

Maria Nasachenko

## STARTUP INDUSTRY IN UKRAINE: A CATALYST FOR POST-WAR RECOVERY AND STRENGTHENING MONETARY TRANSMISSION

*This article examines the role of the startup industry in Ukraine as a catalyst for post-war economic recovery and the strengthening of monetary transmission. The study highlights the significance of supporting innovation and attracting foreign investment to foster economic growth, drawing upon the analysis of the Ukrainian startup ecosystem across diverse sectors, including defense, healthcare, and technology. To quantitatively assess the relationship between the number of startup projects and the prevailing macroeconomic conditions, the author employs a multifactor regression model incorporating variables such as the short-term bank lending rate with a lag of one, past foreign direct investments, real wage index, differences in the National Bank of Ukraine's policy rate with a lag of two, and economic agents' inflation expectations for the next 12 months. To approximate the number of startups, the proxy variable of registered patents and inventions is used. The analysis underscores the comparative advantages of Ukrainian startups, particularly in terms of accessing talented IT professionals, and emphasizes the need for supporting the promotion of young innovative entrepreneurs. Ultimately, the research reveals that the growth of the startup industry can contribute to the strengthening of monetary transmission and reduce dependence on traditional sectors, enhancing the economy's resilience to external shocks. Furthermore, Ukraine possesses significant potential for developing the startup business sector, driven by the successful resistance to Russian aggression, which has led to new initiatives by war veterans in drone manufacturing, improving the technical specifications of various weapons, and integrating into the global investment landscape. This, coupled with the country's growing reputation as a new geopolitical investment hub for foreign investors, contributes to the increasing popularity of Ukraine in the global investment space.*

**Keywords:** startups, monetary policy, transmission mechanism, investment, risks, economic activity, financial stability.

**JEL classification:** C22, M13, O31, E52, E58, F35

**Introduction and research problem.** In today's world, the startup industry is considered a promising sector of the economy that can help boost economic growth and improve the effectiveness of monetary instruments in Ukraine. The country is facing economic and political challenges caused by crises and dependence on other nations, so it is important to make the most of available resources and explore alternative ways to stimulate economic growth. Developing the startup industry and innovative technologies can help Ukraine recover from the effects of war. By implementing successful startup projects, monetary instruments can be used more effectively to promote economic development. The startup industry is one of the most promising sectors of the world economy, which can be a source of economic growth and increase the effectiveness of monetary transmission. Ukraine has a great potential for the development of a startup ecosystem, which can become one of the key drivers of economic

growth. Therefore, the examination of the issue of startup industry development in Ukraine as a means of enhancing the effectiveness of monetary transmission is relevant and important for the further development of the country's economy. In the subsequent analysis, the main trends in the development of the startup industry in Ukraine will be examined, the factors affecting its development will be identified, and the contribution of the startup industry to the country's economy as a means of enhancing the effectiveness of monetary transmission will be determined.

**Recent publications analysis.** The startup ecosystem in Ukraine is still in the formation stage and requires development, support, and guidance from potential investors and the government. According to the research findings of Dorosh-Kizym and Dorosh (2022), Ukrainian startups are usually concentrated in several industries, particularly in IT, biotechnology, and energy

efficiency, and their main success factors are the presence of a talented and motivated team, financing, access to scientific research in certain fields, opportunities for business and technology development. The authors believe that the main obstacles to the development of startups in Ukraine are inadequate government and business community support, insufficient infrastructure development, and a lack of experienced mentors. The growth of foreign direct investment in the startup industry in Ukraine is one of the main sources of influence on monetary policy. However, there may also be a reverse effect, as the central bank's policy affects the macroeconomic environment, and as a result, the conditions for doing business. For example, a study of the relationship between startups and monetary policy in Italy found that startups are more sensitive to changes in interest rates compared to traditional business companies, as they typically rely on external financing and have virtually no internal financial resources. In addition, the funding and credit risk of startups depend on the type of interest rate instrument used by the central bank. Specifically, a reduction in the discount rate leads to an increase in funding and credit risk for startups, whereas a reduction in the policy rate has the opposite effect (Mehtar & Al-Faryan, 2022).

Mugler and Weichenrieder (2017) arrived at similar conclusions, analyzing the role of startups in the transmission mechanism of monetary policy in Germany. Based on a panel regression model and vector autoregressive model, the authors found that lowering interest rates on loans has a positive impact on the creation and growth of new startups. However, the lack of access to financing is the main factor limiting the creation and development of startups. Thus, policies aimed at facilitating easier access to financing for startups can promote their development, while regulatory restrictions on lending limit the opportunities for creating and refining new technologies proposed by founders.

The development of startup ecosystems, its benefits, impact on economic growth, and transmission mechanisms have also been explored in the research conducted by M. Mehtar, M. Al-Faryan (2022), P. Kijkasiwat (2021), E. Skawinska, R. Zalewski (2020), H. Hvide, T. Meling (2023), and numerous others.

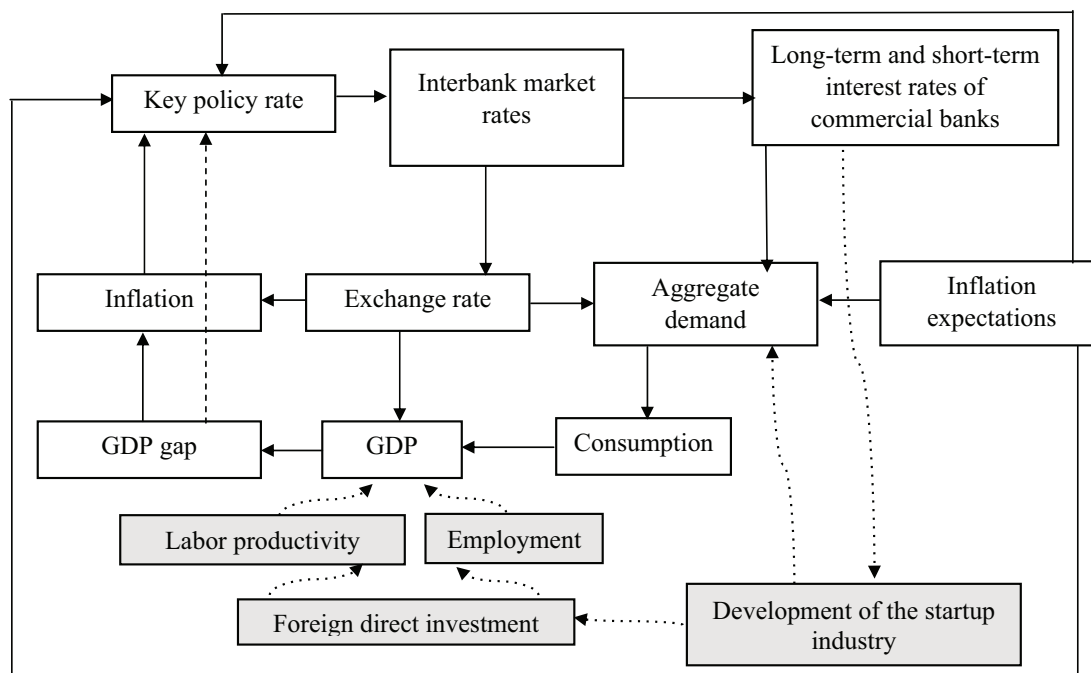
**Unsolved parts of the problem.** In the context of post-war reconstruction and the full-scale Russian-Ukrainian war, promoting economic growth and maintaining monetary stability is a critical goal for policymakers. Therefore, it is necessary to investigate the relationship between the development of startups – potential drivers of

economic growth – and monetary policy in Ukraine. The paucity of research on the development of Ukraine's startup ecosystem, including insufficient statistical data on the number, volume, and areas of focus for startups, as well as their impact on various sectors of the economy, underscores the importance of both theoretical and empirical analyses to evaluate the startup industry's impact on NBU's monetary regulation.

**Research goal and questions.** The goal of this research is to investigate the relationship between the development of startups and monetary policy in Ukraine, particularly in the context of post-war reconstruction and the full-scale Russian-Ukrainian war, with the aim of contributing to the promotion of economic growth and maintenance of monetary stability. The research questions aim to explore the relationships between the growth of the startup industry and monetary policy in Ukraine, as well as the potential for the further development of startups to shape NBU policies and contribute to economic growth.

**Main findings.** The development of the startup industry in Ukraine is poised to impact the transmission mechanism of monetary policy (see Fig. 1). The central bank, following the tenets of inflation targeting, sets a target inflation rate that it endeavors to uphold through the implementation of diverse monetary policy instruments (National Bank of Ukraine, 2023). The rise of businesses stemming from startups will effectuate changes in some aspects of the macroeconomic landscape. Startups, while generating innovation and new beneficial technologies, necessitate substantial financing during their early stages. Although the founders of startup projects may obtain funds for the continued advancement of their developments from varied sources, the most consequential are direct investments from investors or borrowing. Therefore, augmenting the number of startups in the country will incentivize an increase in the demand for credit resources. This, in turn, may engender a surge in the aggregate volume of loans, which would invigorate the economy and expedite inflation. Bank loans procured by businesses and the public (e.g., the ability of a startup founder to borrow funds as an individual during the preliminary stages of innovating a product) widen opportunities for consumption and, consequently, augment aggregate demand for goods and services, leading to price escalation (Lukianenko et al., 2020).

If there is a threat of the consumer price index going outside the target range due to an increase in demand for lending, the central bank can take measures by raising the policy rate. Obtaining



**Fig. 1.** Transmission mechanism of monetary policy with the impact of startup industry development in Ukraine taken into account

Source: by the author based on (National Bank of Ukraine, 2023; Skawinska & Zalewski, 2020; Kijkasiwat, 2021)

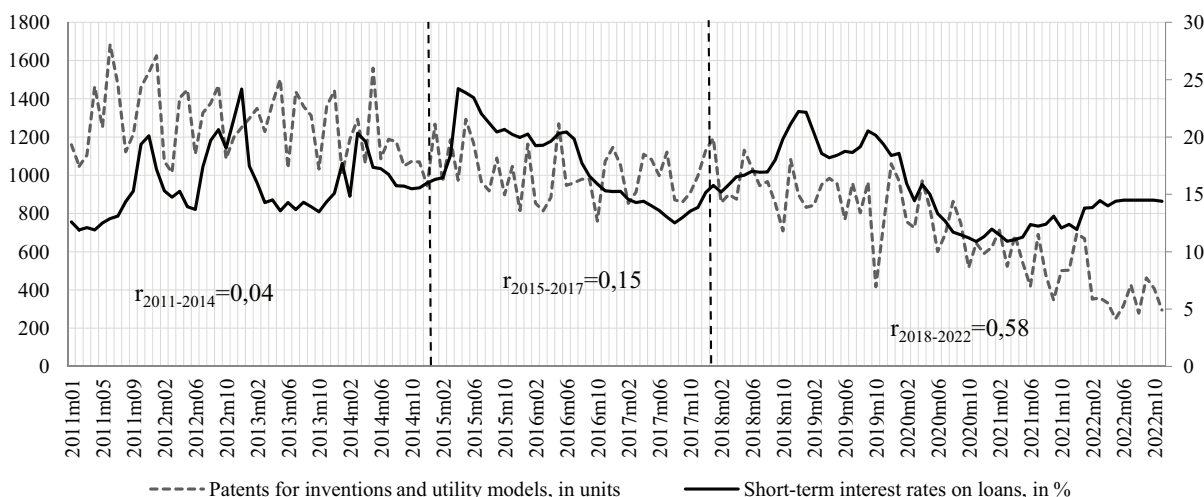
financing (for example, overnight loans to support liquidity) becomes more expensive, and therefore commercial banks are forced to increase the cost of loans in order not to keep their profits at the proper level. Higher interest rates on loans reduce the demand for debt capital, as they exclude potential customers who cannot afford to pay higher interest rates for borrowing funds. Thus, a reverse process takes place – a decrease in lending volumes reduces overall aggregate demand and inflationary pressure (Mishchenko, Somyk, & Lysenko, 2010).

Additionally, the startup industry represents a valuable source of innovation and development that has the potential to boost productivity and foster GDP growth. This may be accomplished through the creation of new job opportunities that are generated by startups, as well as through enhancing the efficiency and competitiveness of diverse economic sectors via the introduction of novel technologies and markets that emerge from startups. Furthermore, the startup industry can incentivize the expansion of highly remunerated positions and attract gifted and knowledgeable experts who can contribute to the advancement of the economy in key sectors.

After 2015, active initiatives in the Ukrainian startup industry were established and their direct correlation with bank lending was confirmed through an analysis of issued patents for inventions and utility models. Figure 2 shows the dynamics of short-term loan rates (right scale), as well as issued

patents for utility models and inventions (left scale). By their nature, startups involve the creation of new technological solutions, innovative products, and services, which are patented in the relevant organizations to protect the startup founder/inventor from possible copying and misappropriation by dishonest market players. During 2011–2014, the correlation between short-term loan rates and patents for utility models / inventions was almost zero, as the startup industry in Ukraine was only in its infancy at that time. The next three years (2015–2017) can be characterized, according to data obtained through surveys of startup founders (Polish-Ukrainian Startup Bridge, 2022), as the formation of the main postulates regarding the peculiarities of founding and running startups, the formation of “rules of the game” in the Ukrainian market, and the exploration of opportunities for attracting investment and debt financing, among other things (Lukianenko & Riabtsun, 2021). Therefore, during these three years, the link between loan rates and patents for inventions strengthened to 15 % ( $r_{2015-2017} = 0.15$ ). During 2018–2022, the correlation significantly increased, reaching 58 %, as the development of the startup industry gained more momentum, and, accordingly, the demand for short-term bank loans increased significantly.

To evaluate the interdependence of startups on a specific set of factors, such as monetary policy instruments, interest rates, inflation, and others, a multifactor regression model was formulated based



**Fig. 2.** Comparison of the correlation between patents for inventions and utility models and short-term loan rates over different time intervals

Source: by the author based on data (National Bank of Ukraine, 2023; The State System of Intellectual Property Legal Protection, 2023)

on Ukraine data. As there is a lack of organizations in Ukraine that compile statistical data on the establishment of startup projects over a given period (month, quarter, year), the number of patents registered for utility models and inventions, provided by the State System of Intellectual Property Legal Protection, was used as a substitute for the number of startups (The State System of Intellectual Property Legal Protection, 2023). The essence of the startup business is traditionally linked with the integration of new technologies and inventions, which must undergo the process of patenting and licensing to preserve the author’s rights over the innovation.

The equation specification implies the dependence of patents for inventions and utility models (*Patents<sub>t</sub>*) on short-term loan rates with a lag of one period (*Short<sub>loans<sub>t-1</sub></sub>*), foreign direct investment in the previous

period (*FDI<sub>t-1</sub>*), real wage index (*IRW<sub>t</sub>*), differences in the accounting rate two months ago (*D(KPR<sub>t-2</sub>)*), and inflation expectations (*Infl<sub>exp</sub>*). The results of the estimation of the multifactor regression model are presented in Table 1.

The relationships between patents and foreign direct investment (FDI) in the preceding month is positive, thereby confirming the hypothesis of an interdependence between capital inflows into the Ukrainian economy from abroad and a surge in innovative activity. An upswing in FDI by one million dollars prompts an uptick of 0.1 in the number of registered patents. Moreover, variations in the real wage index directly impact the number of patents, as an increase in the index by one point augments the number of patents by 4.6. This trend arises from the nearly concurrent increase in

**Table 1.** The results of the estimation of the multifactor regression model for registered patents and utility models (t-statistics are reported in parentheses)

The equation of registered patents for inventions and utility models, in units.	
$Patents_t = -1342.5 - 6.4 * Trend_t + 12.7 * Short_{loans_{t-1}} + 0.1 * FDI_{t-1} +$	
(-14.7)	(2.6) (3.5)
$+ 4.6 * IRW_t + 13.4 * D(KPR_{t-2}) - 14.1 * Infl_{exp}_t$	
(2.5)	(2.8) (-4.0)
Coefficient of determination: 74.6 %, DW-stat = 2.08	

where *Trend<sub>t</sub>* is the trend; *Short<sub>loans<sub>t-1</sub></sub>* is the short-term loan rate in %; *FDI<sub>t-1</sub>* is the net foreign direct investment in millions of USD; *IRW<sub>t</sub>* is the real wage index; *KPR<sub>t</sub>* is the NBU accounting rate in basis points; and *Infl<sub>exp</sub>* is the inflation expectations for the next 12 months in %.

Source: by the author based on data (National Bank of Ukraine, 2023; The State System of Intellectual Property Legal Protection, 2023)

innovation product development and wages during periods of macroeconomic growth. Furthermore, a modification of the main monetary policy instrument (the key policy rate) two periods ago, by one percentage point, culminates in a surge of 13.4 registered patents. A decrease in the key policy rate signals the market about the expansion of economic growth and consumption, leading commercial banks to reduce interest rates on loans and facilitating access to funding for startup activities. Conversely, an increase in the benchmark interest rate inhibits innovation and economic development in general.

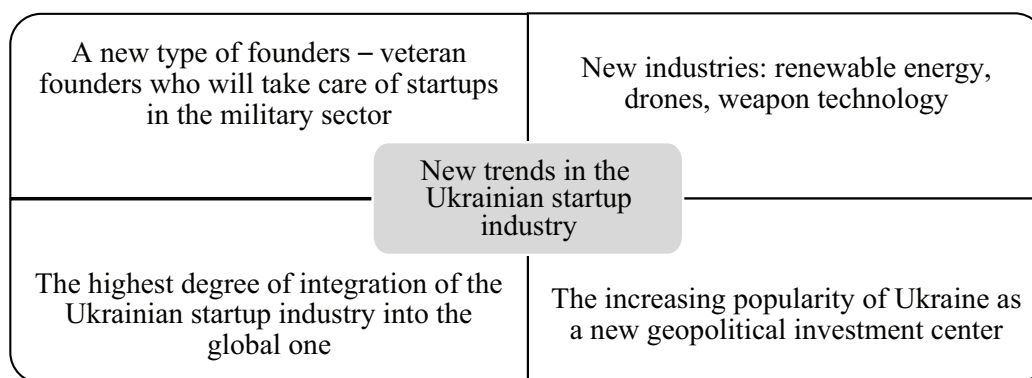
The present study reveals that the fluctuation of short-term bank interest rates on loans has a direct impact on the quantity of patents registered for inventions and utility models. Specifically, a 1% increase in the loan rate in the preceding month is associated with a 12.7 unit increase in the number of registered patents. This phenomenon can be explained by the fact that a rise in loan rates stimulates the interest of investors in channeling their funds into startups and other innovative ventures that hold significant potential for growth and development. This trend may further trigger the attraction of fresh investors who can provide the startups with requisite financial backing and resources for implementing their innovative ideas.

Despite the unfavorable conditions for the development of startup businesses in Ukraine, it is important to identify promising directions for this industry in the post-war period. Following Ukraine's victory over Russian aggression, a comprehensive reconstruction of the devastated infrastructure will commence, including the participation of international financial organizations, donor investors, grantors from partner countries, and others. As of the first half of 2023, initiatives to rebuild the Ukrainian economy have multiple directions and have been crystallized into well-defined projects, such as the "Ukraine Recovery

Plan" (2023), supported by the President of Ukraine, the Verkhovna Rada, the Cabinet of Ministers, and the Ministry of Digital Transformation; the "Rebuild Ukraine" program (2023), aimed at attracting external financing, and others. The latter program includes the reconstruction and modernization of infrastructure, such as roads, bridges, airports, railways, as well as the installation of new energy and water supply systems. Additionally, the concept focuses on supporting small and medium-sized enterprises, developing technological startups, and improving the efficiency of state management. "Rebuild Ukraine" also concentrates on the development of education and science, which aims to ensure the country's future economic growth. Comparable projects, concepts, and initiatives will eventually materialize and generate the initial results. Therefore, the foundation of Ukraine's post-war future is the development of science and technology, which will contribute to the establishment of a startup ecosystem.

After the victory over Russia, the field of innovation and technology has the potential to act as a driver for the development of the Ukrainian economy. The preconditions established by the large-scale reconstruction will foster the emergence of new trends in the Ukrainian startup industry (see Fig. 3). Among the various possible vectors for the further development of startup projects, it is worth highlighting the emergence of a new type of founder (veteran founders), the development of renewable energy, drone production, and so on. Additionally, the integration of the Ukrainian startup industry into the global industry and the increasing role of Ukraine as a new geopolitical investment center are expected.

One of the fundamental principles for creating successful startups is having competent and experienced mentors possessing the necessary knowledge and skills. In this regard, veteran-founders with



**Fig. 3.** New trends in the Ukrainian startup industry in the post-war period  
 Source: by the author based on data (Polish-Ukrainian Startup Bridge, 2022)



unparalleled experience in tactical, strategic, and resource management matters can introduce effective innovative projects in military and related domains following their return to civilian life. The ongoing development of technologies worldwide will motivate Ukrainian innovators to explore new areas, including renewable energy, drone production for military and civilian applications, weapon modernization, etc., particularly in the context of the “better than before” principle. Furthermore, the higher level of integration of the Ukrainian startup industry into the global arena, facilitated by foreign donor investors, international financial organizations, concerned governments, and others, will also act as a driving force for post-war recovery. The gradual return of Ukraine to the path of macroeconomic growth is expected to enhance its role as a new geopolitical investment hub, both through its own efforts and the support of the EU, USA, Canada, and Great Britain (Polish-Ukrainian Startup Bridge, 2022).

#### Conclusions and further research proposals.

Primarily, the Ukrainian startup industry is progressively evolving and holds substantial potential in diverse domains, comprising military, medical, agricultural, and others. Ukrainian startups are actively engaged in fabricating new technologies and innovative products, thereby facilitating the augmentation of the country’s competitiveness in the global market. Secondly,

the development of startups can have a significant positive impact on the monetary transmission in Ukraine. By creating new businesses and driving innovation, startups can generate employment opportunities, attract foreign investment, and boost economic growth. Thirdly, one of the pivotal advantages of Ukrainian startups is accessibility to proficient and skilled IT professionals, which enables them to create and execute novel technologies and products in various fields. Further, it is essential to provide support to young entrepreneurs, foster their professional growth and learning, which will facilitate the development of the startup ecosystem in Ukraine.

In conclusion, the analysis of the Ukrainian startup industry reveals its potential to drive economic growth and increase competitiveness in various fields. The country has faced significant challenges, including the ongoing Russian-Ukrainian war, but is slowly recovering and seeking to attract foreign investment to support its economic development. The advantage of having access to a skilled IT workforce gives Ukrainian startups a competitive edge in developing new technologies and innovative products. The development of startups can also have a positive impact on the monetary transmission in Ukraine, generating employment opportunities and economic growth, as well as contributing to the diversification of the economy.

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Насаченко М. Ю.

## ІНДУСТРІЯ СТАРТАПІВ В УКРАЇНІ: КАТАЛІЗАТОР ВІДНОВЛЕННЯ ПІСЛЯ ВІЙНИ ТА ПОСИЛЕННЯ МОНЕТАРНОЇ ТРАНСМІСІЇ

Розглянуто роль стартап-індустрії в Україні як каталізатора післявоєнного відновлення економіки та зміцнення монетарної трансмісії. Результати дослідження потенціалу української стартап-індустрії в різних галузях, як-от військова, медична та технологічна, доводять важливість підтримання інновацій та залучення іноземних інвестицій для збільшення економічного зростання. З метою кількісного оцінювання залежності між кількістю стартап-проектів і поточними макроекономічними умовами авторка використовує багатофакторну регресійну модель, що містить такі залежні змінні, як процентна ставка за короткостроковими банківськими кредитами з лагом один, прямі іноземні інвестиції минулого періоду, індекс реальної заробітної плати, різниці облікової ставки НБУ з лагом два та інфляційні очікування економічних агентів на наступні 12 місяців. Проксі-змінною для визначення орієнтовної кількості стартапів слугує кількість офіційно зареєстрованих патентів та винаходів. За результатами проведеного аналізу наголошено на порівняльній перевазі українських стартапів, зокрема завдяки доступу до талановитих ІТ-фахівців, а також необхідності підтримання просування молодих підприємців-новаторів. У підсумку дослідження виявило, що зростання стартап-індустрії сприятиме посиленню монетарної трансмісії та зменшенню залежності від традиційних галузей, що зробить економіку більш стійкою до зовнішніх шоків. До того ж Україна має значний потенціал для розвитку галузі стартап-бізнесу, оскільки у зв'язку з успішним протистоянням російській агресії з'являються нові ініціативи від ветеранів війни щодо створення дронів українського виробництва, поліпшення технічних характеристик різних видів зброї тощо, а також інтеграції до світового інвестиційного простору разом зі зростаючою популяризацією країни як нового геополітичного інвестиційного центру для іноземних інвесторів.

**Ключові слова:** стартапи, монетарна політика, економічне зростання, трансмісійний механізм, інвестиції.

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