









# “Financial sustainability of a Ukrainian university due to the COVID-19 pandemic: A calculative approach”

<b>AUTHORS</b>	Olena Kapustian 
	
	Yulia Petlenko 
	
	Anton Ryzhov 
	
Ganna Kharlamova 	
	


**ARTICLE INFO** Olena Kapustian, Yulia Petlenko, Anton Ryzhov and Ganna Kharlamova (2021). Financial sustainability of a Ukrainian university due to the COVID-19 pandemic: A calculative approach. *Investment Management and Financial Innovations*, 18(4), 340-354. doi:[10.21511/imfi.18\(4\).2021.28](https://doi.org/10.21511/imfi.18(4).2021.28)

**DOI** [http://dx.doi.org/10.21511/imfi.18\(4\).2021.28](http://dx.doi.org/10.21511/imfi.18(4).2021.28)

**RELEASED ON** Tuesday, 14 December 2021

**RECEIVED ON** Tuesday, 03 August 2021

**ACCEPTED ON** Monday, 13 December 2021

**LICENSE**  This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/)


**JOURNAL** "Investment Management and Financial Innovations"


**ISSN PRINT** 1810-4967

**ISSN ONLINE** 1812-9358

**PUBLISHER** LLC “Consulting Publishing Company “Business Perspectives”

**FOUNDER** LLC “Consulting Publishing Company “Business Perspectives”

  
NUMBER OF REFERENCES  
**48**

  
NUMBER OF FIGURES  
**4**

  
NUMBER OF TABLES  
**4**

© The author(s) 2021. This publication is an open access article.



## BUSINESS PERSPECTIVES



LLC "CPC "Business Perspectives"  
Hryhorii Skovoroda lane, 10,  
Sumy, 40022, Ukraine  
[www.businessperspectives.org](http://www.businessperspectives.org)

**Received on:** 3<sup>rd</sup> of August, 2021

**Accepted on:** 13<sup>th</sup> of December, 2021

**Published on:** 14<sup>th</sup> of December, 2021

© Olena Kapustian, Yulia Petlenko,  
Anton Ryzhov, Ganna Kharlamova,  
2021

Olena Kapustian, Dr. Sci. (Physics & Mathematics), Senior Researcher, Deputy Dean for Science and International Work, Faculty of Computer Science and Cybernetics, Taras Shevchenko National University of Kyiv, Ukraine. (Corresponding author)

Yulia Petlenko, Ph.D. (Economics), Associate Professor, Associated Professor of the Department of Finance, Faculty of Economics, Taras Shevchenko National University of Kyiv, Ukraine.

Anton Ryzhov, Ph.D. (Physics & Mathematics), Associate Professor, Associated Professor of the Department of General Mathematics, Mechanics and Mathematics Faculty, Taras Shevchenko National University of Kyiv, Ukraine.

Ganna Kharlamova, Dr. Habil. in Economics, Associate Professor of Economic Cybernetics Department, Faculty of Economics, Taras Shevchenko National University of Kyiv, Ukraine.



This is an Open Access article, distributed under the terms of the [Creative Commons Attribution 4.0 International license](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted re-use, distribution, and reproduction in any medium, provided the original work is properly cited.

### Conflict of interest statement:

Author(s) reported no conflict of interest

Olena Kapustian (Ukraine), Yulia Petlenko (Ukraine), Anton Ryzhov (Ukraine), Ganna Kharlamova (Ukraine)

# FINANCIAL SUSTAINABILITY OF A UKRAINIAN UNIVERSITY DUE TO THE COVID-19 PANDEMIC: A CALCULATIVE APPROACH

## Abstract

In 2020, due to the COVID-19 pandemic, university funding in Ukraine suffered significant losses due to unprecedented quarantine measures. The challenge for universities is to diversify funding sources, develop effective approaches to minimize existing and prevent future threats to ensure their financial stabilization (sustainability) in the post-pandemic period. The paper aims to consider financial sustainability of a university (the case of Taras Shevchenko National University of Kyiv) due to COVID-19 using the objective calculative approach on the statistical sample of data for 2011–2020. The tasks for achieving the aim are seen in determining, using regression methods, the number of lost receipts from general and special funds in the short and medium term, which will maintain a constant value of receipts at constant assets. The main idea of the paper is that financial sustainability is considered as a condition, and stabilization is considered as a process towards stability/sustainability.

The modeling approach reveals a fragile list of factors for the future preventing measures of the University to sustain. It is estimated that the University's top management should consider financial strategy in dollar terms only. The challenge is that funding in hryvnia seems to be quite increasing and linear, but indeed, funding of the University is non-linear and has a quite intensive downward trend. Thus, for the financial sustainability strategy, this fact should be crucial.

The results indicate the need for a significant increase in university funding to mitigate the impact of macroeconomic instability due to various crises, including the COVID-19 pandemic.

## Keywords

university funding, forecasting, regression, general funds, special funds, trend

## JEL Classification

I22, C01

## INTRODUCTION

The world is currently adapting to the new epoch of lockdowns, quarantines, and other consequences of COVID-19 and its modifications. There are quite enhancing prospects that the impact of viruses could increase in the future, preventing a return to the pre-COVID period. There are great steps towards routing the current threat and making little efforts to prevent them in the future. There is no doubt that scientists around the world have devoted their studies to the impact of COVID-19. The education field has been injured all over the world, billions of students and employees have switched to the on-line mode of the educational process. At the Taras Shevchenko National University of Ukraine (TSNUK), as the case, there were no second-year students in the classrooms yet. Clearly, the discourse on the health of educational institutions is claiming loudly.

Given that there are approximately 220 million students globally have been affected due to the disruption caused by COVID-19 in higher education, the COVID-19 pandemic has already had an unprecedented

impact on higher education worldwide in almost every aspect. It pushed policymakers and educational institutions into unprecedented challenges such as how to mitigate learning losses, how to deploy remote learning, how to safely reopen educational institutions, and how to ensure that underrepresented, vulnerable, and disadvantaged learners are not left behind (EU report on the impact of COVID-19 on higher education). Discussing the difficulties that higher education institutions face in transitioning to 'online pedagogy,' most studies highlight mobility issues, technology connectivity, digital learning, and differential access to education (Treve, 2021), but the key obstacles of a shift to distance education during COVID-19, according to the findings, are technical resources and differential access to education (Drayton & Waltmann, 2020; Smalley, 2021). That, in its turn, has a great impact on the financial stability of universities, and these losses could cause serious financial problems, including, in the extreme, insolvency (Drayton & Waltmann, 2020).

Since at least mid-March 2020, the higher education sector has been losing income as a result of the COVID-19 crisis.

---

## 1. THEORETICAL BASIS

According to the general scientific terminology, "stabilization" is considered as a change in the dynamic properties of the system, aimed at increasing its stability, intensifying the attenuation of the transition process, and reducing the impact of external disturbances. The research perception is that *the financial stabilization of a university* considers its ability to constantly provide its educational and research activities, as well as to fulfill its obligations regarding social benefits and academic scholarships, despite external fluctuations (Petlenko et al., 2021).

However, financial sustainability is a condition in which an economy's mechanisms for pricing, allocating, and managing financial risks (credit, liquidity, counterparty, market, etc.) function well enough to contribute to the performance of the economy (as defined above) (Schinasi, 2004). As yet, there is no generally accepted model or analytical framework for assessing financial system sustainability and examining policies, as there is for economic systems and other disciplines (Schinasi, 2004). This is because the analysis of financial sustainability is still in its infant stage of development and practice, as compared to, for example, the analysis of monetary and/or macroeconomic stability. In the rare cases in which financial systems are expressed rigorously, they constitute one or two equations in a much larger macroeconomic model possessing most of the usual macro equilibrium and macro-stability conditions (Donald, 1980).

Financial stabilization is a set of policy measures in finance aimed at overcoming the state budget deficit, high inflation, and hyperinflation (Adamenko, 2019). To achieve financial stabilization, financial policy must be closely linked to monetary policy. Financial stabilization is one of the conditions for the stable development of the country's economy, it creates the preconditions for the growth of production, development of the non-productive sector, increase in employment, improvement of social and economic living conditions of the population. Prolonged financial stabilization provides more attractive conditions for the inflow of domestic and foreign investment and ultimately for expanded reproduction, which in turn helps the economy as a whole.

The economic essence of the concept of "financial stabilization" is to achieve a stable balance between economic entities and the state and between different economic entities at the macro and micro levels of the financial system.

Anti-crisis financial stabilization mechanisms are mainly based on the method for analyzing the financial condition of an organization, enabling it to assess the financial activities only in the dynamics of the past and what was then that led to insolvency, and not to predict the financial condition of the organization in the future. In modern conditions, it is necessary to form a model of financial analysis aimed at the development of a dynamic analysis of the financial condition of organizations in the past, present, and future, taking into account the possibilities and limitations

of insolvency (bankruptcy) legislation, including a system of indicators to provide the financial condition of the debtor in the post-crisis development (Alferov, 2014).

Summing up, financial stability/sustainability and financial stabilization are almost the same, but the former is a process and the latter is the result of this process. In this paper, the concept of financial stabilization is discussed in terms of the ability of the financial system to ensure the efficient allocation of financial resources, manage financial risks and create conditions for its functioning under crises, the model of sustainable development of classical universities under uncertainty and risks regarding the impact of the global pandemic on the main indicators of their activities.

There are many developments on the impact of previous pandemics on the international economy, in particular, the studies by Cavallo et al. (2013), and Bloom and Canning (2004) that emphasize the need to anticipate and manage future risks. In this regard, Davoodi et al. (2003) and Kretovics and Michael (2005) point to the need to change approaches to sustainable funding for higher education under the influence of global digitalization and the use of online education; it is also stated that the government and government institutes are rapidly losing the ability to regulate the higher education sector. The researchers conclude that long-term consequences of previous crises are the decline of access among low-income students at selective institutions because of the tuition increase, while less selective institutions might compromise the quality (Geiger, 2010; Yang, 2021).

Despite this, these points are widely researched and represent mostly scholarly information. The research gap is still open in the aspect of models, assessments, and statistical analyses of the financial stabilization of higher education, and particularly as to the COVID-19 impact. Quite obvious is that models are not a panacea for higher education institutions for financial stabilization, but they have a potential to provide objective, mathematically evident ground for smart management decisions. However, the analysis of financial sustainability in higher education institutions based on models and a calculative approach is quite in demand. The list of methods applied to the analy-

ses and forecasting of the financial stabilization is also quite limited, i.e. method Monte Carlo (Stein et al., 2014), the two-stage double bootstrap DEA methodology (Martínez-Campillo & Fernández-Santos, 2020), and statistical assessment (Petlenko et al., 2021). To formalize the generalized determinant of the impact of COVID-19 on financial stabilization, one should use the methodological approach proposed by Nakonechnyi et al. (2019), Ryzhov (2006), including some mathematical approaches to statistical simulation.

The additional research gap is hidden in the determinants of the financial sustainability of HEIs, particularly in the COVID-19 period. Basically, European universities potentially have three kinds of revenue: basic support from the government, the support from various government entities for research issues, and other sources of revenue. Some define academic revenues slightly differently, pinpointing that they usually refer to public funding (or taxpayer funding), private funding through student financial contributions (or tuition fees) and other funding sources. The latter includes income generated from contracts with the private sector, philanthropic funding like alumni fundraising, income generated by the provision of services and income obtained through financial or business activities. Direct public funding continues to be the most important income source for universities in Europe and most cases take the form of block grants or earmarked funds. The former requires a higher level of trust between government and universities than the latter. The government funding of higher education can be augmented by additional public funds through open competition for project-based funding or targeted funding.

There is a consensus amongst researchers (Stachowiak-Kudła & Kudła, 2015) that the higher the financial stability, the less it depends on one funding source. Therefore, it is thought to believe that universities should diversify the funding base to extend and protect their financial stability and to undertake an effort to seek alternative sources of income.

The best guarantee of independence is to have multiple funding sources instead of one (from the state budget). This is consistent with the statements that

private income can considerably enhance the independence of educational institutions and increase their freedom of action. However, it is important to emphasize the significance of the choice between accepting and rejecting the different funding sources over the number of available revenue streams. The diversification of funding sources alone is not sufficient to obtain financial sustainability because other factors matter. For example, some stress the importance of trust between government and universities and the existence of a gap between legal and effective autonomy. On the other hand, the prevalence of public funding does not exclude the high level of universities' sustainability. However, in most cases, the higher share of private financing means higher risk for higher education institutions, because the private sector is not obliged to provide funds for higher education if it does not provide clear benefits. Therefore, it is expected that the increase in private financing at the expense of the public should improve efficiency and increase the risk taken (Leshanych, 2018).

The financial sustainability of HEIs' financing is a complex concept. First off, the management of universities strives to achieve a wider range of objectives than merely minimizing revenue variance. Secondly, financial stability regulations should include many specific regulations of the impact on financial stability. This restriction can be completely formal or, in extreme cases, can exclude public funding depending on the interpretation of the law (Kovalenko & Popovych, 2018).

Inherent in the financial situation of universities is their financial sustainability. This refers to financial sustainability in the long run.

Generally, financial stability for the diversification of sources of funding for universities, especially advocating for the greater use of private funds is very important (Patel & Assaf, 2013).

The conditions for the spread of the COVID-19 global pandemic can be seen as complex and multifaceted, both necessitating a change in approaches to government regulation of education funding, although Keegan (1996) questioned the relevance of recognizing distance learning as a full-fledged educational component. At the same time, distance education in terms of the COVID-19 spread

has become one of the possible and affordable modes, and therefore governments of different countries are reviewing and adjusting strategies for the development of education in general and higher education in particular. The Government of Ukraine is not an exception. Thus, the Program of the Government of Ukraine has developed the strategic goals in education and science, among which is the goal to make higher education institutions autonomous, and 70% of them will lose the status of a budgetary institution. The purpose of reducing the number of budgetary institutions and the transition to financial autonomy is to ensure the diversification of funding sources and reduce dependence on funding from public sources. In this regard, Giofré (2017) stresses the need to reduce direct funding of higher education institutions, diversify funding sources, pointing to the need to create conditions to stimulate the search for new sources of funding and deregulate financial security in education.

Even more active development of science with the possibility of commercialization of its results is an important component of the hybrid development of a university, which should further develop the company value management (Ignatyuk et al., 2021). However, according to the literature review, there is a great research gap in the Ukrainian scientific discourse as to the analyses of financial stabilization of Ukrainian HEIs under any threats and challenges, COVID-19 in particular, as well as the high necessity to use a complicated calculative approach to the problem of the COVID-19 impact on the HEIs and their stabilization and sustainability.

Thus, to formalize the generalized determinant of the impact on financial stabilization under COVID-19, the paper adopts the methodological approach of the regression analyses and time series mathematical approaches for statistical simulations. In general, this study focuses on the development of universities as hybrid organizations and the assumption that it is necessary to maintain a stable amount of funding to ensure sustainable development. Taking into account Maassen's (2000) foreign experience, the development of financial autonomy of Ukrainian universities will require a transition to new institutional forms of governance, including university corporatization

(Cernostana, 2018). This form will allow applying market mechanisms of accumulation of necessary financing (Woods, 2008), to stimulate the development of internal business following the practical application of scientific developments created in universities and to build a rather steady system to prevent financial risk.

So, the literature review proves the necessity to apply modeling approaches to sustain the university financial management. The paper aims to consider possible fragile factors that should be involved in the model to avoid the vulnerable impact on the financial sustainability of HEIs. The case of the TSNUK financial stabilization model is proposed as a theoretical discussion on the issue based on the objective mathematical approach. The reason for using a modeling technique is to receive an objective point of view.

## 2. RESULTS

The results of testing the theoretical base are supposed to help identify and substantiate the empirical patterns of university funding at different stages of economic development, including the pandemic state caused by the manifestations of COVID-19. One of the most important problems of economic analysis of university funding from the standpoint of financial sustainability ensuring in the short and medium term is the study of the relationship of economic indicators, such as the amount of funding of universities in terms of general and special funds with the results of forecasting the likelihood of pandemics and their manifestations. The development of a university funding strategy under the global pandemic is integral to regulating the economic variables based on knowledge of how these variables affect other variables, being the key to making informed strategic decisions. Determining the parameters of the financial stabilization of Ukrainian universities modeling follows the data analysis, consisting of three successive stages such as data collection, statistical data analysis, and generalization of analysis results, which allows achieving the ultimate goal of the paper – to make a strategic decision on financial stabilization of activities of the Ukrainian universities in the short and medium term.

The first stage is the collection of statistical data from open sources (in particular, from the reports of the rector of the University during 2012–2020). Indicators such as funding of the University (for general and special funds) are used as data, and these indicators are averaged for comparability. The averaging of data on the University's financing is carried out by converting the actual data in conventional units (US dollars), using the average annual exchange rate of the US dollar to the hryvnia (Table 1). Financial indicators of TSNUK activity, depending on time, are presented in Table 1.

The second stage focuses on the regression analysis to mathematically formalize the problem of modeling universities' financial stabilization, which reveals statistical relationships between the values of university funding, where revenues from the state budget are accumulated in the general fund, and their own revenues are credited to a special fund. Further, a number of regression models are proposed to assess the significance of the influence of selected factors on the main parameters of the University, which creates opportunities for making sound economic decisions on the financial stabilization of universities.

The absolute values of financing under the general and special funds in monetary terms – the national currency of Ukraine (million UAH), and the data in million US dollars at the average annual exchange rate to ensure comparison of the current period with previous periods, are taken as the dependent variable. A simple linear regression  $y = a + bx$  is chosen as the formula for the relationship of the time-dependent variable (Das, 2019). This function allows drawing a straight line that is closest to the points of observation of their totality. The Least Squares Method (LSM) allows minimizing the sum of squares, which describe the variation of observations of the dependent variable from the desired linear function, to estimate the parameters of linear regression:

$$Q = \sum_i e_i^2 = \sum_i (y_i - (a + bx_i))^2 \rightarrow \min, \quad (1)$$

where  $y_i$  is the observed values of the dependent variable,  $x_i$  is a corresponding calendar year from 2011 to 2020,  $a$ ,  $b$  are unknown parameters of regression, and  $e_i = y_i - (a + bx_i)$  are random errors. Since the function  $Q$  is continuous, convex

and lower bounded, it has a minimum. For the general characteristics of the trend, it is necessary to calculate the average annual growth (as a percentage,  $\bar{k}$ ), using the following formula (Hamilton, 2020):

$$\bar{k} = 100(\exp(\beta) - 1), \quad (2)$$

where  $\beta$  is a slope coefficient in the log-linear regression model:

$$\ln(y) = \alpha + \beta x + \varepsilon, \quad (3)$$

calculated by the LSM. This value characterizes the change in the studied indicator for the entire observation period.

The amount of financing to stabilize the negative trend is modeled. Let  $N$  be a number of observation years,  $n$  be a number of prediction years. Since the values of independent variables  $x_1, x_2, \dots, x_N$  and  $x'_1, x'_2, \dots, x'_n$  are well-known, then the model helps to find predicted amounts of financing  $y'_1, y'_2, \dots, y'_n$  under the following conditions:

1) achieving a minimum of functional (1):

$$\sum_{i=1}^N (y_i - (a' + b'x_i))^2 + \sum_{i=1}^n (y'_i - (a' + b'x_i))^2 \rightarrow \min, \quad (4)$$

2) the condition of stagnation:  $b' = 0$ ,

3) the condition of constant growth:

$$y'_n - y'_{n-1} = \dots = y'_2 - y'_1 = y'_1 - y'_N.$$

Absolute and relative indicators of the University funding are provided in Table 2.

Table 1 and 2 show that there was an increase in funding for both general and special funds over the past 10 years. Thus, the general fund grew on average by UAH 100.5 million, or +11.7% annually, and the special fund grew by UAH 54.5 million (+10.0% annually), respectively (Figure 1). In particular, the growth of the general fund volumes was observed both in connection with the effects of COVID in 2020 relatively to 2019 figures

**Table 1.** Average data on funding of the University

Years	Financing, UAH mln		Exchange rate of hryvnias to the US dollar (average)	Financing, USD mln	
	General fund	Special fund		General fund	Special fund
	Y1	Y2		Y3	Y4
2011	563,4	388,4	7,98	70,60	48,67
2012	582,7	434,5	8,08	72,12	53,77
2013	684,2	399,9	8,15	83,95	49,07
2014	664,3	290,4	12,01	55,31	24,18
2015	685,5	331,9	21,95	31,23	15,12
2016	765,9	366,6	25,55	29,98	14,35
2017	1042,7	422,7	26,61	39,18	15,89
2018	1191,59	669,19	27,19	43,82	24,61
2019	1352,56	910	25,8	52,42	35,27
2020	1390,17	819,42	27,02	51,45	30,33

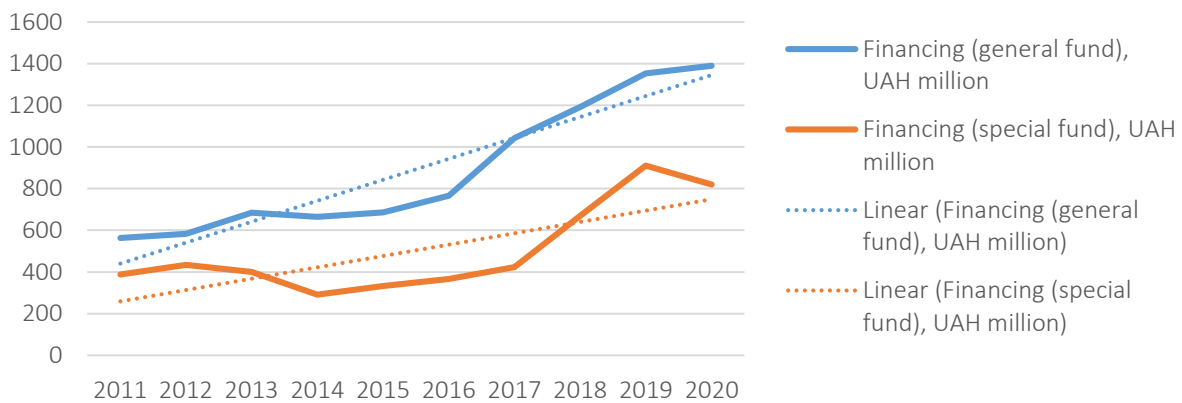
Note: \* according to the National Bank of Ukraine <https://bank.gov.ua/en/markets/exchangerate-chart>.

**Table 2.** Absolute and relative indicators for funding of the University, 2011–2020

Indicator	$b \pm s.e.(b)$	p	$\bar{k}$ , %	p
General fund financing, UAH mln, Y1	100.5±12.1	<0.01	11.7	<0.01
Special fund financing, UAH mln, Y2	54.5±16.4	0.01	10.0	0.014
General fund financing, USD mln, Y3	-3.4±1.7	0.085	-5.5	0.146
Special fund financing, USD mln, Y4	-2.7±1.5	0.106	-7.0	0.209

Note:  $b$  – the slope of the trend line;  $s.e.(b)$  – standard error of the slope factor;  $p$  – achieved level of significance ( $p$ -value);  $\bar{k}$ , % – average annual growth (as a percentage).

Source: Authors' development based on Table 1.



**Figure 1.** Change in the amount of funding of the University under the general and special fund, UAH mln, 2011–2020

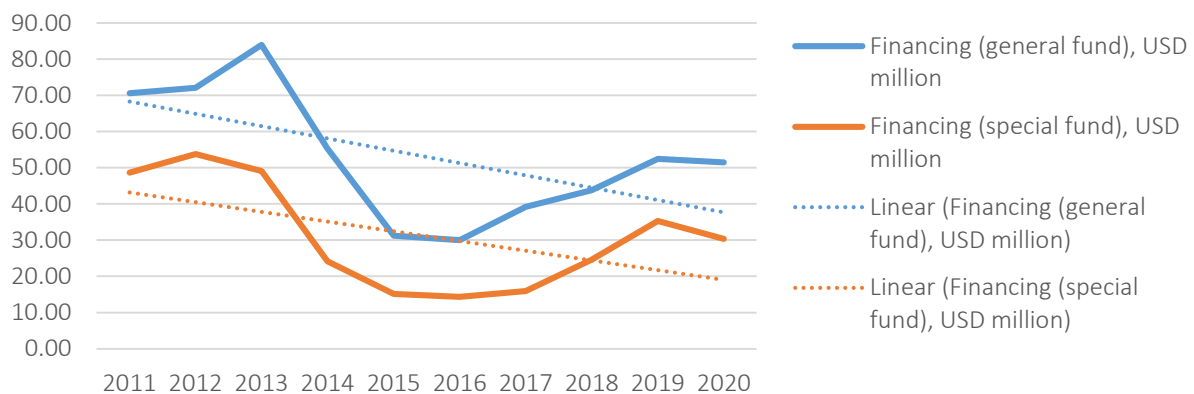
by UAH 37.6 (1352,56–1390,17) million, but the amount of special funding decreased by UAH 90.5 (910,00–819,42) million.

At the same time, the University's funding was reduced to a comparable form by converting the data  $Y1, Y2$  in US dollars ( $Y3, Y4$ ) (Table 1), and underwent significant changes (Figure 2), especially in 2013–2015, and generally tended to decline. This decline is explained by the change in the model of financing the higher education institutions in Ukraine, namely the transition to a targeted model of public procurement for training in specialties and educational institutions, as well as the application of the budget funding formula focused on quality indicators of educational, scientific and technical activities. As a result of such changes, revenues to the general fund were to be reduced and revenues to the

special fund were to increase, but the theoretical preconditions proved difficult to implement. Thus, it was found that the rate of reduction of revenues to the special fund was ahead of revenues to the general fund and makes up  $-7.0\%$  (\$2.7 million), while the general fund has been decreasing by an average of  $5.5\%$  (\$ 3.4 million) annually.

It should be noted that in interpret the USD data, linear forecasting is not appropriate and the time series line has an obvious polynomial trend (Figure 2). This suggests that the impact of the cyclic economy and its bifurcations is quite strong for the indicators, and this should be highly emphasized in the financial stabilization strategy of the University, since most managing decisions are based on the assumption of the linear stable development of the process.

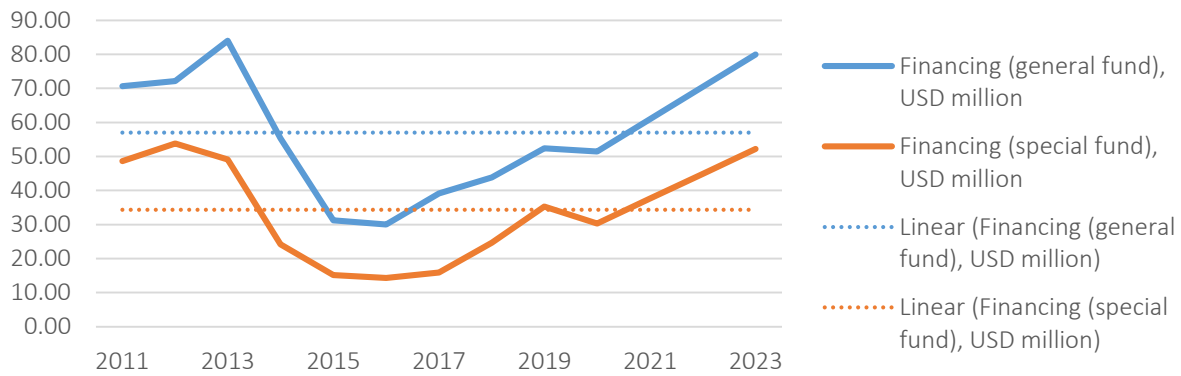
Source: Authors' development.



**Figure 2.** Change in the amount of funding of the University under the general and special fund, USD mln, 2011–2020



Source: Authors' development based on Tables 1-3.



**Figure 3.** Dynamics (2011–2020) and short-term forecast (2021–2023) of the amount of the University's funding under the general and special fund, USD mln

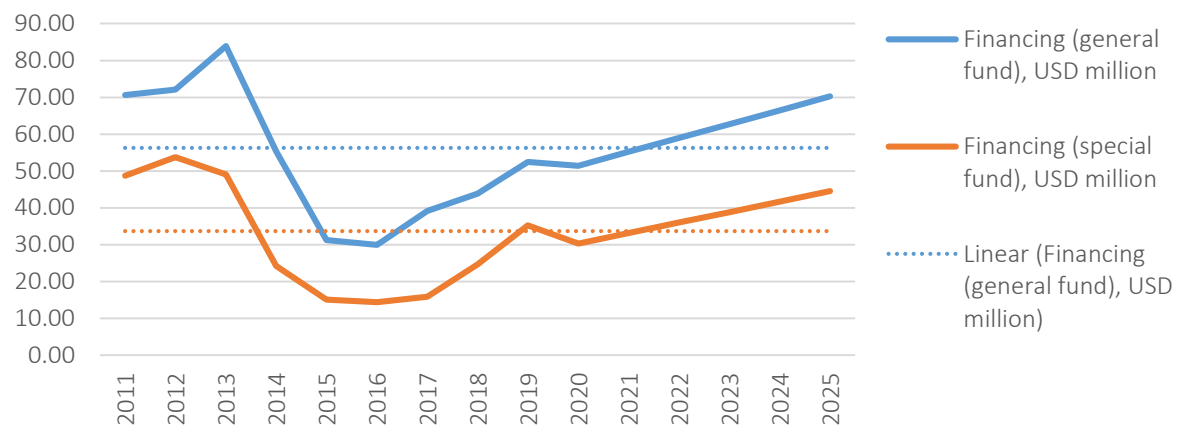
The results of short-term (3 years) and medium-term (5 years) modeling of general and special funds are presented in Table 3 and Figures 3-4. The results show that when planning for three years, the trend will stabilize with an annual total increase in funding by USD 16.8 million (where

USD 9.5 million belong to the general fund and USD 7.3 million to the special fund). At the same time, with a 5-year forecast, the increase in funding is expected at the level of USD 6.6 million, where USD 3.8 million belong to the general fund and USD 2.8 million – to the special fund.

**Table 3.** Estimated financing for the University during 2021–2025

Years	Model 1 (3 years)		Model 2 (5 years)	
	Financing of the general fund, USD mln	Financing of the special fund, USD mln	Financing of the general fund, USD mln	Financing of the special fund, USD mln
2021	60.9	37.6	55.2	33.2
2022	70.4	44.9	59.0	36.0
2023	79.9	52.2	62.7	38.8
2024	–	–	66.5	41.7
2025	–	–	70.2	44.5

Source: Authors' development based on Tables 1-3.



**Figure 4.** Dynamics (2011–2020) and medium-term forecast (2021–2025) of the amount of the University's funding under the general and special fund, USD mln

The third stage is devoted to the assessment of the fragile factors as was announced above. To assess the correlation between  $Y_i$  ( $i = 1...4$ ) and the main indicators of the education financing, the correlation matrix is built. The list of fragile factors is chosen based on the Ministry of Education and Science of Ukraine's official data and Bilinets et al. (2021) and grounded on the methodology of Cernostana (2018).

Indicators of dynamics and structure of financing of higher education in Ukraine during 2006–2019:

$X1$  – Funds of individuals, %.

$X2$  – Funds of legal entities, %.

$X3$  – Funds of local budgets, %.

$X4$  – State budget funds, %.

$X5$  – Financing of higher education, UAH billion.

Indicators of higher education financing in Ukraine for 2010–2022:

$X6$  – Total consolidated budget expenditures on education, amount, UAH million.

$X7$  – Total consolidated budget expenditures on education, share in total expenditures, %.

$X8$  – Total consolidated budget expenditures for higher education, amount, UAH million.

$X9$  – Total consolidated budget expenditures on higher education, share in total expenditures, %.

$X10$  – Training of specialists at the expense of the state budget of Ukraine per 10 thousand population during 2005–2020, persons (3-4 level of accreditation).

$X11$  – Training of specialists at the expense of the state budget of Ukraine per 10 thousand population during 2005–2020, persons (1-2 level of accreditation).

The significant correlation indicators revealed that the dependent variables of the TSNUK case relate to the factors indicated above not in the same way

(meaning hryvna and USD equivalents). That fact proves the necessity for the financial management to consider the USD equivalent of the funding in its strategy. The financial stabilization should be reached mainly in the USD equivalent indicators. Thus, the regression analyses (on the base of the correlation coefficient ( $r$ )) disclosed the following factor dependences:

1. *General fund financing of TSNUK*, UAH million ( $Y1$ ) is highly directly (linearly) correlated with Funds of local budgets, % ( $X3$ , 0.92), Financing of higher education, UAH billion ( $X5$ ,  $r = 0.97$ ), Total consolidated budget expenditures on education, amount, UAH million ( $X6$ , 0.68), Total consolidated budget expenditures for higher education, amount, UAH million ( $X8$ , 0.98).

Thus, the increase in one factor supposes the correspondent increase in another under the same external conditions and tendencies. However, there is an opposite high (linear) correlation of  $Y1$  with Total consolidated budget expenditures on higher education, share in total expenditures, % ( $X9$ ,  $-0.86$ ); Training of specialists at the expense of the state budget of Ukraine per 10 thousand population during 2005–2020, persons (3-4 level of accreditation) ( $X10$ ,  $-0.82$ ); Training of specialists at the expense of the state budget of Ukraine per 10 thousand population during 2005–2020, persons (1-2 level of accreditation) ( $X11$ ,  $-0.89$ ). Thus, the paradox revealed that the increase in total budget expenditures on high education generally does not support the TSNUK budgeting increase. The increase in TSNUK funding does not obviously provoke the increase in training of specialists at the expense of the state budget.

2. *Special fund financing of TSNUK*, UAH million ( $Y2$ ) has the same correlation ties. That reflects the hypothesis that there is not enough financial autonomy of universities, as according to some studies (Cernostana, 2018; Petlenko et al., 2021), there should be no such mirroring of correlations.
3. *The general ( $Y3$ ) and special ( $Y4$ ) fund financing of TSNUK* in USD equivalent correlates

with the factors differently. There is just one strong indirect (linear) connection among the whole list of analyzed factors – with X6, Total consolidated budget expenditures on education, amount, UAH million (–0.91 and –0.72, correspondently). That could be a marker not of inflation and economic situation affecting the funding of education in general. Both funds in USD equivalent are directly highly (liner) correlated with the Total consolidated budget expenditures on higher education, share in total expenditures, % (X9), Training of specialists at the expense of the state budget of Ukraine per 10 thousand population during 2005–2020, persons (3-4 level of accreditation) (X10). However, there is no tight linear connection with Training of specialists at the expense of the state budget of Ukraine per 10 thousand population during 2005–2020, persons (1-2 level of accreditation) (X11), which is a rather paradox situation that testifies to the wrong formula for higher education funding.

The rest of the factors were found to be not impactful and correlated to  $Y_i (i = 1, \dots, 4)$ .

Note that any correlation analysis is not relevant enough without significance analyses (regression modeling). The summing results of regression modeling in Eviews and Excel softs are presented in Table 4.

An obvious fact is that the factors  $X_i$  are mostly multicorrelated with each other, then just one-factor regression models can be modeled to trace the value of linear dependencies (Table 4).

Thus, regression analyses approved point 1 above (about correlations between *General fund financing of TSNUK*, UAH million (Y1) and the selected factors). So, the University's management can account for the changes in the state-level indicators for the financial stabilization forecasting insurance.

*Special fund financing of TSNUK*, UAH million (Y2) revealed behaving not the same as it was detected by the correlation analyses, and fully unlikely to the general fund, which is quite a normal tendency for the option of the financial stabilization. Thus, it appears that there is just one linear significant connection with the Training of specialists at the expense of the state budget of Ukraine per 10 thousand population during 2005–2020, persons (1-2 level of accreditation) (X11). And this dependence point to the increasing role of contract trainings in TSNUK, which is a good indicator of financial stabilization. Then, non-linear connection is detected with the Financing of higher education, UAH billion (X5), which once again is a good feature of financial stabilization and can be used for TSNUK's financial management.

**Table 4.** Linear regression modeling and Ramsey RESET test

Dependent variable	Factor	Significance of the linear dependence (adj R-sq)	Significance of non-linear dependence (prob (F) Ramsey Reset test)
Y1	X5	Significant (0.93)	Not-significant (0.09)
	X8	Significant (0.98)	Not-significant (0.7)
	X9	Significant (0.69)	Not-significant (0.17)
	X10	Significant (0.62)	Not-significant (0.37)
	X11	Significant (0.75)	Not-significant (0.91)
Y2	X3	Not-significant	Not-significant (0.31)
	X5	Not-significant	Significant (0.01)
	X8	Not-significant	Not-significant (0.95)
	X9	Not-significant	Not-significant (0.33)
	X10	Not-significant	Not-significant (0.07)
Y3	X11	Significant (0.56)	Not-significant (0.95)
	X6	Not-significant	Not-significant (0.06)
	X9	Not-significant	Significant (0.01)
	X10	Not-significant	Significant (0.03)
Y4	X6	Not-significant	Not-significant (0.06)
	X9	Not-significant	Significant (0.00)
	X10	Not-significant	Significant (0.03)

Both funds in USD equivalent revealed similar regression dependencies with the same list of selected factors, but there is no approved linear connection with selected factors. However, the forecasting of the fund in USD equivalent is possible in a non-linear way by the factors  $X9$  – Total consolidated budget expenditures on higher education, share in total expenditures, %;  $X10$  – Training of specialists at the expense of the state budget of Ukraine per 10 thousand population during 2005–2020, persons (3-4 level of accreditation). This is also a promising signal for financial stabilization.

### 3. DISCUSSION

Various researchers have already argued about the approaches to higher education financing in the world (Adams, 1977; Kohtamäki, 2009; Estermann & Bennetot Pruvot, 2011; Onuoha, 2013). Petlenko et al. (2021) define three main types of financing of higher education institutions: 1) state subsidies via the redistribution of taxes of taxpayers at the state and local levels, 2) private funds of institutions, organizations and individuals; 3) other funds, such as a grant or technical support, lending. At the same time, the structure of sources of funding for higher education depends on a number of components, among which Adams (1977) identifies the demand for higher education, national traditions, historical experience, the financial and budgetary structure of the state, social values and priorities.

In addition, scientists around the world are currently researching the impact of the COVID-19 global pandemic on all areas of human life, identifying possible ways to prevent similar risks in the future. At the same time, there is a need to further investigate the evolution of approaches to university funding, the peculiarities of financial instability in previous periods and their impact on university activities, as well as identify the most adequate forecasting methods and basic determinants of financial support to develop the models for universities' financial stabilization in the long run. Also, the paper pays attention to the possibilities and institutional feasibility of changing the organizational form of universities, in particular, their corporatization and increase in the revenues to the special fund of university financing. Given the need to ensure financial stabilization of uni-

versities in the short and long term, they are increasingly diversifying funding sources through the development of financial hybridization (Grossi, 2019). That is the explanation to the share of revenues to the general fund decreases, the university will gradually adapt to the conditions of the market environment. At the same time, public funding should be expanded due to the extension of the state order not so much for educational services as for the development of science and technology, which will create demand for the training of highly qualified professionals – master's degree holders and doctors of philosophy.

Economic and mathematical models for forecasting the stabilization of the negative trend of “average” University funding have been developed and tested taking into account the formulated hypotheses. The proposed mathematical model shows a significant decline in funding for universities in Ukraine, due to changes in the funding model of higher education institutions in general since 2014. The significance of this reduction is exacerbated by the fact that public funding only partially covers the University's operating costs, namely teachers' salaries and utilities, and such costs as the purchase of stationery, low-value and perishable items, furniture, educational and methodological literature, current and overhauls, were left without a permanent source of funding. As for capital expenditures that should contribute to the innovative development of free economic zones, their recovery is “lottery”, through a non-transparent mechanism for distributing capital expenditures among 178 free economic zones at the level of the Finance Department of the Ministry of Education and Science of Ukraine. It is clear that additional disturbances in the financing of higher education institutions, in particular those related to the consequences of the COVID-19 pandemic, will lead to a decrease in educational, scientific and technical activities. As can be seen from Figures 3 and 4, the positive trend that began to take shape in 2017–2019 was disrupted in 2020 due to the COVID-19 pandemic, which slowed down financial stabilization processes and forced the Ukrainian Free Economic Development Council to consider accelerating the introduction of a new financial management model on the principles of financial autonomy and full costing. At the same time, such a situation requires non-standard solutions

and further scientific discourse. Since the formation of the cost of educational services of the Free Economic Zone on the basis of full costing will lead to a rapid increase in the cost of educational services for both the state and the private sector, which may reduce the number of applicants and cause social unrest among young people.

At the same time, it is expedient to expand the internationalization of free economic activities at the expense of foreign students. However, this requires a number of preconditions that are difficult to address due to the unfavorable situation in the domestic labor market for potential migration of foreigners with higher education obtained in Ukraine, since foreign nationals mostly consider education as one of the channels for potential migration. In this regard, it seems necessary to shift the priorities of universities from educational to scientific activities in order to increase funding through access to interna-

tional grant support for promising research of Ukrainian scientists and involve them in international collaboration with scientists from leading universities. All this will allow justifying the need to ensure the internationalization of education and increase the level of international rankings for evaluating the performance of universities by improving quality indicators such as the citation rate of university staff in order to ensure the optimal financial stabilization in the short and medium term. Ensuring the improvement of these indicators will provide for significant improvement in the international competitiveness of a university, enhancing its investment attractiveness and increasing cash flow from international activities, in particular by expanding educational and research projects funded by various international sources, as well as creating the grounds for the development of educational and scientific alliances between Ukrainian and foreign universities.

---

## CONCLUSION

Short-term (for 3 years) and medium-term (for 5 years) modelling of general and special fund financing was carried out in order to implement an approach to stabilize the negative trend of “average” funding of the University.

According to the results, the amount of funding at which the trend will stabilize was established. The simulation results demonstrated the need to significantly increase funding for public higher education institutions to mitigate the effects of various crises, in particular, the effects of the global COVID-19 pandemic. It is necessary to introduce financial autonomy of the Ukrainian university to expand the financial powers of the university and strengthen the results of the use of budget funds, which will allow optimizing its organizational structure and applying hybrid financing models. This approach is constructive both to ensure financial stabilization in the short term through the manifestations of the global pandemic and for the development of new forms of funding for expanding the number of educational and research projects funded from various international sources, especially educational and research alliances with foreign universities.

Regression analysis showed that for the university management, in an attempt to ensure financial stabilization, accounting and forecasting of funds must be carried out only in dollar terms, and a non-linear development of the situation should be assumed. Then the fragility of factors such as the percentage of total budget on higher education and the amount of training units, most likely, will heavily affect the funds of the TSNUK and in a multiplicative volume.

One of the results of received models highlighted the possibility to reject the typical assumption of the university management in Ukraine that funding is mostly the same as in the previous year and is growing linearly. The reality is that funding is highly cyclical and polynomial, so a wavy trace is expected for this trend line.

## AUTHOR CONTRIBUTIONS

Conceptualization: Yulia Petlenko, Olena Kapustian.

Data curation: Olena Kapustian, Yulia Petlenko, Anton Ryzhov.

Formal analysis: Olena Kapustian, Yulia Petlenko, Anton Ryzhov, Ganna Kharlamova.

Funding acquisition: Yulia Petlenko.

Investigation: Olena Kapustian, Yulia Petlenko, Anton Ryzhov, Ganna Kharlamova.

Methodology: Yulia Petlenko, Olena Kapustian, Anton Ryzhov.

Project administration: Yulia Petlenko.

Resources: Anton Ryzhov.

Software: Anton Ryzhov.

Supervision: Olena Kapustian, Yulia Petlenko, Ganna Kharlamova.

Validation: Olena Kapustian, Yulia Petlenko.

Visualization: Olena Kapustian, Anton Ryzhov.

Writing – original draft: Yulia Petlenko, Olena Kapustian, Anton Ryzhov.

Writing – review & editing: Yulia Petlenko, Olena Kapustian, Ganna Kharlamova.

## ACKNOWLEDGMENT

The study is carried out under the grant funded from the National Research Fund of Ukraine within the competition Science for Human Security and Society, topic 2020.01/0265.

## REFERENCES

1. Adamenko, I. (2019). Financial stabilization in economic transformations. *University Economic Bulletin*, 43, 126-133. <https://doi.org/10.31470/2306-546X-2019-43-126-133>
2. Adams, W. (1977). Economic Problems Confronting Higher Education: Financing Public. *The American Economic Review*, 67(1). Retrieved from: <https://www.jstor.org/stable/i331493>
3. Alferov, V. (2014). Antikrizisnyye mekhanizmy finansovoy stabilizatsii i razvitiya organizatsii [Anti-crisis mechanisms of financial stabilization and development of the organization]. *Strategicheskkiye resheniya i risk-menedzhment – Strategic decisions and risk management*. (In Russian). <https://doi.org/10.17747/2078-8886-2011-6-78-83>
4. Bilinets, M. Yu., Bilinets, M. Yu., Buryachenko, A. E., Buryachenko, A. E., Paentko, T. V., & Paentko, T. V. (2021). *Financing higher education in Ukraine in the XXI century: challenges and prospects for overcoming them*. <https://doi.org/10.33763/finukr2021.02.098>
5. Bloom, D. E., & Canning, D. (2004). Epidemics and economics: Interactions between global change and human health. *Scripta Varia*, 106, 304-331.
6. Cavallo, E., Galiani, S., Noy, I., & Pantano, J. (2013). Catastrophic natural disasters and economic growth. *Review of Economics and Statistics*, 95(5), 1549-1561. [https://doi.org/10.1162/REST\\_a\\_00413](https://doi.org/10.1162/REST_a_00413)
7. Cernostana, Z. (2018). Measuring financial sustainability of private higher education institutions. *Engineering for Rural Development*, 1173-1178.
8. Das, P. (2019). *Econometrics in Theory and Practice* (574 p.). Springer.
9. Davoodi, H. R., Tiongson, E. R., & Asawanuchit, S. S. (2003). *How useful are benefit incidence analyses of public education and health spending?* (IMF Working Paper WP/03/227). Washington, DC: International Monetary Fund. Retrieved from <http://www.imf.org/external/pubs/ft/wp/2003/wp03227.pdf>
10. Donald, J. M. (1980). Financial reform and stabilization policy in a developing economy. *Journal of Development Economics*, 7(3), 359-395. [https://doi.org/10.1016/0304-3878\(80\)90017-6](https://doi.org/10.1016/0304-3878(80)90017-6)
11. Drayton, E., & Waltmann, B. (2020). *Will universities need a bailout to survive the COVID-19 crisis?* The Institute for Fiscal Studies.
12. Estermann, T., & Bennetot Pruvot, E. (2011). *Financially Sustainable Universities II. European Universities Diversifying Income Streams*. Brussels: European University Association. Retrieved from <https://eua.eu/downloads/publications/financially%20sustainable%20universities%20ii%20%20european%20universities%20diversifying%20income%20streams.pdf>
13. Geiger, R. (2010). *Impact of the financial crisis on higher education in the United States*. International Higher Education.
14. Giofré, M. (2017). Financial education, investor protection and international portfolio diversification. *Journal of International*

- Money and Finance*, 71, 111-139. <https://doi.org/10.1016/j.jimonfin.2016.11.004>
15. Grossi, G., Dobija, D., & Strzelczyk, W. (2019). The Impact of Competing Institutional Pressures and Logics on the Use of Performance Measurement in Hybrid Universities. *Public Performance & Management Review*. <https://doi.org/10.1080/15309576.2019.1684328>
  16. Hamilton, J. D. (2020). *Time series analysis*. Princeton University Press.
  17. Ignatyuk, A., Dikiy, A., Shevtsiv, L., Petlenko, Y., Klymash, N., & Zaitsev, O. (2021). Determination of the Company's Value under the Influence of Various Factors. *Journal of Optimization in Industrial Engineering, Special issue*, 127-133. <https://doi.org/10.22094/joie.2020.677841>
  18. Keegan, D. (1996). *Foundations of Distance Education* (3rd ed.). Routledge. <https://doi.org/10.4324/9781315004822>
  19. Kohtamäki, V. (2009). *Financial Autonomy in Higher Education Institutions – Perspectives of Senior Management of Finnish AMK Institutions*. Tampere: Tampere University Press.
  20. Kovalenko, Y., & Popovych, L. (2018). Financing of higher education institutions: problems and directions of improvement in Ukraine. *Problems and Prospects of Economics and Management*, 1(13), 150-159. [http://dx.doi.org/10.25140/2411-5215-2018-1\(13\)-150-159](http://dx.doi.org/10.25140/2411-5215-2018-1(13)-150-159)
  21. Kretovics, M. A., & Steve, O. M. (2005). Financing Higher Education in a Global Market. *Algora*, 314.
  22. Leshanych, L., Miahkykh, I., & Shkoda, M. (2018). Models Of Financing Of Higher Education Institutions In Foreign Countries. *Baltic Journal of Economic Studies*, 4(5), 145-150. Retrieved from <https://ideas.repec.org/a/bal/journal/2256-074220184523.html>
  23. Maassen, P. (2000). Models of Financing Higher Education in Europe, *Center for Higher Education Policy Studies (CHEPS) University of Twente*. Retrieved from [https://www.stjornarradid.is/media/menntamalaraduneyti-media-media/mrn-pdf\\_annad/radstfarm-modelsoffinancinghigher.pdf](https://www.stjornarradid.is/media/menntamalaraduneyti-media-media/mrn-pdf_annad/radstfarm-modelsoffinancinghigher.pdf)
  24. Martínez-Campillo, A., & Fernández-Santos, Y. (2020). The impact of the economic crisis on the (in)efficiency of public Higher Education institutions in Southern Europe: The case of Spanish universities. *Socio-Economic Planning Sciences*, 71, 100771. <https://doi.org/10.1016/j.seps.2019.100771>
  25. Ministry of Education and Science of Ukraine. (n.d.). *Stratehiia rozvytku vyshchoi osvity v Ukraini na 2021–2031 roky [Strategy for the development of higher education in Ukraine for 2021–2031]*. (In Ukrainian). Retrieved from <https://mon.gov.ua/storage/app/media/rizne/2020/09/25/rozvitku-vishchoi-osviti-v-ukraini-02-10-2020.pdf>.
  26. Nakonechnyi, O., Pashko, A., Kapustian, O., Zinko, T. & Shevchuk, I. (2019). *Proceedings of the 2019 IEEE International Conference on Advanced Trends in Information Theory (ATIT-2019)*. Kyiv, Ukraine. Retrieved from <http://toc.proceedings.com/53329webtoc.pdf>
  27. Onuoha, L. (2013). Financing Higher Education in Nigeria: The Role of Internally Generated Revenues and How University Managements Can Maximize the Sources. *Canadian Social Science*, 9(1), 9-14. <http://dx.doi.org/10.3968/jcss.1923669720130901.1956>
  28. Patel, K., & Assaf, F. (2013). *Improving Financial Stability for Community College Students*. John F. Kennedy School of Government.
  29. Petlenko Yu., Pohribna N., & Biliavska O. (2021). The new approach to budgeting in modern universities. *The Scientific Heritage*, 3(66), 3-6. <https://doi.org/10.24412/9215-0365-2021-66-3-3-6>
  30. Petlenko, Y., Stavytskyy, A., & Kharlamova, G. (2021). Is the endowment fund a panacea for the financial autonomy of classical universities in Ukraine? *Problems and Perspectives in Management*, 19(3), 396-407. [https://doi.org/10.21511/ppm.19\(3\).2021.32](https://doi.org/10.21511/ppm.19(3).2021.32)
  31. Publications Office of the European Union. (n.d.). *The impact of COVID-19 on higher education. A review of emerging evidence: analytical report*. Retrieved from <https://op.europa.eu/s/uxbx>
  32. Ryzhov, A. Y. (2006). A test of the hypothesis about the homogeneity of components of a mixture with varying concentrations by using censored data. *Theory of Probability and Mathematical Statistics*, 72, 145-155. <https://doi.org/10.1090/S0094-9000-06-00672-7>
  33. Schinasi, G. J. (2004). *Defining Financial Stability* (IMF Working Papers, 2004(187), A001). Retrieved from <https://www.elibrary.imf.org/view/journals/001/2004/187/article-A001-en.xml>
  34. Slovo i Dilo. Analytical Portal. (n.d.). *Education financing: how much the state spends on Ukrainian universities*. (In Ukrainian). Retrieved from <https://www.slovoidilo.ua/2021/07/05/infografika/suspilstvo/finansuvannya-osvity-skilky-derzhava-vytrachaye-ukrayinski-universytety>
  35. Smalley, A. (2021). *Higher Education Responses to Coronavirus (COVID-19)*. Retrieved from <https://www.ncsl.org/research/education/higher-education-responses-to-coronavirus-covid-19.aspx>
  36. Stachowiak-Kudła, M., & Kudła, J. (2017). *Financial regulations and the diversification of funding sources in higher education institutions: selected European experiences*. <https://doi.org/10.1080/03075079.2015.1119109>
  37. Stein, M., Braun, W., Villà, M. S., & Binding, V. (2014). Monte Carlo Cash Flows and Sustainability: How to Decide on Going Green. *The Journal of Sustainable Real Estate*, 6(1), 143-162. Retrieved from <http://www.jstor.org/stable/24846697>
  38. Taras Shevchenko National University of Kyiv. (2012). *Zvit rektora Kyivskoho natsionalnoho universytetu imeni Tarasa Shevchenka*

- Guberskogo L. V. *pro robotu z hrudnia 2011 roku po hruden 2012 roku ta zavdannia na nastupnyi rik* [Report of the Rector of the Taras Shevchenko National University of Kyiv L. V. Gubersky on the work from December 2011 to December 2012 and tasks for the next year]. Kyiv: TSNUK. (In Ukrainian).
39. Taras Shevchenko National University of Kyiv. (2013). *Zvit rektora Kyivskoho natsionalnoho universytetu imeni Tarasa Shevchenka Guberskogo L. V. pro robotu z hrudnia 2012 roku po hruden 2013 roku ta zavdannia na nastupnyi rik* [Report of the Rector of the Taras Shevchenko National University of Kyiv L. V. Gubersky on the work from December 2012 to December 2013 and tasks for the next year]. (In Ukrainian). Retrieved from <http://univ.kiev.ua/pdfs/Zvit2013.pdf?fbclid=IwAR0d7kpUxrNv2jis94KpJ2xfUmmKO0WpsSYzPytQ1iaAJMaln5q8tietQfM>
40. Taras Shevchenko National University of Kyiv. (2014). *Zvit rektora Kyivskoho natsionalnoho universytetu imeni Tarasa Shevchenka Guberskogo L. V. [Report of the Rector of the Taras Shevchenko National University of Kyiv L. V. Gubersky]*. (In Ukrainian). Retrieved from [http://www.library.univ.kiev.ua/ukr/elcat/new/detail.php3?doc\\_id=1611910](http://www.library.univ.kiev.ua/ukr/elcat/new/detail.php3?doc_id=1611910)
41. Taras Shevchenko National University of Kyiv. (2015). *Zvit rektora Kyivskoho natsionalnoho universytetu imeni Tarasa Shevchenka Guberskogo L. V. [Report of the Rector of the Taras Shevchenko National University of Kyiv L. V. Gubersky]*. (In Ukrainian). Retrieved from [http://www.library.univ.kiev.ua/ukr/elcat/new/detail.php3?doc\\_id=1681128&title=%C7%E2%B3%F2+%F0%E5%EA%F2%EE%F0%E0&div=0&source=1&prev=0&page=0&docType=24&docType1=8&docType2=17&docType3=13&docType4=14&docType5=15&docType6=26&docType7=18&docType8=19&docType9=25&parentId=0](http://www.library.univ.kiev.ua/ukr/elcat/new/detail.php3?doc_id=1681128&title=%C7%E2%B3%F2+%F0%E5%EA%F2%EE%F0%E0&div=0&source=1&prev=0&page=0&docType=24&docType1=8&docType2=17&docType3=13&docType4=14&docType5=15&docType6=26&docType7=18&docType8=19&docType9=25&parentId=0)
42. Taras Shevchenko National University of Kyiv. (2016). *Zvit rektora Kyivskoho natsionalnoho universytetu imeni Tarasa Shevchenka Guberskogo L. V. [Report of the Rector of the Taras Shevchenko National University of Kyiv L. V. Gubersky]*. (In Ukrainian). Retrieved from <http://www.univ.kiev.ua/pdfs/zvit/zvit-rektora-2016.pdf>
43. Taras Shevchenko National University of Kyiv. (2017). *Zvit rektora Kyivskoho natsionalnoho universytetu imeni Tarasa Shevchenka Guberskogo L. V. [Report of the Rector of the Taras Shevchenko National University of Kyiv L. V. Gubersky]*. (In Ukrainian). Retrieved from <http://www.univ.kiev.ua/pdfs/zvit/zvit-rektora-2017.pdf>
44. Taras Shevchenko National University of Kyiv. (2018). *Zvit rektora Kyivskoho natsionalnoho universytetu imeni Tarasa Shevchenka Guberskogo L. V. [Report of the Rector of the Taras Shevchenko National University of Kyiv L. V. Gubersky]*. (In Ukrainian). Retrieved from <http://www.univ.kiev.ua/pdfs/zvit/zvit-rektora-2018.pdf>
45. Taras Shevchenko National University of Kyiv. (2019). *Zvit rektora Kyivskoho natsionalnoho universytetu imeni Tarasa Shevchenka Guberskogo L. V. [Report of the Rector of the Taras Shevchenko National University of Kyiv L. V. Gubersky]*. (In Ukrainian). Retrieved from <http://www.univ.kiev.ua/pdfs/zvit/zvit-rektora-2019.pdf>
46. Treve, M. (2021). *What COVID-19 has introduced into education: challenges Facing Higher Education Institutions (HEIs)*. <https://doi.org/10.1080/23752696.2021.1951616>
47. Woods, M. (2008). The Theory, History and Practice of Resource allocation Models in UK Universities. *The Journal of Finance and Management in Colleges and Universities*, 5, 139-155.
48. Yang, L., Brotherhood, T., & Chankseliani, M. (2021). A crisis of opportunity at English universities: Rethinking higher education through the common good idea. *Educational Review*, 1-18. <https://doi.org/10.1080/00131911.2021.1965961>