makers accountable for potential deviations. Therefore, concepts like “human-in-the-loop”, “human-on-the-loop”, and “human-in-control”—which refer to active human involvement in the AI decision-making cycle—become even more significant in AI-driven monetary policymaking (Crisanto et al., 2024). In this context, the report published by the Bank of England on 21 November 2024 indicates that 84% of companies currently using AI identify assigning a responsible individual or team to oversee AI applications as the most common governance framework, control, or process they employ (Bank of England, 2024).

Moreover, in the realm of digital money creation or central bank digital currencies (CBDCs), transparency regarding allocation algorithms, transaction processing methods, and liquidity control approaches plays a crucial role in preventing public misperceptions, enhancing the legitimacy of the central bank, and increasing the effectiveness of monetary regulations. In other words, transparency in the performance of AI models provides a foundation for institutional accountability concerning decisions that may directly affect public access to money, inflation, or credit policies. Any use of AI in redesigning the mechanisms of money creation and liquidity control, without a clear regulatory framework and well-defined accountability, may lead to monetary instability or a decline in public trust (Deutsche Bundesbank, 2025). For this reason, many international

organizations, including the European Central Bank and the Basel Committee, have emphasized the importance of algorithmic transparency, process documentation, and role of the human in key decision-making.

One of the major challenges associated with using AI, as suggested by some experts, is the absence of adequate legal and regulatory frameworks. Despite the potential risks posed by AI, there are minimal oversight mechanisms in place, and the existing laws often address AI only indirectly. AI has the capacity to empower a small group of individuals with the necessary expertise, and if these individuals harbor malicious intentions, they could exploit these powerful technologies to cause significant disruption (Shirzad & Rahmani, 2024). In this regard, the effective implementation of transparency and accountability requires the development of clear and binding legal and regulatory frameworks.

In the absence of such mechanisms, using complex and, in some cases, non-explainable models can pave the way for corruption, misuse of decision-making power, and the erosion of public trust. Therefore, forward-looking smart regulations must focus on three key pillars:

a. *Mandatory disclosure and documentation of algorithms and datasets*: Monetary authorities should be required to fully document and provide accessible versions of the algorithms, data sources used, and key decision-making parameters. Such transparency facilitates independent auditing and enables robust accountability mechanisms.

b. *Establishment of independent supervisory bodies with special authority in the AI domain*: To prevent excessive concentration of power within monetary institutions, specialized regulatory entities must oversee the development, deployment, and operation of AI-based models and be empowered to intervene effectively in case of errors or deviations.

c. *Formulation of ethical and legal principles governing the use of AI in monetary policymaking*: These principles should include provisions such as the prohibition of algorithmic discrimination, assurance of public access to relevant information, protection of privacy, and clear institutional responsibility for the social and economic consequences of algorithmic decisions.

2. Public Trust and Fairness Based on Oversight

In the process of utilizing AI in monetary policymaking—particularly in money creation and liquidity management—maintaining and strengthening public trust, upholding the principles of fairness, and ensuring human oversight in key decisions are fundamental requirements. Sole reliance on algorithms, without human supervisory mechanisms, may lead to systemic errors, unintended biases, or undermine the legitimacy of monetary policies. On one hand, money creation or the issuance of financial instruments such as participation bonds—when guided by AI-based models—must be backed by transparent human oversight and validation to prevent one-sided or unfair decisions imposed on the market. On the other hand, in the field of liquidity management, predictive analyses performed by AI should not replace human judgment, but rather serve as tools to enhance

accuracy and enable timely responses. Especially in sensitive economic conditions, any decision made using AI models must be reviewed from social, ethical, and financial risk perspectives.

Achieving this principle requires transparency in AI decision-making processes, accountability of policymaking institutions regarding the outcomes of this technology, and consideration of distributive and procedural justice—ensuring that monetary policies are formulated with attention to the diverse economic and social conditions of different groups in society. More importantly, to prevent discrimination or injustice arising from algorithmic errors, systems must be designed to always allow for human review and final control. Machine-based decision-making, without accounting for human and societal dimensions, cannot fully meet the real needs of society. Economic and monetary decisions must always prioritize human insight and experience alongside machine analysis (Crisanto et al., 2024). More precisely, the increasing role of non-banking actors using AI technologies in the monetary and banking sectors has made the presence of experts—who possess up-to-date knowledge in both monetary economics and AI—an unavoidable necessity. This combination not only enhances the accuracy of economic analyses but also enables the alignment of decisions with social realities, public needs, and specific conditions through the contribution of informed human experts. This synergy between technology and human expertise adds greater depth to monetary policymaking and ensures its alignment with the actual conditions and economic requirements of society.

3. Technological Cooperation under a Responsible Legal Framework

In order to develop AI tools aligned with their operational requirements—particularly liquidity management—the Central Bank must be engaged in sustained collaborations with technology firms. These companies can play a pivotal role in designing and implementing AI-based systems (Ozili, 2020). At the initial stage, it would be prudent for the Central Bank to engage with smaller-scale projects, thereby enabling an empirical assessment of both the technology's capabilities and the competence of these firms. Such pilot initiatives may include AI-driven systems for forecasting liquidity needs or identifying associated risks. Moreover, monetary policy experts must establish clear ethical guidelines for the utilization of AI in liquidity management to ensure that the integration of such technologies occurs within a reliable framework (Efuntade & Efuntade, 2024). In this regard, designing a robust legal framework to govern the relationship between the Central Bank and AI service providers becomes indispensable. A desirable legal framework should, above all, guarantee the legal accountability of technology firms for the consequences arising from the operation of AI systems. In other words, the mere provision of technology must not be construed as exemption from responsibility or legal consequences. Furthermore, transparency in contractual terms and the processes of system development and deployment should be regarded as foundational pillars of any legal regulation. Obligations related to data use, analysis, and system

performance must be clearly defined, such that the transfer of technology does not absolve providers from subsequent liabilities.

Strict requirements pertaining to data security and privacy must also be integrated into this framework—particularly in cases where sensitive financial data is made accessible to non-banking actors. Should AI systems malfunction or lead to data breaches, enforceable legal safeguards must be in place to protect both institutional and public interests. Therefore, clearly defined and enforceable remedies should be considered as integral components of the legal structure. Ongoing oversight mechanisms over both AI systems and their providers, as enacted by legislators and implemented by monetary authorities, are likewise essential. To this end, the Central Bank can draw upon the experiences of other countries and institutions that have previously undertaken similar initiatives. One of the most effective avenues for staying abreast of the latest developments in AI within monetary sectors is participation in international conferences and specialized forums on central banking and financial technology (Efuntade & Efuntade, 2024).

With the increasing penetration of Fintech[1] firms and major technology corporations into the credit market, the "AI-driven transformation" could gradually erode the traditional role of banks in financial intermediation. This shift could also reshape the transmission channels of monetary policy. Rather than being implemented solely through the banking system, policy effects may increasingly be transmitted via technologically adept non-bank institutions. For example, if investment funds leveraging AI are able to maintain more stable portfolios than banks, policies such as quantitative easing—which primarily target long-term interest rates—may influence money creation and liquidity through using entirely new mechanisms (Holm-Hadulla et al., 2023).

In such a context, the effectiveness of conventional tools of monetary policy may require reevaluation or supplementation with advanced technological instruments. Accordingly, the presence of flexible and forward-looking legal frameworks governing the relationships between monetary authorities and technology actors becomes not only beneficial but indispensable.

Measuring Efficiency and Assessing Risks of Utilizing AI in Monetary Policy

As mentioned in the previous section, the introduction of AI into the field of monetary policy has created new opportunities to improve decision-making in areas such as money creation, liquidity management, and the policies related to them. This technology, with its advanced processing capabilities and learning from vast datasets, can enhance the speed, accuracy, and flexibility of monetary policy responses to economic changes. However, the implementation of AI in the policymaking process comes with complexities and risks, requiring a detailed examination of its practical implications and associated risks in the monetary system. The technological potentials and opportunities of AI in the areas of money creation and liquidity management are explored in this section. Then, the

1. Financial technology.

operational risks and potential challenges of using this technology in monetary policy formulation are discussed.

1. Technological Opportunities of AI in Money Creation and Liquidity Control

Although AI has been used for several years by central banks to analyze market trends and optimize financial services, its current role has significantly expanded. AI now plays a deeper part in decision-making processes by conducting complex data analyses, uncovering hidden patterns, predicting economic developments, and even offering initial interpretations. This shift largely stems from the growing trust in AI technologies — a trust that views AI as more accurate, impartial, and less vulnerable to human error. In such a context, employing AI in monetary policy design presents a valuable opportunity to enhance the efficiency and improve the speed of response to economic changes (Chakraborty & Joseph, 2017). On the other hand, the application of AI can enable more precise supervision of the banking system. Through conducting advanced financial data analysis and high-volume data processing, central banks will be able to identify potential systemic banking risks and prevent financial crises. More specifically, AI allows central banks to detect financial problems before they materialize them by conducting more detailed analyses of macro- and micro-level data, enabling timely preventive and corrective measures.

Moreover, by leveraging AI capabilities, central banks can simulate and forecast subtle and timely fluctuations in money supply within the economy. This enhances the efficiency of adjusting and aligning various monetary policies such as interest rates and open market operations. In this regard, AI equips central banks with the means to more precisely analyze the behavior of commercial banks and financial institutions, monitor their performance, and assess the impact of their actions on overall banking system liquidity. Consequently, central banks will be able to make more accurate and timely supervisory decisions to effectively manage liquidity (Njoroge, 2024).

International organizations specializing in monetary and banking affairs—such as the International Monetary Fund (IMF), the Bank for International Settlements (BIS), and the Basel Committee—can play a key role in enhancing the use of emerging technologies in the monetary domain, thanks to their deep understanding of global financial dynamics and access to accurate and up-to-date knowledge and data. These institutions can support countries by transferring expertise in advanced analytics, big data, and AI algorithms, thereby enabling more precise design and implementation of monetary policies, particularly in liquidity management and money creation. In this context, these organizations—especially the Basel Committee—possess practical achievements in developing policies and supervisory recommendations that can assist developing countries in improving their monetary policy frameworks and liquidity control. Moreover, they can take effective steps in optimizing the use of AI and new technologies in monetary policymaking by offering training and capacity building for central banks on one hand, and developing legal frameworks and enforcement mechanisms on the other.

Some experts believe that using AI systems to analyze financial data can help central

banks enhance the effectiveness of monetary policy. By leveraging the power of advanced processing and pattern recognition, these systems can proactively identify abnormal changes in the performance data of financial institutions and reveal early warning signs of potential stress in the money market (Ozili, 2024). This level of advanced analysis allows central banks to respond more timely and accurately to changes in liquidity conditions, thereby improving financial stability through timely intervention, better regulation of money flows in the economy, and avoiding confusion in the face of liquidity fluctuations. In this regard, AI plays a key role in transforming monetary policy from a reactive approach to a more forward-looking and stable one. In short, central banks can utilize AI technologies to promptly detect any abnormal changes in financial data reported by institutions, which may indicate vulnerabilities or deterioration in the condition of one or more entities within the banking system. This enables the central bank to assess these changes in a timely manner and intervene within the financial network before such risks evolve into systemic threats.

Central banks can also utilize AI to extract micro-level economic and non-economic data from various online sources such as news websites, social media platforms, and other digital environments. These data, often generated by the public and businesses in the virtual space, can offer valuable insights into trends in the money and capital markets, public expectations, and economic behavior (Shabsigh & Boukherouaa, 2023). Despite the high potential of such information, many central banks are either unaware of these sources or remain hesitant to use them in monetary and economic policy-making due to their unstructured nature and third-party origins. However, the intelligent and systematic use of this data can significantly enhance the policy-making process, improve understanding of household and business needs, and allow for more accurate calibration of policy tools, including liquidity management.

Although AI is widely regarded by experts as having substantial potential to improve the quality of monetary policy, it is also accompanied by considerable operational and institutional challenges. In the following section, some of the most important challenges are highlighted.

2. Operational Challenges in Utilizing AI for Monetary Policies

Given the rapid advancements in AI and its diverse applications, one of the primary concerns—explicitly or implicitly mentioned by most scholars in related literature—is using AI to create false or manipulated content (Njoroge, 2024). These alterations may appear in the form of images, videos, audio recordings, or other digital data. One of the most serious threats in this area is the generation and dissemination of fake content involving prominent figures in economic and financial sectors, especially those with central roles in monetary policy-making. AI has the capability to reconstruct digital content with such precision and speed that the resulting material appears convincingly real. In sensitive areas like financial and monetary systems, this phenomenon can mislead public opinion, trigger social and economic crises, and undermine trust in key institutions such as central banks. Techniques like “deep fakes”, which simulate the voice, appearance,

or video of high-profile economic personalities, can be exploited by malicious actors to manipulate economic decisions and perceptions. Considering the growing prevalence of AI, there is a critical need to establish strict legal frameworks and transparent technologies to detect and counter manipulated and fake content. Such measures are essential to safeguard monetary systems, maintain public confidence, and prevent the undue influence of manipulated information on governmental and financial institutions.

Another significant concern in the context of risks associated with AI applications in monetary policy is the phenomenon known as "AI hallucination". This occurs when intelligent systems, due to biased datasets or flawed algorithm design, produce incorrect and misleading outputs—even when the input data is valid and accurate. Since AI algorithms are often designed to simulate human decision-making processes, their erroneous outputs may not be easily identifiable as false. This issue is particularly critical in the financial policy domain, where central banks and monetary authorities rely on such systems for macroeconomic assessments. If AI-based tools deliver inaccurate evaluations or unrealistic analyses of economic and financial conditions, they may lead to misguided policy decisions and deviations in monetary implementation strategies. Moreover, these systems are vulnerable to cyber threats that target financial infrastructures, including data breaches and model inversion attacks. In the latter case, attackers attempt to infer sensitive underlying information—such as model parameters or training data—by analyzing the outputs of intelligent systems (Angwin et al., 2016). The malicious manipulation or exposure of such data can result in identity spoofing of policymaking institutions or a general erosion of trust in official data and communications.

AI systems are particularly vulnerable during the data training phase, as malicious actors may inject corrupted or manipulated data into training sets, ultimately compromising the accuracy of algorithms and distorting the decision-making process (Shabsigh & Boukherouaa, 2023). Such tampering can result in inaccurate assessments of liquidity conditions or money creation trends, potentially triggering market anxiety, inflationary expectations, or even widespread bank runs caused by depositor panic. In this context, cyber security is not merely a technical issue but a fundamental necessity for effective monetary governance in the age of AI (Wirtz et al., 2020).

Effectively managing AI-generated content is a critical aspect of maintaining the credibility of monetary systems and ensuring financial stability in the digital age. Strategic investment in AI becomes imperative when such technologies possess the capability to generate deceptive content—such as fabricated images or simulated voice recordings—which may undermine public trust in core monetary institutions, especially central banks. Consequently, establishing specialized regulatory frameworks within the financial sector is an undeniable necessity. These frameworks should include technical requirements such as transparent labeling of AI-generated content, privacy protection, and prevention of algorithmic bias. Such regulations not only help mitigate systemic risks like fraud and money laundering but also enable central banks to implement monetary creation and liquidity management policies more effectively in an environment of sustained public

trust. In this regard, some experts argue that responsible implementation of AI can bring about a positive transformation in monetary policymaking. If properly designed and monitored, AI systems can help prevent unintended biases while enhancing transparency in decision-making. Protecting the privacy of sensitive data and promoting fairness in distributional impacts of monetary policies are among the other benefits of responsible AI governance (Dignum, 2019). Given the inherent sensitivity of monetary policies and the central role of central banks in safeguarding economic stability, one of the primary challenges in deploying AI—aligned with this vision—is ensuring data confidentiality and privacy protection. AI models, especially during training and macroeconomic data analysis, require access to vast amounts of sensitive information. This raises serious concerns regarding data breaches, potential misuse, or even misinterpretation. Moreover, compliance with strict regulations such as the European Union's AI Act requires that all AI-based solutions be backed by comprehensive documentation, transparent mechanisms, and responsible data governance frameworks. Failure to do so may not only erode public confidence in monetary institutions but also amplify systemic risks arising from decisions based on unreliable data (Cipollone, 2024).

In a speech delivered on April 17, 2024, in Washington, D.C., Pablo Hernández de Cos—Chair of the Basel Committee on Banking Supervision and Governor of the Bank of Spain—highlighted a key challenge in deploying AI and machine learning models within monetary and financial systems. He noted that many foundational AI models are developed by a limited number of technology providers, leading to a form of institutional and technological dependency for banks (Hernández de Cos, 2024). This dependency, especially in the context of digital money creation or the calibration of novel monetary policy instruments, may exacerbate concentration risks and undermine monetary sovereignty.

Furthermore, the increasing reliance on cloud-based infrastructures and shared platforms could reduce the operational flexibility of central banks in managing crisis situations. In such a context, enhancing supervision of technology service providers and imposing stringent standards in governance, risk management, and operational resilience become essential to preserving the autonomy and effectiveness of monetary policy tools. Overreliance on third-party developed models may also reduce the banks' resilience to liquidity shocks and significantly heighten the concentration risk. These developments underscore the need for banks and regulatory authorities to not only leverage the benefits of the advanced technologies but also remain vigilant against the risks of excessive dependence on external algorithms and cloud platforms. To strengthen the adaptability of monetary systems and enhance the intelligent liquidity management, more robust precautionary frameworks must be established.

Another significant challenge in utilizing AI in monetary policymaking is the issue of goal misalignment. This challenge arises when AI adheres to the objectives set by human decision-makers. When intelligent systems are faced with a set of multiple and sometimes conflicting goals, such as profit maximization, ethical compliance, and avoiding legal

violations, the prioritization of these goals may be carried out in an unintended and undesirable manner. This issue becomes especially pronounced when abstract motivations or missions are assigned to AI, while it encounters situations that are not present in the training data. In the financial domain, this situation can lead to serious consequences, including the exacerbation of destabilizing behaviors during financial crises. For example, when financial institutions face liquidity pressures and seek immediate survival, their simultaneous actions may lead to phenomena such as forced asset sales, capital flight, or credit shortages in the market. These misalignments can become even more complex when several AI systems are interacting, learning, and reacting at the same time. Such systems might inadvertently exploit common mechanisms in financial markets, such as strategic complements, to shape behaviors like market manipulation or the creation of quasi-cartel structures. Given that AI has a high capacity to evade oversight, early detection of these behaviors also becomes a significant challenge (Danielsson & Uthemann, 2024). In this regard, it is evident that the best decision proposed by AI tools may not align with the interests or mission of the financial institution. While such incorrect or inconsistent behaviors are also common in human systems, as financial systems increasingly rely on AI, the likelihood of these behaviors occurring and recurring will also rise. The opportunities and challenges of applying AI in monetary policy-making are summarized in Table 1.

Table 1.
Opportunities and Challenges of Using AI in Monetary Policy

Row	Opportunities	Challenges
1	Enhancing the efficiency and speed of response to economic developments.	Risk of generating inaccurate outcomes due to data and algorithmic biases.
2	AI can provide more complex analyses of financial data and enable faster reactions to economic fluctuations.	AI may lead to systematic errors that are difficult to correct.
3	More accurate forecasting of economic developments and better adjustment of monetary policies.	Vulnerability to cyber-attacks: AI systems may be targeted, threatening the security of data and decisions made by monetary bodies.
4	By simulating changes in the money supply and their economic impacts, central banks can make more timely and accurate decisions.	Risk of data manipulation: Hackers may alter sensitive data or liquidity information, potentially causing financial unrest or crises.
5	Increasing transparency in monetary policymaking.	Decline in public trust due to the spread of misinformation: Incorrect decisions may reduce confidence in monetary institutions.
6	AI can make decision-making processes more transparent and reduce human biases.	Vulnerability during data training: Inserting corrupted data into datasets can decrease the accuracy of algorithms.
7	Ability to simulate the behavior of commercial banks and financial institutions.	High costs for implementation and maintenance: AI requires advanced infrastructure and entails substantial operational expenses.
8	As AI can analyze data from banks and financial institutions, it can help optimize liquidity supervision.	Detecting and correcting inaccurate AI-generated data can be complex and time-consuming.
9	—	Increased dependency on third-party service providers: Over-reliance on foundational models developed by a few companies.
10	—	Misalignment between the goals of human decision-makers and AI.

(Source: Researcher's Findings)

Discussion and Conclusion

Using AI in monetary policy and liquidity management, while offering a novel opportunity to enhance efficiency and precision in decision-making, requires a careful, structured approach due to the sensitivity and complexity of this field. One of the key challenges in this regard is the lack of a unified, international definition for AI in financial and monetary spheres. This absence of global standards can lead to a lack of coordination in the implementation of this technology across different countries, resulting in unpredictable problems in decision-making processes and execution of monetary policies. Furthermore, the effective use of AI in this area necessitates the involvement of human experts who simultaneously possess expertise in economics, monetary policy, and technology. Without such expertise, the application of AI in monetary policies may lead to incorrect or even harmful decisions. Therefore, combining AI with human oversight, especially in areas such as money creation and liquidity control, is an unavoidable necessity. AI must serve as a supportive tool alongside economic decision-makers, and should not automatically replace human judgment.

In addition, using AI in monetary and financial policies requires clear governance frameworks and ethical obligations. Without continuous oversight and establishment of clear international laws and regulations, the use of this technology could result in negative consequences, including financial crises. In this regard, institutions such as the Bank for International Settlements (BIS) and the Basel Committee play a crucial role in formulating global regulations and standards. These institutions should ensure that countries can effectively and safely employ AI in their monetary policies by adhering to these standards and regulations.

Ultimately, to effectively harness the potential of AI in money creation and liquidity control, a balance must be struck between technological innovation and legal, ethical, and human responsibilities. In other words, AI can serve to improve monetary operations, provided that it is employed within appropriate frameworks and under precise human oversight, continuously subject to evaluation and improvement. Such an approach can contribute to the creation of a more efficient, transparent, and resilient monetary system capable of withstanding crises.

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