

Електронний журнал «Ефективна економіка» включено до переліку наукових фахових видань України з питань економіки (Категорія «Б», Наказ Міністерства освіти і науки України № 975 від 11.07.2019). Спеціальності – 051, 071, 072, 073, 075, 076, 292. Ефективна економіка. 2024. № 11.

DOI: <http://doi.org/10.32702/2307-2105.2024.11.107>

УДК 338.124.4

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DIGITALIZATION OF THE UKRAINIAN STOCK MARKET DURING WARTIME: CHALLENGES AND OPPORTUNITIES

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ДІДЖИТАЛІЗАЦІЯ ФОНДОВОГО РИНКУ УКРАЇНИ В УМОВАХ ВІЙНИ: ВИКЛИКИ ТА МОЖЛИВОСТІ

The full-scale invasion of Ukraine by Russian troops in February 2022 led to profound changes in all sectors of the economy, including the stock market. This article explores the processes of digitalizing the Ukrainian stock market in wartime, analyzing the challenges and opportunities arising from introducing new technologies and financial instruments. The study delves into the adaptation of market infrastructure to crisis conditions, cybersecurity issues, regulatory changes, and the role of international partners in supporting digital solutions. The conclusions emphasize how digitalization can serve as a strategic response to market challenges and offer ways for economic recovery and further growth. At the same time, the article examines the existing steps towards the digitalization of

the stock market in Ukraine, making it more open and accessible primarily to local investors and investors worldwide. This work analyzes how relevant the implemented technologies are and their prospects for use. In particular, the article examines one of the most common financial instruments in the global financial markets - ETFs and Index Funds, assesses the prospects for implementing and using these instruments, and provides an understanding of their benefits. The article discusses the NBU's strategy of FX restriction easing, moving to greater exchange rate flexibility, and returning to inflation targeting, which is an essential element for economic recovery and signals support for investment activity. The next challenge analyzed for the Ukrainian stock market is attracting foreign direct investment, which plays a vital role in its development. In general, the article explores several key elements of the digitalization of the Ukrainian stock market - from the steps already taken to potentially essential elements that can serve as a growth point for both the Ukrainian stock market and the economic recovery. The article draws attention to the importance of this topic. It considers the use of stock market digitalization opportunities as one of the ways to economic recovery in a country at war.

Повномасштабне вторгнення російських військ на територію України в лютому 2022 року призвело до глибоких змін у всіх секторах економіки, включаючи фондовий ринок. У цій статті досліджуються процеси діджиталізації фондового ринку України в умовах воєнного часу, аналізуються виклики та можливості, що виникають у зв'язку з впровадженням нових технологій та фінансових інструментів. Дослідження заглиблюється в адаптацію ринкової інфраструктури до кризових умов, питання кібербезпеки, регуляторні зміни, та роль міжнародних партнерів у підтримці цифрових рішень. Висновки підкреслюють, як діджиталізація може слугувати стратегічною відповіддю на ринкові виклики та запропонувати шляхи для економічного відновлення та подальшого росту. Водночас, стаття розглядає наявні кроки до діджиталізації фондового ринку

в Україні, що роблять його більш відкритим та доступним в першу чергу для локальних інвесторів та інвесторів з усього світу в тому числі. Аналізує наскільки актуальними є впроваджені технології та яку вони мають перспективу використання. В тому числі, стаття розглядає одні з найрозповсюджених фінансових інструментів на світових фінансових ринках - *ETF's* та *Index Funds*, оцінює перспективу впровадження та використання цих інструментів та дає розуміння переваг кожного з них. Стаття розглядає стратегію пом'якшення валютних обмежень, переходу до більшої гнучкості обмінного курсу та повернення до інфляційного таргетування запроваджену НБУ, що є важливим елементом для відновлення економіки, та сигналізує про підтримку інвестиційної діяльності. Наступний проаналізований виклик для фондового ринку України це залучення прямих іноземних інвестицій, що відіграє важливу роль у його розвитку. Загалом проаналізовано декілька ключових елементів діджиталізації фондового ринку України – від вже запроваджених кроків – до потенційно важливих елементів, що можуть слугувати точкою зростання як для фондового ринку України, так і для відновлення економіки в цілому. Стаття звертає увагу на важливість цієї теми, і розглядає використання можливостей діджиталізації фондового ринку, як один з напрямків економічного відновлення країни в умовах війни.

Keywords: *digitalization, stock market, financial technologies, cybersecurity, investment.*

Ключові слова: *діджиталізація, фондовий ринок, фінансові технології, кібербезпека, інвестиції.*

Statement of the problem in a general form and its connection with important scientific or practical tasks. The outbreak of the full-scale invasion of Ukraine in 2022 and the ongoing war conflict have drastically impacted the stock market, presenting significant challenges such as trading disruptions, reduced

investor confidence, and operational risks. However, the rapid advancement of digital technologies offers a potential solution to these issues. This article explores the digitalization of Ukraine's stock market during wartime, focusing on how digital transformation can address current obstacles and create new opportunities for market recovery and growth.

Analysis of the latest research and publications. The literature related to stock market digitalization highlights several key themes relevant to the Ukrainian context:

Digitalization in Financial Markets: The spread and constant updating of digital technologies significantly change ways of life and the behavior of economic entities. They necessitate the improvement of business processes and the emergence of new business models. Experts, scientists, and politicians are widely discussing these changes. At the same time, it is expedient to be aware of actual transformations, their gradual nature, and the essential properties that make up the basis of their effective activity [4.4].

Impact of Conflict on Financial Systems: Research on financial systems during conflicts reveals that instability often leads to increased volatility, reduced liquidity, and operational disruptions [11]. Adapting digital solutions in such environments is critical for maintaining market functionality and investor confidence.

Cybersecurity Risks and Regulatory Challenges: The shift to digital platforms introduces new risks related to cybersecurity and regulatory oversight [2]. Effective measures are necessary to address these challenges and ensure the integrity of digital financial transactions.

International Support and Technological Collaboration: International organizations and technology providers are crucial in supporting digital transformation in emerging markets [8.8]. Their involvement can accelerate the development of digital infrastructure and facilitate market resilience.

Formulation of the goals of the article. This article aims to:

1. Analyze the impact of wartime conditions on the Ukrainian stock market and the role of digitalization in addressing these challenges.
2. Assess the market's current state of digital transformation, including infrastructure, cybersecurity, and regulatory aspects.
3. Identify opportunities for enhancing market inclusivity, attracting foreign investment, and developing innovative financial instruments.
4. Explore the role of international partners and technology providers in supporting digitalization.

The main material of the research is the digitalization of Ukraine's stock market, which has been both an opportunity and a challenge amidst the ongoing conflict. One of the primary issues is the current state of digital infrastructure. Before the war, Ukraine's stock market had a relatively rudimentary digital infrastructure, with limited online trading capabilities and insufficient integration of advanced financial technologies. The onset of the conflict has exacerbated these limitations, as the physical damage to infrastructure and the disruptions in communication have further strained the existing systems.

Despite these challenges, a concerted effort has been made to upgrade the digital infrastructure. New trading platforms have been introduced to enhance market efficiency and accessibility. For instance, the Ukrainian Exchange (UX) implemented a new electronic trading system that supports real-time transactions and improved market transparency in 2019, relatively not so far ago [10]. However, the effectiveness of these systems is contingent upon their resilience against cyber threats. The war has heightened the risk of cyberattacks, targeting financial institutions and trading platforms. Ensuring robust cybersecurity measures is crucial to protecting sensitive financial data and maintaining the integrity of digital transactions. Developing secure and resilient digital infrastructure is essential for preventing potential breaches and maintaining investor confidence. Research indicates that implementing advanced encryption techniques and multi-factor authentication can significantly enhance the security of digital platforms [1].

The increased cyber threat landscape has prompted the Ukrainian government and financial institutions to invest in cybersecurity enhancements. Collaborative efforts with international cybersecurity firms and adopting best practices from global financial centers have been pivotal in strengthening the digital infrastructure. Despite these advancements, there is still a need for continuous monitoring and updating of cybersecurity protocols to stay ahead of evolving threats.

The regulatory landscape governing digital trading platforms has also undergone significant changes. The war has complicated updating regulatory frameworks, creating an unstable implementation environment. The need for a comprehensive update to the regulatory framework is evident, as existing regulations were primarily designed for traditional trading platforms and did not adequately address the complexities of digital transactions.

Key areas requiring attention include developing new regulations for digital trading platforms, enhancing investor protection measures, and adapting existing laws to address the unique challenges posed by digital financial transactions. For instance, rules concerning digital asset trading, data protection, and anti-money laundering (AML) must be updated to reflect the evolving digital landscape [11]. The introduction of clear guidelines for digital trading platforms and increased oversight to ensure compliance with international standards are crucial steps in this process.

The Ukrainian National Securities and Stock Market Commission (NSASMC) has been working on developing new regulations tailored to digital trading. These include frameworks for electronic securities, digital asset custody, and remote trading operations. However, the ongoing conflict and the dynamic nature of the digital market pose challenges to the timely implementation of these regulations.

Despite that, in 2023, NSASMC announced and developed a new electronic system called Veleten. It is already a big step toward digitalizing the Ukrainian Stock market. This is a software and hardware complex of the National Depository

of Ukraine authorized by the NSASMC to support the holding of the GMS (general shareholders meeting) [6.6]. The main features of Veleten:

1. Ensures identification and registration of owners (their representatives).
2. Obtaining documents that owners can familiarize themselves with in preparation for the meeting.
3. Voting by ballot.
4. Participation in the discussion of leading questions.
5. I am summarizing the e-voting results.

One of digitalization's most significant advantages is its enhanced remote access. In a conflict zone where physical access to market infrastructure may be limited, digital platforms enable investors to engage in trading activities from any location. This capability is precious for maintaining market functionality and investor participation despite disruptions in physical infrastructure.

Digital platforms can increase market inclusivity by offering access to a broader range of investors, including those who may have yet to participate in traditional trading environments. For instance, the introduction of mobile trading applications and online brokerage services allows investors to trade from anywhere with an internet connection. This increased accessibility can help engage new market investors and support continued investment.

Moreover, digital platforms can facilitate the inclusion of smaller investors who may have been previously excluded due to high entry barriers associated with traditional trading platforms. By lowering transaction costs and providing user-friendly interfaces, digital platforms democratize access to financial markets and promote greater participation [3].

Using such capabilities would also allow the creation of more financial instruments to engage new investors in the market by lowering market entry barriers. An example of such a financial instrument is Index Funds and ETFs (exchange-traded funds).

Big foreign Stock Markets widely use these tools. I suggest reviewing the similarities and differences between Index Funds and ETFs (Table 1).

Table 1. Comparison of ETFs and Index Funds features

Feature	ETFs	Index Funds
Accessibility via Digital Platforms	ETFs are highly accessible through digital trading platforms, offering real-time trading and flexibility, critical in wartime conditions where physical trading is disrupted.	Index funds are also accessible digitally but are less flexible since they are traded only once per day. This may limit responsiveness to market volatility in times of conflict.
Market Liquidity	ETFs generally offer higher liquidity because they are traded throughout the day, which can be advantageous in a volatile wartime economy where quick buying or selling might be necessary.	Index funds tend to have lower liquidity because they are not traded intraday, potentially leading to delays in accessing funds when needed quickly.
Digital Infrastructure Requirements	ETFs rely heavily on stable and secure digital infrastructure. The ongoing risk of cyberattacks in a war zone could make real-time trading systems vulnerable, though ETFs are supported by advanced technologies like blockchain, improving resilience.	Index funds also benefit from digital systems, but their less frequent trading makes them less vulnerable to immediate infrastructure risks. However, they may offer less opportunity for real-time market participation.
Investment Flexibility and Costs	ETFs allow investors to start with minimal amounts, often even fractional shares, which can encourage broader participation in a market with low capital availability due to the war. They also come with lower management fees, but trading costs (bid/ask spreads) could increase during periods of market disruption.	Index funds typically require a higher initial investment, which might deter smaller investors, especially in a conflict-driven economy. However, they often have slightly lower management fees, reducing long-term costs for stable, long-term investors.
Tax Efficiency	ETFs tend to be more tax-efficient, especially on digital platforms that automate tax optimization strategies. This can be beneficial in a conflicting environment where economic policies may change abruptly.	Index funds might be less tax-efficient due to more significant capital gains distributions, which can be challenging to manage in a highly uncertain financial environment.
Risk and Volatility Management	With their intraday trading, ETFs provide investors with more options to react to market volatility caused by wartime disruptions. However, they can be more susceptible to short-term price fluctuations.	With their once-a-day pricing, Index funds offer a more stable investment for long-term growth, which may appeal to conservative investors looking for lower volatility in a wartime market.
International Investment Appeal	ETFs may attract foreign investors to Ukraine's digital stock market due to their transparency, liquidity, and ability to integrate global assets like commodities and currencies. This is particularly valuable as international capital is crucial during wartime.	Index funds generally appeal to long-term foreign investors focused on stability rather than market timing. Their digital availability makes them accessible but may be less attractive in highly volatile times.

Source: table created by the author.

To summarize the information in the sheet, both financial tools we have reviewed have proven their effectiveness already. However, considering Ukraine's

current economic conditions, ETFs may offer a more adaptive and responsive instrument for the stock market's digitalization. At the same time, index funds could still be valuable for investors seeking a long-term, lower-risk strategy.

Digitalization can significantly enhance the appeal of Ukraine's stock market to foreign investors. Integrating technologies such as blockchain and smart contracts can offer greater transparency and security, which are critical factors for international investors. Blockchain technology, in particular, can improve the transparency of transactions and reduce the risk of fraud by providing a decentralized ledger of all trading activities [7.7].

Improved digital infrastructure also enables seamless cross-border transactions, making it easier for foreign investors to participate in the Ukrainian market. Enhanced digital platforms can support multi-currency transactions, real-time settlement of trades, and automated compliance with international regulations. These features are crucial for attracting foreign investment and integrating Ukraine's stock market into the global financial system.

In addition, developing digital financial instruments, such as tokenized assets and digital bonds, can create new investment opportunities for foreign investors. Tokenized assets, digital representations of real-world assets, can provide greater liquidity and transparency. Digital bonds, on the other hand, offer innovative investment avenues and can help diversify the market.

The adoption of digital technologies opens opportunities for creating innovative financial instruments. Tokenized assets and digital bonds are examples of how digitalization can drive market innovation. Tokenized assets can enhance market liquidity by allowing fractional ownership and easier transferability of assets. This innovation can attract a broader range of investors and increase market participation.

Digital bonds, which are issued and traded electronically, offer several advantages over traditional bonds. They provide greater efficiency in the issuance and trading processes, reduce administrative costs, and offer improved

transparency. The development of these instruments can contribute to market diversification and resilience.

Furthermore, digital technologies enable the creation of new investment products tailored to the needs of modern investors. For example, decentralized finance (DeFi) platforms leverage blockchain technology to offer financial services such as lending, borrowing, and trading without intermediaries. These innovations can expand the range of financial products available and provide new investment opportunities [2].

International organizations such as the European Bank for Reconstruction and Development (EBRD), the World Bank, and the International Monetary Fund (IMF) play a crucial role in supporting Ukraine's stock market's digital transformation. These organizations provide technical assistance, funding, and expertise to help develop and implement digital solutions.

The EBRD has actively supported digital financial systems in emerging markets, including Ukraine. Their assistance includes funding technology upgrades, technical advisory services, and capacity-building initiatives. The World Bank and IMF also contribute through policy advice, financial support, and sharing best practices from other markets [8.8].

These international organizations' involvement is instrumental in strengthening market infrastructure and effectively ensuring the adoption of new technologies. Their support helps address the challenges faced by Ukraine's stock market and facilitates the development of a robust digital financial ecosystem.

Partnerships with global technology providers can further facilitate the digitalization process. These collaborations bring advanced technologies, best practices, and innovative solutions to the Ukrainian market. Technology providers can offer expertise in blockchain, cybersecurity, and digital trading platforms.

For instance, collaborations with technology firms specializing in blockchain technology can enhance the transparency and security of digital transactions. Similarly, partnerships with cybersecurity companies can strengthen the protection of digital platforms against cyber threats. Leveraging the expertise of technology

providers can accelerate the development of Ukraine’s digital financial ecosystem and improve its competitiveness in the global market [1].

In fact, we already saw a positive trend in digitalization back in 2021, when multiple banks and investment organizations released financial marketplace apps, allowing the purchase of foreign stocks for private investors. A good example could be an app called “mono invest.” according to open-source information, there were 20000 active users, while the app was only in the “beta” stage in February 2022, and developers expected at least 100000 users after the final app release in March 2022. However, a full-scale invasion had a significant impact on it, and the National Bank of Ukraine set certain limitations on such investments, restricting the users from adding new funds to the broker's account and making it unusable. However, this experience can be used in the future.

The National Bank of Ukraine has also developed a Strategy for Easing FX Restrictions, Transitioning to Greater Flexibility of the Exchange Rate, and Returning to Inflation Targeting. It was implemented behind the following reasoning: At the outbreak of the full-scale war, the NBU fixed the hryvnia’s exchange rate and imposed several administrative restrictions. These decisions made it possible to prevent panic and ensure the stable operation of the financial system and helped businesses and households adjust to the full-scale war. However, the fixed exchange rate regime and FX restrictions come with both benefits and costs, and over time, the costs could outweigh the benefits [5.5].

I suggest reviewing each step of this strategy (Table 2).

Table 2. STAGES OF FX RESTRICTIONS EASING

Stage	Steps
Stage 1	<ul style="list-style-type: none"> - Minimizing the existence of multiple exchange rates. - Increasing opportunities for businesses to conduct trade transactions. - Facilitating new lending/investment.
Stage 2	<ul style="list-style-type: none"> - Liberalizing trade finance. - Managing the banks’ FX risks. - Enabling the repayment of interest on legacy loans;
Stage 3	<ul style="list-style-type: none"> - Payments on loans and investments. - Transactions of households (transfers abroad). - Transactions with derivatives, lending to foreigners. - Investment abroad.

Source: National Bank of Ukraine [5].

This indicates that NBU supports investment activity and digital improvements in the Ukrainian stock market, which can become essential to post-war economic recovery.

I suggest looking at the Foreign direct investment and net outflows index to explore the importance of digitalizing the Ukrainian Stock Market. Foreign direct investment refers to direct investment equity flows in an economy. It is the sum of equity capital, reinvestment of earnings, and other capital. Direct investment is a category of cross-border investment associated with a resident in one economy having control or a significant degree of influence on managing an enterprise resident in another economy. It shows net outflows of investment from the reporting economy, in our case, Ukraine, to the rest of the world [9]

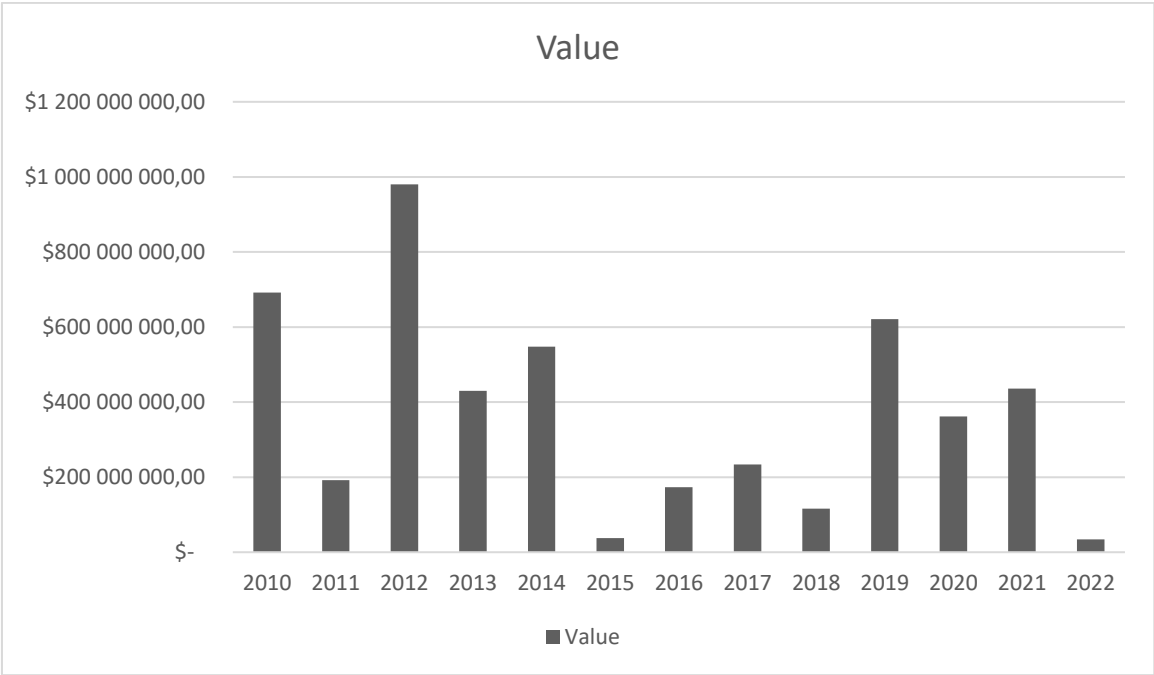


Figure 1. Foreign direct investment, net outflows (BoP, current US\$) - Ukraine

Source: World Bank [9], created by the author.

Ukraine's stock market, like many emerging markets, faces challenges in attracting foreign direct investment (FDI). A significant barrier is the digital divide, which limits accessibility and efficiency. By examining historical FDI outflow data and exploring the potential benefits of digitalization, I argue that a more digitally advanced stock market is crucial for Ukraine to retain capital and attract foreign

investors. The data from the World Databank shows a concerning trend of FDI outflows from Ukraine, indicating a less-than-ideal investment climate. These outflows can be attributed to various factors, including economic instability, political uncertainty, and limited access to market information. A digitally advanced stock market can address these challenges by boosting its transparency and providing real-time data and analytics, cutting costs by lowering the transaction costs with online trading, and expanding access to it by opening the stock market to a broader range of investors. By embracing digitalization, the Ukrainian stock market can become more transparent, efficient, and accessible. This, in turn, can help reduce FDI outflows and create a more favorable investment climate.

Conclusions. Digitalizing Ukraine's stock market during wartime presents both challenges and opportunities. Addressing cybersecurity risks, updating regulatory frameworks, and building investor confidence are essential for successful digital transformation. Support from international organizations, partners, and collaborations with technology providers are crucial for facilitating this process and ensuring long-term market resilience. Embracing digital technologies can help Ukraine's stock market navigate current disruptions and lay the foundation for future growth and stability.

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Стаття надійшла до редакції 20.10.2024 р.