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## FinTech Impact on Social and Income Inequality

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**Abstract** The rapid digital transformation of the financial sector, particularly through financial technologies (FinTech), has significantly redefined the dynamics of banking, investment, insurance, and payment systems. This paper explores the evolving FinTech ecosystem, analyzing its potential to impact social and income inequality. At the core of this transformation is a shift towards greater financial inclusion, especially for underserved populations. FinTech's role in bridging gaps in access to credit, savings, and insurance is examined, alongside the risks related to digital divides, data privacy, cybersecurity, and regulatory fragmentation. The study also considers the growing importance of artificial intelligence, big data analytics, and open banking frameworks, which are reshaping financial product development and risk assessment models.

This paper concludes by underscoring the imperative of fostering a human-centered FinTech ecosystem—one that not only leverages technology for economic efficiency but also aligns with broader societal goals of equity, trust, and sustainability. The findings support the development of policy frameworks that encourage ethical innovation, strengthen digital financial literacy, and promote inclusive growth. Ultimately, the study advocates for a collaborative, multi-stakeholder approach to building a resilient, fair, and future-ready financial landscape.

**Keywords** Digitalization, AI, GINI Coefficient.

DOI: <https://doi.org/10.56065/FNJ2025.1.112>

**Introduction**

Digitalization and financial technology (FINTECH) have become defining forces in the modern global economy, transforming traditional business models and reshaping economic relationships. While digitalization broadly encompasses integrating digital technologies across all economic sectors, FINTECH focuses explicitly on applying these technologies within financial services. Both phenomena are increasingly powered by artificial intelligence (AI), which has fundamentally altered how information is processed and decisions are made in the economic sphere.

Our study explicitly addresses how digitalization and FINTECH impact social and income inequality across European Union member states, including Bulgaria. While increased

profits and productivity at the company level represent positive outcomes from digitalization, these benefits do not necessarily translate to societal improvements. The modification of economic agent behavior and market mechanisms through digital technologies raises essential questions about Pareto efficiency—the principle that maximum efficiency occurs when no economic agent can improve their position without worsening another's situation.

We employ the Gini coefficient as a proxy measurement for changes in Pareto efficiency, analyzing whether digitalization tends to create more equitable income distributions or exacerbate existing inequalities. Through correlation analysis, cluster analysis, and regression estimation using Python, we examine data from the Global Findex, utilizing digital payments and mobile banking adoption as indicators of digitalization and AI implementation across EU member states.

### **1. What do we consider about digitalization and FINTECH?**

Digitalisation is generally the use of digital technologies in the economy, while Fintech has a more limited meaning and is limited to applying digital technology in finance. Both concepts involve the massive use of artificial intelligence.

Digitalisation and artificial intelligence have received considerable attention from economists, governments, businesses, and international institutions. The world's richest man and a key figure in President Trump's administration, Elon Musk, recently made shocking statements that should give each of us serious pause. In particular, the influential businessman said humanity is merely the biological bootlender of digital superintelligence.

This thought is not new, for a long time, some AI theorists have promoted the idea of reaching a state of "singularity", i.e. In this situation, AI will be superior in everything to our natural intelligence and displace humans from the management of the economy and the whole conscious evolutionary process. However, the same argument, made by one of the most influential people in the world, who is directly involved in the development and use of AI, has a very different ring to it. It's a concrete verdict that we're all becoming unnecessary for the foreseeable future.

The strongest argument against AI omnipotence is the self-consciousness thesis. AI can only replace us if it consciously decides to obliterate humanity as a biological intelligence. However, there is no scientific evidence, and there may not be, that AI possesses self-consciousness. If an AI does not have self-awareness, it cannot independently set tasks for itself. Therefore, AI can only destroy us if we put it as a goal. However, this is no great comfort.

Let us return to Musk's thesis. It argues that a digital superintelligence will replace us. The keyword here is not intelligence, a concept without precise scientific definition, but digital.

We often don't distinguish between digital, or something expressed in numbers, and digits. The ordinary decimal digital system contains 10 digits; other digital systems, such as binary, are possible. All numbers, expressed in digits are some sequence of digits. The problem is that almost all numbers, as is well known from mathematics, are infinite periodic or non-periodic sequences of digits. These infinite sequences inevitably arise in the process of computer computation. We cannot practically work with these numbers since we do not use infinite but finite numerical approximations of the numbers. Hence, a digital superintelligence that is based on a digital approximation of the real world always operates with some error, which should increase as the number of calculations that computers perform increases. In other words, the digital world of super intelligence is not absolutely accurate, but is an unavoidable approximation of reality.

The thesis of the possibility of digital superintelligence is based on the understanding that AI is simply some kind of computational process, a thesis that has not been proven at all. Some authors go so far as to consider AI as a functional quality of certain logical symbolic algorithms, independent of the specific physical forms of these algorithms (Newell and Simon, 1976).

However, this is profoundly wrong. Every computational process is a physical process, whether it occurs as a function of our brains, as garbage disposal operations, and by implementing complex computer programs in electronic devices. These processes require the expenditure of energy and material resources. These costs can be enormous, especially when processing large databases, typical of modern neural networks. If the data processing is overly complex, the energy expenditure can be prohibitive, and the corresponding digital super intelligence may be physically infeasible.

On the other hand, modern mathematical logic has not definitively ruled on whether a finite number of logical operations can even serve a digital superintelligence. Since the last century, the so-called decision problem (Entscheidungsproblem) has been known. It is not clear whether a finite algorithm exists to prove whether a complex decision is true or false. There are also other logical constraints, calling into question the very existence of theories explaining everything (theory of everything), which are indispensable for a digital superintelligence. The idea that control is a process of processing information about the surrounding world was known to Aristotle, but whether this process is finite and can result in full and final knowledge is an unanswerable question. We must not forget that digitalization and AI have economic goals and limitations. Digitalization must solve some tasks either in the field of decision-making or directly in production. The benefit of AI is usually measured by its ability to increase labor productivity. At the level of an individual economic agent, the use of artificial intelligence algorithms makes sense if the additional profit exceeds the costs. Since processing information and creating digital models of reality requires significant expenses, the use of AI is objectively limited.

## 2. How to measure the effect of applying digitalization and AI

The application of AI can lead to increased profits and profitability of a company, but this does not mean that this circumstance benefits society. The use of digitalization and AI not only increases productivity at the company level, but it also modifies the behavior of economic agents and the way market mechanisms function. Here, the so-called Pareto efficiency is of crucial importance. According to this principle, maximum economic efficiency is achieved when no economic agent can improve its economic well-being without worsening the position of another economic agent. This principle is at the core of the social welfare theory in decentralized market economies.

Measuring Pareto efficiency as a tool for evaluating the results of the application of digitalization and AI is highly complex. Within the framework of this study, we use changes in the Gini coefficient as an approximate measure of changes in Pareto efficiency. The logic is as follows. Suppose the Gini coefficient grows due to digitalization. In that case, we have reason to assume that digitalization deforms economic mechanisms by moving them away from the state of perfect competition, so that it allows redistribution, where some economic agents increase their incomes at the expense of others. In the opposite case, digitalization improves the efficiency of market mechanisms. Of course, changes in the Gini coefficient are only an approximate indication of changes in Pareto efficiency.

The application of digitalization and AI in pricing, banking, and financial markets can violate the Pareto principle and lead to redistribution in favor of economic agents occupying dominant market positions or having asymmetric information, at the expense of other participants in the economic exchange. In principle, using AI to process large databases violates the condition of equal, free, and accessible information for all, which is at the core of classical economic theory. Non-compliance with the principle of Pareto efficiency means that the application of AI, under certain conditions, may be detrimental to economic efficiency.

Compliance with the Pareto principle is not considered when applying modern AI algorithms. This principle is part of the broader problem of moral and ethical constraints in using AI. Although the legislation of the EU, the USA, and other countries imposes specific requirements when using AI, these restrictions are insufficient. On the other hand, they can slow down the use of AI, which can create problems with the competitiveness of states regulating AI.

The problem with the moral and ethical aspects of AI is fundamental. The purpose of moral and ethical constraints is to ensure that AI will work for the benefit of people. The existence of a digital superintelligence, turning people into an unnecessary machine appendage, will not be possible. Therefore, the central problem is precisely what kind of superintelligence is being developed through the large-scale programs for implementing computer systems capable of processing and analyzing all available information of humanity. The paradox in this case is that the application of moral and ethical constraints in the

development of AI does not reduce, but rather guarantees, high socio-economic efficiency from the application of digital AI.

If these systems self-improve and have no moral and ethical limitations, the global economy's result can be strongly negative, increasing social stratification and inefficient resource use.

### 3. Digitalization and the Gini coefficient

Usually, the analysis of the impact of digitalization and AI on social inequality is based on micro data within the framework of the use of new technologies in individual firms and industries (Rockall et al., 2025). This approach is natural but does not consider the impact of digitalization and AI on the overall behavior of firms and market mechanisms.

For example, the spread and evolution of pricing algorithms raise various questions related to the competitive structure of markets (Harrington, 2017). In particular, as many researchers note, there are concerns that reinforcement learning algorithms may learn to negotiate tacitly, i.e., to communicate with each other without having explicitly been instructed to cooperate; instead of competing, they enter into implicit agreements to coordinate pricing policy. Although no one has brought an antitrust case against autonomous secret algorithms, many state agencies in the field of antitrust policy are seriously discussing the problem.

In our study, we analyze the impact of digitalization on the dynamics of the Gini coefficient in EU member states, including Bulgaria. To estimate the effects of FINTECH on the GINI coefficient, we use Python to apply correlation analysis, cluster analysis, and regression estimation. To estimate FINTECH development, we use data from Global Findex<sup>1</sup>. Digital payments and mobile banking are proxies measuring digitalization and the application of AI.

Fig.1 shows the average values of the Gini coefficient, the use of digital payments, and mobile banking in the EU for 2011-2020. As can be seen, the digitalization process is developing intensively during the explored period.

Applying the OLS regression model, we aim to understand the relationship between changes in the GINI coefficient (a measure of income inequality) and the adoption of digital financial services (digital payments and mobile banking). It builds two regression models, each exploring a different aspect of this relationship. Based on the results of the regression models, we separate the EU member states into countries with high deviation of GINI according to the FINTECH development and countries with low deviation. Fig. 2 presents the relationship between the share of the population using digital payments before COVID-19 and the change in the Gini coefficient in individual EU member states based on the applied

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<sup>1</sup> <https://www.worldbank.org/en/publication/globalindex/Data>

regression model. As can be seen, the impact varies—in some countries, inequality increases, while in others, it decreases. In Bulgaria, digitalization is associated with a slight decrease in income inequality.

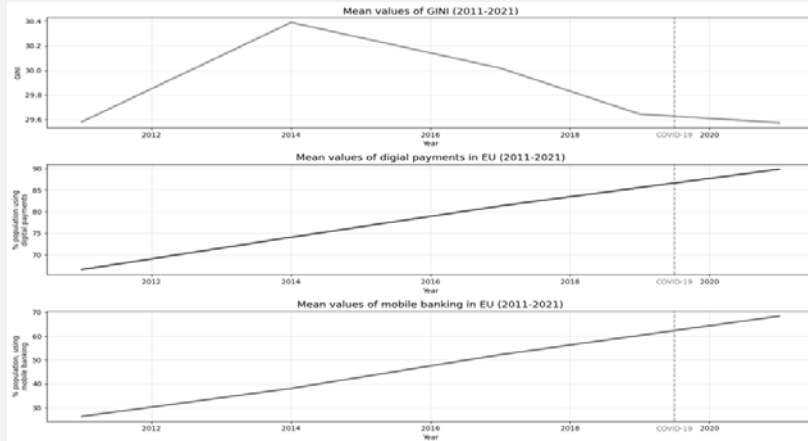


Fig. 1. Dynamic of mean values of the explored variables. Source: Authors' calculation

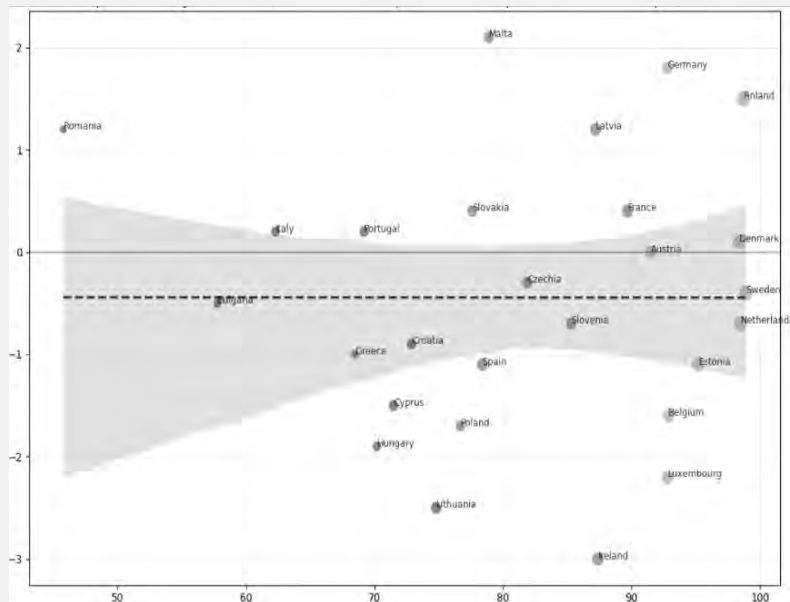


Fig. 2. Relationship between GINI and digital payments for the EU countries. Source: Authors' calculation

Fig. 3 illustrates changes in the Gini coefficient depending on the level of digitalization. The impact is positive at all levels, but in countries with the lowest level of digitalization, the positive effect on income stratification is strongest.

Fig. 3. Clustering of EU member states-based GINI dynamic during COVID-19 according to the level of digitalization. Source: Authors' calculation

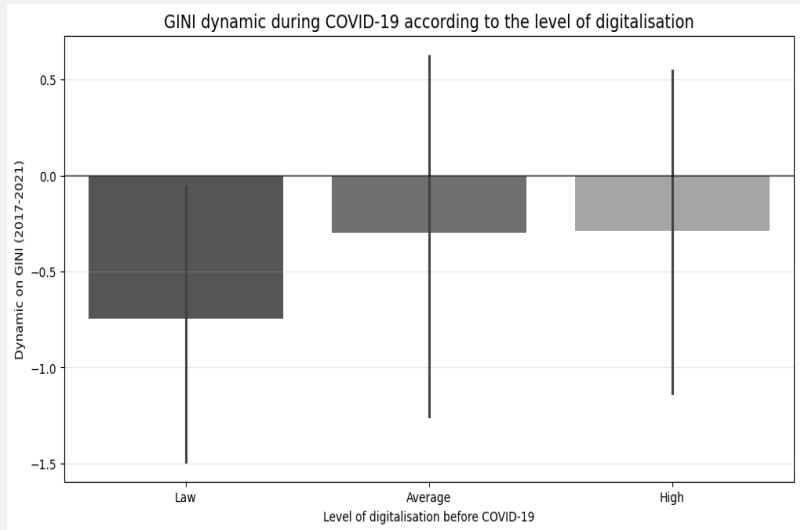
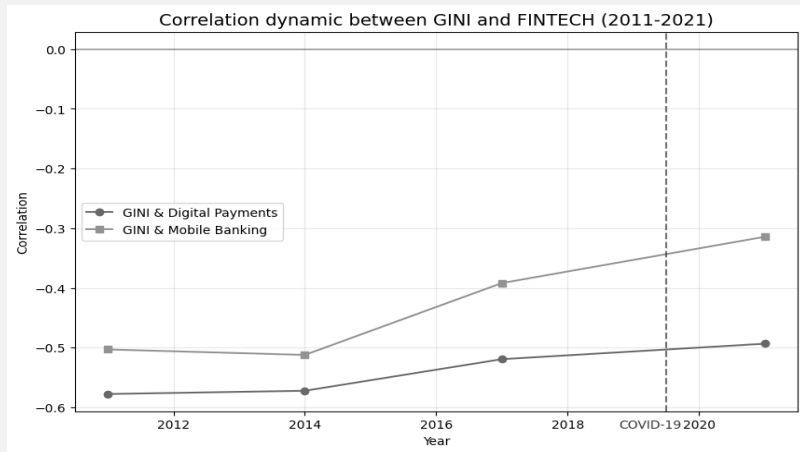


Fig. 4 shows the correlation between the Gini coefficient and digitalization. Digitalization's impact on income distribution is increasing, but it remains negative.

Fig. 4. Correlation dynamic between GINI and FINTECH. Source: Authors' calculation



**Conclusion**

Our comprehensive analysis of digitalization's impact on income inequality across EU member states yields several significant findings with important implications for economic policy and technological governance. The data reveals that digitalization, including AI and FINTECH applications, demonstrably affects income stratification, though the nature and magnitude of this effect vary considerably among countries.

The predominant trend within our studied group of countries indicates that digitalization generally promotes greater income homogeneity and enhances economic efficiency. This suggests that digital technologies serve as equalizing forces within economies when properly implemented and regulated, contrary to some pessimistic predictions. However, this positive outcome is not universal—we identified specific countries and periods where digitalization coincided with increased inequality, highlighting the contextual nature of technology's socioeconomic impacts.

In Bulgaria specifically, our findings indicate that digitalization has reduced social stratification, albeit to a limited extent. This modest positive effect suggests that Bulgaria's digital transformation is moving in an economically beneficial direction from an equality perspective. However, further policy support may be needed to amplify these effects.

Notably, our analysis uncovered a counterintuitive pattern: the positive impact of digitalization on reducing inequality appears to diminish in countries with higher degrees of digital penetration. This finding warrants particular attention from policymakers, as it suggests that the equalizing benefits of digitalization may follow a diminishing returns curve, with early adoption yielding more substantial equality benefits than later-stage digital enhancements.

These results underscore the importance of incorporating moral and ethical constraints into AI development and digitalization strategies. Far from restricting economic benefits, applying such constraints appears to enhance socioeconomic efficiency by maintaining Pareto-optimal conditions where technological advances benefit society broadly rather than concentrating advantages among select economic actors.

For policymakers and business leaders, our study indicates that thoughtful regulation of digitalization and AI should not be viewed merely as a defensive measure against potential harms but as an affirmative strategy to maximize the societal benefits of these transformative technologies. Regulatory frameworks should address how digitalization affects market competition structures, particularly focusing on the potential for algorithmic collusion and asymmetric information advantages that can distort market efficiency.

Future research should explore how digitalization affects inequality at different stages of digital maturity and identify policy approaches that can sustain the equalizing effects of digitalization even in highly digitalized economies. Additionally, as AI capabilities continue to advance, monitoring their impacts on social and income inequality will remain essential for ensuring that technological progress translates to broadly shared prosperity.

The presented study allows us to draw the following conclusions:

- Digitalization, including AI, affects income stratification;
- This influence in the studied group of countries is generally toward greater income homogeneity and higher economic efficiency.
- There are countries and periods where this impact is negative.

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- In Bulgaria, digitalization has, albeit limited, a positive impact on reducing social stratification;
- Notably, the positive impact decreases in countries with a high degree of digitalization.

Acknowledgments: The research was carried out within the project "Exploring the new trilemma in post-pandemic Europe: artificial intelligence – digital economy - economic development" (ArtInDIGEC Development), funded under contract No. BG-175467353-2024-11-0240-C01, Competition for Funding fundamental Scientific Research - 2024, supported by the Scientific Research Fund.

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