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Educational dominant of the information economy development: a case of Latvia for Ukraine

Abstract

Introduction. In recent years, digitalization is one of the defining trends of the development in the leading countries of the world. The development of information economy is influenced by a combination of factors; however, the most powerful is an educational dominant. The higher education institutions (HEIs) carry out training activities for information economy, the development of digital skills of the personnel, as well as carrying out studies of the personnel's digital skills, and conducting research, generating innovations and their transfer to the real sector of economy. *The purpose of the paper* is to analyze the impact of higher education on the dynamics of information economy on the example of Latvia with further identification of the best practices and their adaptation to the Ukrainian social and economic conditions. The research *methodology* is conditioned by the implementation of the in-depth comparative analysis of the development of higher education systems in Latvia and Ukraine; within the study, were used the method of constructing cubic regression models of the relationship between indicators.

The hypothesis:

- 1) there is an objective interaction between the level of economic development of the country and the amount of public funding for higher education;
- 2) the information economy development is largely determined by the level of higher education development, and funding for research at HEIs.

Results. The study revealed the following constraints on the development of the national higher education system: complex geopolitical, demographic, migration situation, which affects the parameters of the student body of HEIs; low competitiveness level of HEIs in the global educational services market; low level of financial autonomy of HEIs; lack of financing, low level of diversification of the financing sources for HEIs, etc. These problems negatively affect the pace of the information economy development in Ukraine. The authors proved that the Latvian experience in the implementation of the digitalization strategy could be useful for Ukraine, because of some similar economic, social, mental, historic conditions and factors of development of both countries. The calculations on the econometric models of relationship between funding and basic indicators of higher education development in Ukraine and Latvia showed: the amount of funding for higher education systems does not depend on the number of HEIs; the number of students depends on the amount of public funding (this indicates the important role of the state in the higher education development, in increasing the level of accessibility of higher education for citizens); close relationship between the amount of funding for higher education and the number of graduate students; positive trend in funding for higher education.

Conclusions. The authors conclude that strengthening the impact of the educational dominant on the information economy development requires: ensuring a proactive position of HEIs (by modernizing their educational, research and innovation activities); activating the role of the government sector in protection of intellectual property, stimulating the development of innovatively active enterprises and their cooperation with universities, involving investments in the development of the HEIs' innovative infrastructure, commercialization of innovative results of the research in the real sector of the economy.

Keywords: Information Economy; Digitalization; Higher Education; University; Science; National Economy; Innovations; GDP; Latvia; Ukraine

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Освітня домінанта розвитку інформаційної економіки: латвійський кейс для України

Анотація

Вступ. Розвиток цифрової економіки відбувається під впливом сукупності факторів, проте найпотужнішою є освітня домінанта. Зкладами вищої освіти (ЗВО) реалізується діяльність з підготовки кадрів для інформаційної економіки, розвитку цифрових навичок персоналу, а також проведення досліджень, генерації інновацій та їх трансферу у реальний сектор економіки. **Мета статті** – проаналізувати вплив вищої освіти на динаміку інформаційної економіки на прикладі Латвії з подальшою ідентифікацією кращих практик та їх адаптацією до українських соціально-економічних умов. **Методологія** дослідження обумовлюється реалізацією глибокого компаративного аналізу розвитку систем вищої освіти Латвії та України; у ході дослідження використано метод побудови кубічних регресійних моделей взаємозв'язку між показниками. **Гіпотези:**

1) існує об'єктивний взаємовплив між рівнем розвитку економіки країни та обсягами державного фінансування вищої освіти;

2) розвиток інформаційної економіки у значній мірі детермінується рівнем розвитку вищої освіти в країні, фінансуванням проведення наукових досліджень у ЗВО.

Результати. Авторами доведено, що латвійський досвід реалізації стратегії діджиталізації може бути корисним для України з огляду на наявність у обох країн низки схожих економічних, соціальних, ментальних, історичних умов та чинників розвитку. Розрахунки по економетричним моделям залежності між обсягом фінансування та базовими показниками розвитку вищої освіти в Україні та Латвії показали: обсяг фінансування систем вищої освіти не залежить від кількості ЗВО; кількість студентів

залежить від обсягу державного фінансування (це свідчить про важливу роль держави у розвитку вищої освіти, підвищенні рівня доступності для громадян навчання в ЗВО); наявність тісного зв'язку між обсягами фінансування вищої освіти та кількістю аспірантів; позитивна тенденція у фінансуванні вищої освіти. Автори доходять *висновку*, що посилення впливу освітньої домінанти на розвиток інформаційної економіки потребує забезпечення проактивної позиції ЗВО (шляхом модернізації їх освітньої, науково-дослідної й інноваційної діяльності); активізації ролі державного сектору у захисті прав інтелектуальної власності, стимулюванні розвитку інноваційно активних підприємств та їх співпраці з університетами, залученні інвестицій у розвиток інноваційної інфраструктури ЗВО, комерціалізації інноваційних результатів досліджень в реальному секторі економіки.

Ключові слова: інформаційна економіка; діджиталізація; вища освіта; університет; наука; національна економіка; інновації.

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**Образовательная доминанта развития информационной экономики:
латвийский кейс для Украины**

Аннотация

Введение. Развитие цифровой экономики происходит под влиянием совокупности факторов, однако самой мощной является образовательная доминанта. Высшими учебными заведениями (вуз) реализуется деятельность по подготовке кадров для информационной экономики, развитию цифровых навыков персонала, а также проведению исследований, генерации инноваций и их трансфера в реальный сектор экономики. *Цель статьи* – проанализировать влияние высшего образования на динамику информационной экономики на примере Латвии с последующей идентификацией лучших практик и их адаптацией к украинским социально-экономическим условиям. *Методология* исследования определяется реализацией глубокого сравнительного анализа развития систем высшего образования Латвии и Украины; в ходе исследования использован метод построения кубических регрессионных моделей взаимосвязи между показателями. *Гипотезы:*

1) существует объективное взаимовлияние между уровнем развития экономики страны и объемами государственного финансирования высшего образования;

2) развитие информационной экономики в значительной степени детерминировано уровнем развития высшего образования в стране, финансированием проведения научных исследований в вузах.

Результаты. Авторами доказано, что латвийский опыт реализации стратегии диджитализации может быть полезным для Украины, учитывая наличие у обеих стран ряда схожих экономических, социальных, ментальных, исторических условий и факторов развития. Расчеты по эконометрическим моделям зависимости между объемом финансирования и базовыми показателями развития высшего образования в Украине и Латвии показали: объем финансирования системы высшего образования не зависит от количества вузов; количество студентов зависит от объема государственного финансирования (это свидетельствует о важной роли государства в развитии высшего образования, повышении уровня доступности для граждан обучения в вузах); наличие тесной связи между объемами финансирования высшего образования и количеством аспирантов; положительная тенденция финансировании высшего образования. Авторы приходят к *выводу*, что усиление влияния образовательной доминанты на развитие информационной экономики требует обеспечения проактивной позиции вузов (модернизации их образовательной, научно-исследовательской и инновационной деятельности); активизации роли государственного сектора в защите интеллектуальной собственности, стимулировании развития инновационно активных предприятий и их сотрудничества с университетами, привлечении инвестиций в развитие инновационной инфраструктуры вузов, коммерциализации инновационных результатов исследований в реальном секторе экономики.

Ключевые слова: информационная экономика; диджитализация; высшее образование; университет; наука; национальная экономика; инновации.

1. Introduction

The development of information society in the XXI century occurs in the direction of the total digitalization of social and economic processes. The EU countries have timely recognized the decisive transformational impact of information and communication technologies on the development of all spheres of economic activity. In 2010, the European Parliament adopted the Digital Agenda for Europe. In the framework of this document, 8 priority areas of the EU digitalization were identified. Education and science are prominent among them (para. 2.5 «Research and innovation» and para. 2.6 «Enhancing digital literacy, skills and inclusion»). In Digital Agenda for Europe, the responsibility of the countries-the EU member-states for solving the problem of underdevelopment of digital skills of citizens till 2020 is attributed.

The implementation of the Digital Agenda for Europe is currently at its initial stage; however, some results of its implementation can already be assessed (Giesenbauer et al., 2020; Klochkova et al., 2020; Kulik et al., 2020). The Republic of Latvia, as a member of the EU, is also a co-executor of this document. Almost 99% of Latvian enterprises actively use computers and information and communication technologies in their activity; 96% of big companies and 82.5% of medium-sized companies have their own websites. The educational process at educational institutions and universities is actively digitalized, modern information and communication technologies are introduced, the practice of using distance, online courses is expanding (Polishchuk et al., 2019; Degtyarova et al., 2018; Radionova et al., 2013; Marhasova et al., 2020; Popelo et al., 2021). Finally, it brings the expected results: there is an increase in the development level of digital literacy and digital skills of young people (Ershova et al., 2019; Grinberga-Zalite et al., 2019). The above has a positive effect, firstly, on the competitiveness of graduates of higher educational institutions in labor markets; secondly, it satisfies business demand for ICT specialists (20% of all entrepreneurs in Latvia and the EU-28 hired ICT specialists) (Lezhebokov et al., 2020; Liao et al., 2019).

According to the official Eurostat statistics, 24% of the Latvians have digital skills above the basic level. In the total number of employees in the country, 4.15% were workers in the field of information and communication technologies (ICT); 3.97% - ICT services; 0.18% - ICT manufacturing. The systematized parameters of employment of ICT specialists in Latvia in comparison with the EU average are presented in Table 1.

Latvia is characterized by growing employment trends of ICT specialists, including those with higher education. It is worth noting that Latvian employers are paying more and more attention to the development of ICT skills of their employees: in 2020, 17% of all enterprises in the country trained staff to develop their ICT skills (in 2018 - 11%). According to official statistics, in 2020, only 2% of enterprises had difficulties by filling vacancies requiring ICT skills (mean value in the EU - 5% in 2020). The analysis of trends in the digitalization of the Latvian economy has shown their consistency with the European trends. That is why, the experience of Latvia is valuable for

Table 1:
Employment of ICT specialists

Parameter	Employed ICT specialists, thous. people		% of the employed ICT specialists in the total number of employees		Employed ICT specialists by educational attainment level – tertiary education, thous. people		Employed ICT specialists by educational attainment level – tertiary education, %	
	EU-27	Latvia	EU-27	Latvia	EU-27	Latvia	EU-27	Latvia
2005	6054.1	29.2	3.3	3.0	2926.1	11.1	47.6	37.1
2006	6368.2	27.4	3.4	2.7	3150.5	9.2	48.4	32.6
2007	6559.4	28.0	3.4	2.6	3220.1	12.2	48.3	42.3
2008	6727.8	29.0	3.5	2.8	3311.1	13.8	48.5	45.8
2009	6739.6	24.5	3.6	2.7	3477.8	12.5	50.8	49.3
2010	6767.0	23.6	3.6	2.8	3541.9	12.6	51.6	52.1
2011	5620.5	21.9	3.0	2.5	3090.6	13.3	54.8	59.8
2012	5913.8	19.6	3.2	2.2	3255.7	11.8	55.1	59.4
2013	6119.3	21.8	3.3	2.4	3443.3	13.2	56.3	60.0
2014	6302.5	22.5	3.4	2.5	3681.2	13.0	58.4	56.1
2015	6540.6	24.7	3.5	2.8	3902.1	15.8	59.7	62.4
2016	6908.3	24.6	3.6	2.8	4174.7	16.9	60.4	68.3
2017	7173.4	25.3	3.7	2.8	4431.8	16.8	61.8	66.2
2018	7570.3	23.5	3.8	2.6	4713.4	14.3	62.3	60.7
2019	7846.2	28.6	3.9	3.1	4981.5	17.8	63.5	62.1
2020	8431.3	33.0	4.3	3.7	5372.5	21.9	63.7	66.5

Source: Compiled by authors according to the data of the Statistics Service of the European Union (<https://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do>)

countries that are currently trying to join the global digitalization process, introducing innovative technologies in all spheres of society's activities. Ukraine is one of such countries.

The existing statistical base in Ukraine does not allow to fully access the trends of the economy digitalization. As Ukraine is not a member of the European Union, the data for the country are not available on Eurostat. However, the results of the study of existing statistical indicators allow us to state that in Ukraine, the information economy is only at the formation stage. Accordingly, the need to find acceptable strategies for digitalization of the national economy tested in practice is actualized.

Latvia's experience for Ukraine may be acceptable, first of all, as both countries are characterized by quite similar economic, historical, mental and cultural features (common past, similarity of the citizens' mentality, similar development trends of national economies). However, along with this, there is a difference in the pace, intensity, effectiveness of digitalization.

While in Ukraine only in 2020 the program «Country in a smartphone» (e-government) is announced, in Latvia since 2017 almost 70% of the population uses the Internet to communicate and receive information from government officials. As of 2018, according to the State Statistics Service, 95.5% of the enterprises in Ukraine used computers (99,8% - in Latvia). However, only 32.8% of the average number of employees of the Ukrainian enterprises used computers; of this number, only 82.6% of employees had access to the Internet. More than 10.000 enterprises had ICT specialists and 3082 enterprises hired ICT specialists. Problematic for Ukraine are the issues of staff training in the field of information and communication technologies, in particular: only 1804 enterprises organized appropriate courses for their employees; 2025 companies conducted training for other employees; higher activity in this aspect is observed among small enterprises (with average number of employees less 50 persons). Information economy of Ukraine is in its infancy and needs highly qualified ICT specialists. This, in turn, leads to a number of challenges to higher education as a system of training and retraining the staff.

The authors' team of this article is presented by scientists of Latvia and Ukraine. The analysis of the official data of the Latvian Statistics Bureau and Eurostat, the State Statistics Service of Ukraine allows us to state that Latvia's experience in the field of the education development, support for the development of new technologies, digitalization of all spheres of society deserves attention, given the presence of significant achievements, and, in part, taking into consideration national characteristics, that can be borrowed for the higher education development in Ukraine.

2. Brief Literature Review

Problems of the information economy development are covered by a number of scientists, and among them, it is appropriate to identify the founders of the information society concept, namely Bell D. (1973), the founders of the information economy theory, in particular: Castells M. (1999), Masuda Y. (1983) and Porat M. (1977). The analysis of modern research of information economy shows that many scientists define it as a global trend of economic development, without which the existence of society is impossible today (Vertakova et al., 2013; Woźnicki, 2013; Wu et al., 2009; Zalite et al., 2020). The ability to generate knowledge and innovation makes it possible to increase the competitiveness of both the country and its regions, which, in turn, determines the pace of their social and economic development. In this direction, the need to determine levels of the information economy development and its structural components (educational, research, innovation) and each of them in particular is actualized (Shkarlet et al., 2019; Shalimova et al., 2020; Vorontsova et al., 2019; Zatonatska et al., 2019).

Sannikova A., Dobele A. & Zvirbule-Berzina A. (2015), Vidruska R. (2016), Zvirbule A. & Grinberga-Zalite G. (2017), Popelo O. (2017) devoted their works to the research issues of information economy and its influence on education of the EU countries in general, and Latvia in particular. These researchers determined that the nature of education in economic reality was associated primarily with the transition to knowledge economy, and people's knowledge acquired during the training process becomes a real factor of production, creating high added value.

Despite the availability of scientific developments devoted to the study of information society and information economy, the issues of assessing the impact of education and universities, in particular, on the information economy dynamics remains insufficiently disclosed in the scientific literature.

In our study, we proceed from the hypothesis of the interaction of higher education and information economy. On one hand, information economy creates specific challenges to the higher

education system, causing the transformation of its activities, in particular, such as: dynamization of social and economic processes; knowledge transformation into the productive force and commodity; spread of ICT; creation of the global information field; virtualization of workplaces; problems aggravation of information security and protection of intellectual property rights.

On the other hand, the higher education system and universities play a decisive role in the processes of the creation and development of information economy, as they determine the dynamics of its individual structural components. It is higher education institutions that train a new generation of employees who have digital competencies, are media literate, able to generate innovations and quickly adapt to work with the latest technologies (Cosmulese et al., 2019; Ivashchenko et al., 2017; Shaposhnykova et al., 2018; Vovk et al., 2020). In addition, universities concentrate powerful intellectual capital, enabling them to conduct quality research, scientific discoveries and innovative developments with their subsequent commercialization in the real sector of the national economy (Bekkers et al., 2008; Kholiavko et al., 2020; Shkoda et al., 2020).

3. Research Methodology

The research methodology is conditioned, first of all, by the implementation of the in-depth comparative analysis of the development of higher education systems in Latvia and Ukraine, the search for common and distinctive features of these systems functioning. By conducting the research, the following *hypothesis* were considered:

- 1) there is an objective interaction between the level of economic development of the country and the amount of public funding for higher education;
- 2) the information economy development is largely determined by the level of higher education development in the country, funding for research at higher education institutions and individual research institutions.

The study is based on the comparative analysis use of the higher education development in Latvia and Ukraine, which directly requires the use of statistical and econometric research methods that include, first of all, the index analysis and the traditional correlation-regression method of cognition.

Within the study, we used the method of constructing cubic regression models of the relationship between indicators. The equation of this model can be represented as the following algebraic expression:

$$y = \alpha_0 + \alpha_1 x^3 + \alpha_2 x^2 + \alpha_3 x$$

}

y – value of the dependent variable;

x – value of the independent variable;

$\alpha_0, \alpha_1, \alpha_2, \alpha_3$ – parameters of the model.

The construction of the outlined models of the relationship between economic and social indicators was also accompanied by the verification of these models for adequacy, which was carried out by determining the coefficient of determination (R) and the F-criterion.

4. Results

As noted above, Latvia's experience can be useful for Ukraine, as after the collapse of the Soviet Union, the initial conditions for the development of each country were quite similar. Each of the outlined countries faced a significant number of similar economic, social and mental problems. Some of these problems remain identical and relevant today. In [Figure 1](#), statistical information on common trends in social development and the development of educational system in Latvia and Ukraine is presented.

Therefore, the analysis of [Figure 1](#) allows us to state that during the last ten years both in Latvia and in Ukraine there is a tendency to decrease the population, which negatively affects the development of higher education systems in both countries.

In connection with this trend, we observe a similar trend of decreasing the number of students and postgraduate students in each of the countries; gradually, although at different rates, the number of educational institutions of the III-IV accreditation levels is decreasing.

Thus, it is possible to determine the existence of some common features in the higher education development of the mentioned above countries. However, conducting a more detailed comparative analysis of the higher education development in these countries, using not only absolute indicators, but also relative indices, allows us to determine in more detail the basic

differences between the higher education development in Latvia and Ukraine. Relative information is submitted in Figure 2.

It is logic that the higher education development in the country depends on the development of the national economy, which determines the state's ability to provide sufficient funding for higher education institutions, to finance the development and implementation of new innovations and information technologies.

In general, the trend of GDP change in Latvia and Ukraine indicates the unstable state of growth, which is accompanied by recessions and declining economic activity. This tendency is similar among the countries.

However, the calculation of GDP per capita shows the difference between economic development of the countries and their ability to finance higher education. If at the end of 2020, the GDP per capita in Latvia was 15.44 thous. euros, then in Ukraine - only 3.46 thous. euros. This once

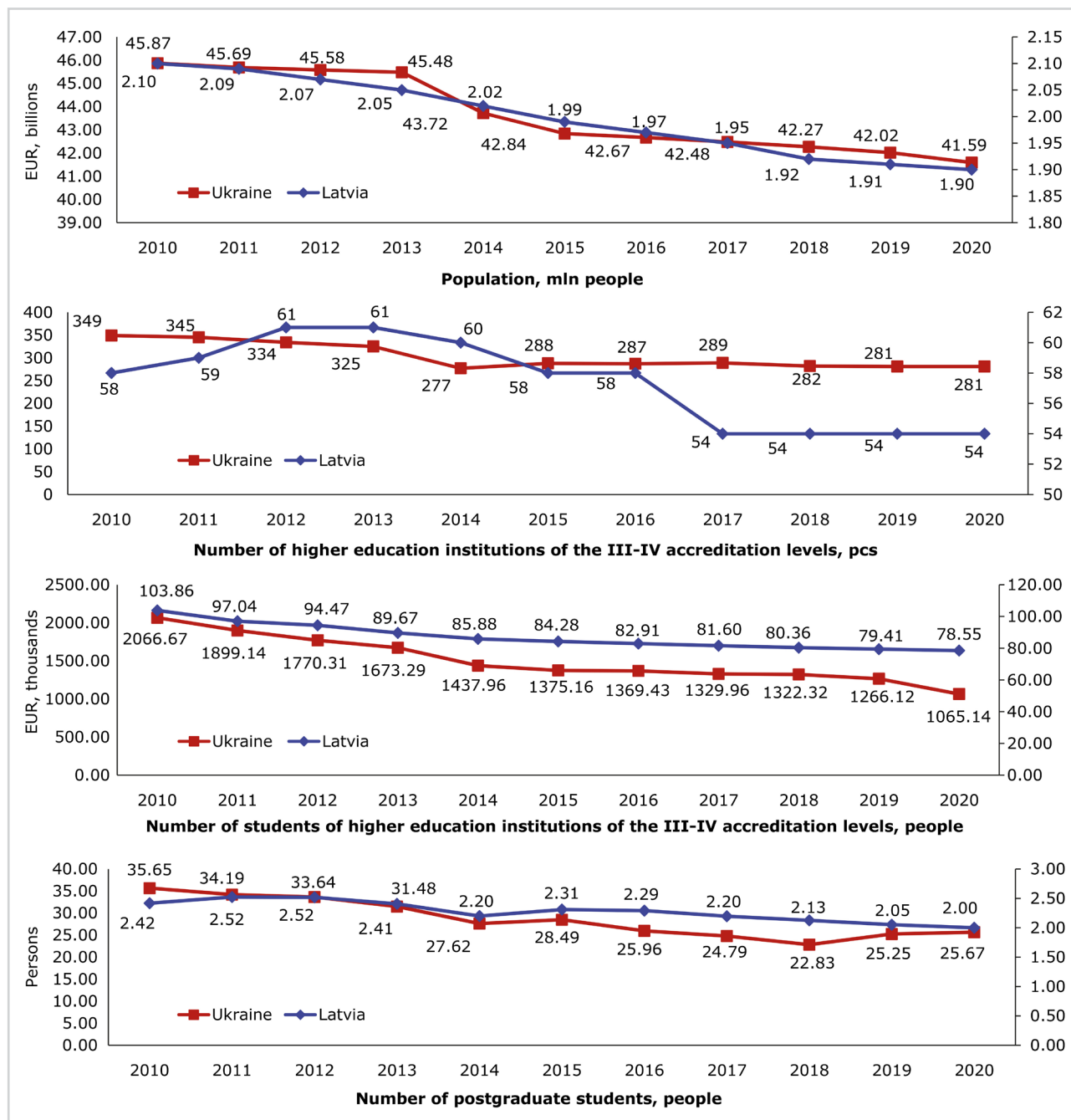


Figure 1:

Dynamics of the indicators of the higher education development in Latvia and Ukraine, 2010-2020

Source: Compiled by authors according to the data of the State Statistics Service of Ukraine

(<http://www.ukrstat.gov.ua>) and Central Statistics Bureau of Latvia (<http://data1.csb.gov.lv/pxweb/en>)

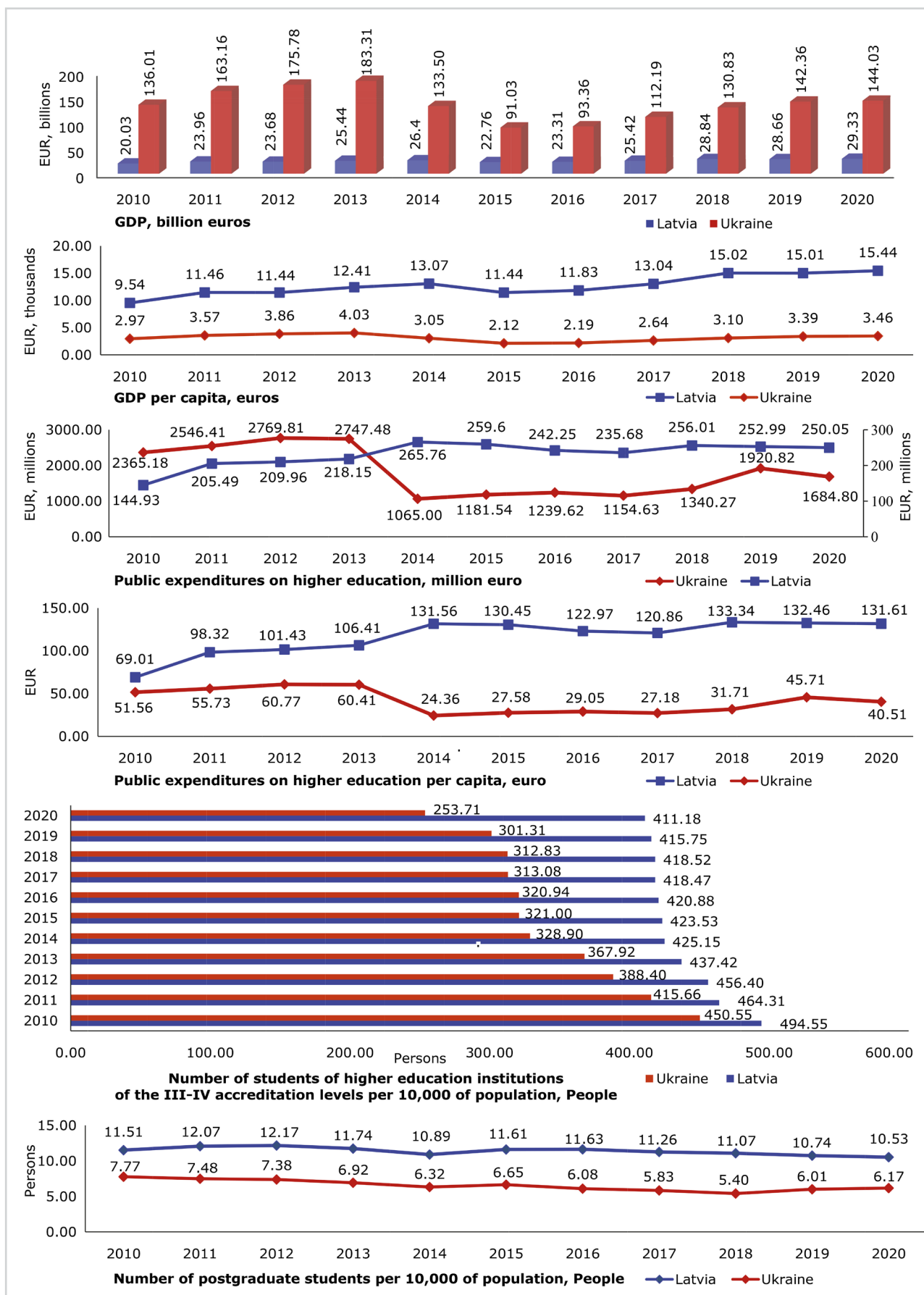


Figure 2:

Analytical information concerning the higher education development in Latvia and Ukraine in 2010-2020

Source: Compiled by authors based on the data of the State Statistics Service of Ukraine

(<http://www.ukrstat.gov.ua>) and the Central Statistics Bureau of Latvia (<http://data1.csb.gov.lv/pxweb/en>)

again confirms that Latvia's experience in reforming the national economy and the social sphere in general is useful for Ukraine.

Available stable long-term economic development allows Latvia to actively finance higher education, to invest in the development of new information technologies that improve the life of society. The data of [Figure 2](#) show that over the last decade in Latvia, the volume of finances for higher education increases. However, in Ukraine this situation is not stable that is due to the periods of economic and political instability. Determining the indicator of public spending on higher education per capita shows that in Latvia in 2020 this figure was three times higher than in Ukraine.

This situation indicates that the higher education system in Ukraine needs more funding to enable it to produce new knowledge, technologies and innovations. It is clear that countries with higher economic development than in Latvia, today invest in higher education even more financial resources, which allows them to ensure a high competitiveness level of the national economies.

In addition, information in [Figure 2](#) shows that the amount of funding for higher education in Latvia allows to attract more students to study, to fund the research of the greater number of postgraduate students. If you look at the statistics, you can see that in Latvia the number of students and postgraduate students per 10.000 of population is an order of magnitude higher than in Ukraine. Naturally, a significant number of students studies at their own expense. However, postgraduates' training takes place in the vast majority of cases at the expense of budget funding. Thus, if in Ukraine in 2020 there were 6 postgraduate students per 10.000 persons, then in Latvia - 11 postgraduate students, which is almost twice as many. It should be noted that this result in Latvia was achieved with a declining population in the country and the total number of postgraduate students in the country. However, the rate of decline in the outlined indicators in Latvia is an order of magnitude lower than in Ukraine.

For example, in Latvia during 2010-2020 the number of postgraduate students decreased from 2.42 to 2.0 thousand persons. During the same period, the number of postgraduate students in Ukraine decreased for 10.000 persons, from 35.65 thousand person to 25.66 thousand persons. In fact, for 11 years the number of postgraduate students in the country decreased for 30.0%, which is a serious indicator of declining science development in the country, reducing the level of innovation and competitiveness of the national economy, and this, in our point of view, which is the most important, decreasing the potential to producing new knowledge, technologies, innovations in long-term perspective, which is important to ensure stable conditions for, above all, intensive economic development in future.

As already mentioned, there is a coevolutionary link between the development of the country's economy and the amount of funding for higher education, the essence of which is that GDP growth in general should increase the amount of funding for higher education, as the state has additional revenues. On the other hand, the intensification of scientific activities, financing of innovative developments and technologies should contribute to the economic development of the country, ensure the competitiveness of goods and services in international markets. Let's analyze how the outlined connection is typical for Latvia and Ukraine. In [Figure 3](#), the relevant information is presented.

Therefore, based on the data in [Figure 3](#) we can see that in 2020 in Latvia, the growth of the country's GDP by 1 euro contributed to the funding increase by 0.009 euros. In Ukraine, these figures are lower (2020 - 0.012 euro). This indicates that in Latvia, economic growth in the country is used to increase funding for higher education creating conditions for further development of the national economy in the long run. It is also worth noting that in Latvia, with the GDP growth in the country, as a rule, the rate of the increase in funding for higher education is always higher.

Accordingly, the financing of higher education has a positive effect of the GDP formation. It is clear that the GDP formation is influenced by a large number of factors. However, it is significant that in Latvia during 2015-2020 there is an increase in the ratio between the financing of higher education and GDP of the country. The provision of this important ratio confirms the rational use of additional financial opportunities that arise in the state in the process of economic growth.

In Ukraine, the situation is somewhat similar, but there is no clear correlation between the growth rate of the higher education funding and the increase in the country's GDP. During 2015-2020, there is a situational change in the GDP indicator per 1 hryvnia of the higher education funding. In general, the data presented in [Figure 3](#) show that for Ukraine the correlation

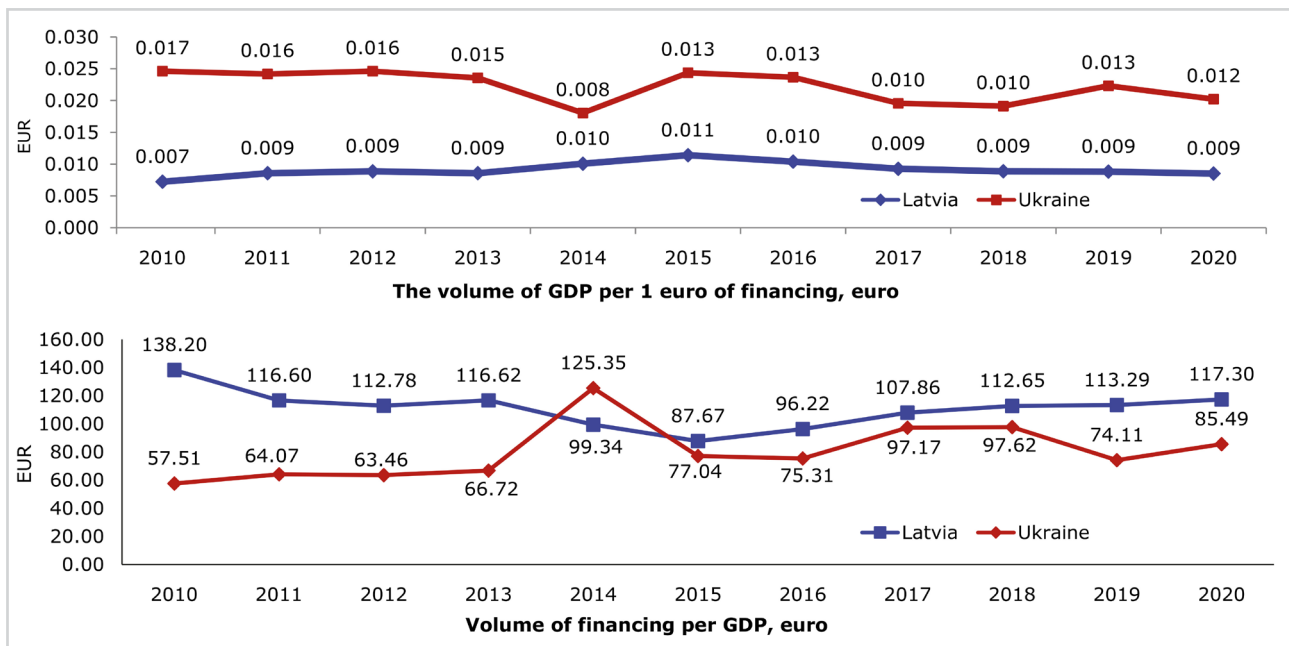


Figure 3:

Correlation of the expenditures for higher education and the GDP volume in Latvia and Ukraine, euros

Source: Compiled by authors based on the data of the State Statistics Service of Ukraine

(<http://www.ukrstat.gov.ua>) and Central Statistics Bureau of Latvia (<http://data1.csb.gov.lv/pxweb/en>)

between the country's GDP and the funding amount for higher education is not constant, in contrast to Latvia. Accordingly, this situation needs to be changed. The outlined conclusions are also confirmed by the results of the correlation-regression modeling of the coevolutionary relationship between the economic development level of the countries and the amounts of funding for their higher education systems. The results of this modeling are presented in Figure 4.

The data presented in Figure 4 give grounds to assert that the econometric models of the relationship between GDP of Latvia and Ukraine and the amounts of financing for higher education in these countries obtained in the process of using the correlation-regression method show a close connection between these indicators. In general, these models are adequate and reflect actual trends in the higher education development of the mentioned countries. In addition, the obtained results confirm the importance of the achieving in the country the state, when under different conditions of economic development, the expenditures for the higher education financing are stable and do not decrease as a result of the declining GDP growth.

It is also important to increase funding for higher education while gaining positive trends in economic development. In this case, the obtained additional economic opportunities should be used rationally and unambiguously directed to the development of education, science, which allows to gradually form a solid foundation of the information economy development.

It is logical that the availability of sufficient funding for the effective development of higher education in the country does not mean that such funding is used rationally, and the country creates the preconditions for its own innovative development. In this case, it is really important to understand the efficiency of spending the available funds, how they are distributed among higher education institutions. That is, the quality of funding for higher education largely depends on the institutional capacity of the state to ensure this quality.

The basic condition for the social and economic development of any country is the availability of higher education for its citizens. In this case, the issues of financing the education of citizens at the expense of the state, providing them with this right, providing financial resources for research within higher education institutions and research institutions become important. In Figure 5, the results of modeling the influence of financing on the individual aspects of the higher education development in Latvia and Ukraine are presented.

Thus, in Figure 5, the econometric models of the relationship between funding and three basic indicators of higher education are presented, namely: a number of higher education institutions, a number of students and postgraduate students. The analysis of the outlined models gives the chance to formulate the following conclusions:

1. The amount of funding for higher education system of Latvia does not depend on the number of higher education institutions ($R = 0.48$; $F = 0.71$). However, a different situation is observed in Ukraine. There is a strong correlation between the number of higher education institutions of the III-IV accreditation levels and the amounts of funding for their activities ($R = 0.93$; $F = 14.05$). This situation indicates the inefficiency of spending public funds, some of which are spent for maintenance of these institutions in Ukraine, rather than on supporting the education of students and postgraduate students. This relationship is confirmed by the analysis of the inverse correlation between the number of higher education institutions and the amount for their funding. For Latvia this relationship is not visible ($R = 0.76$; $F = 3.24$), but for Ukraine it is quite stable ($R = 0.92$; $F = 13.03$).

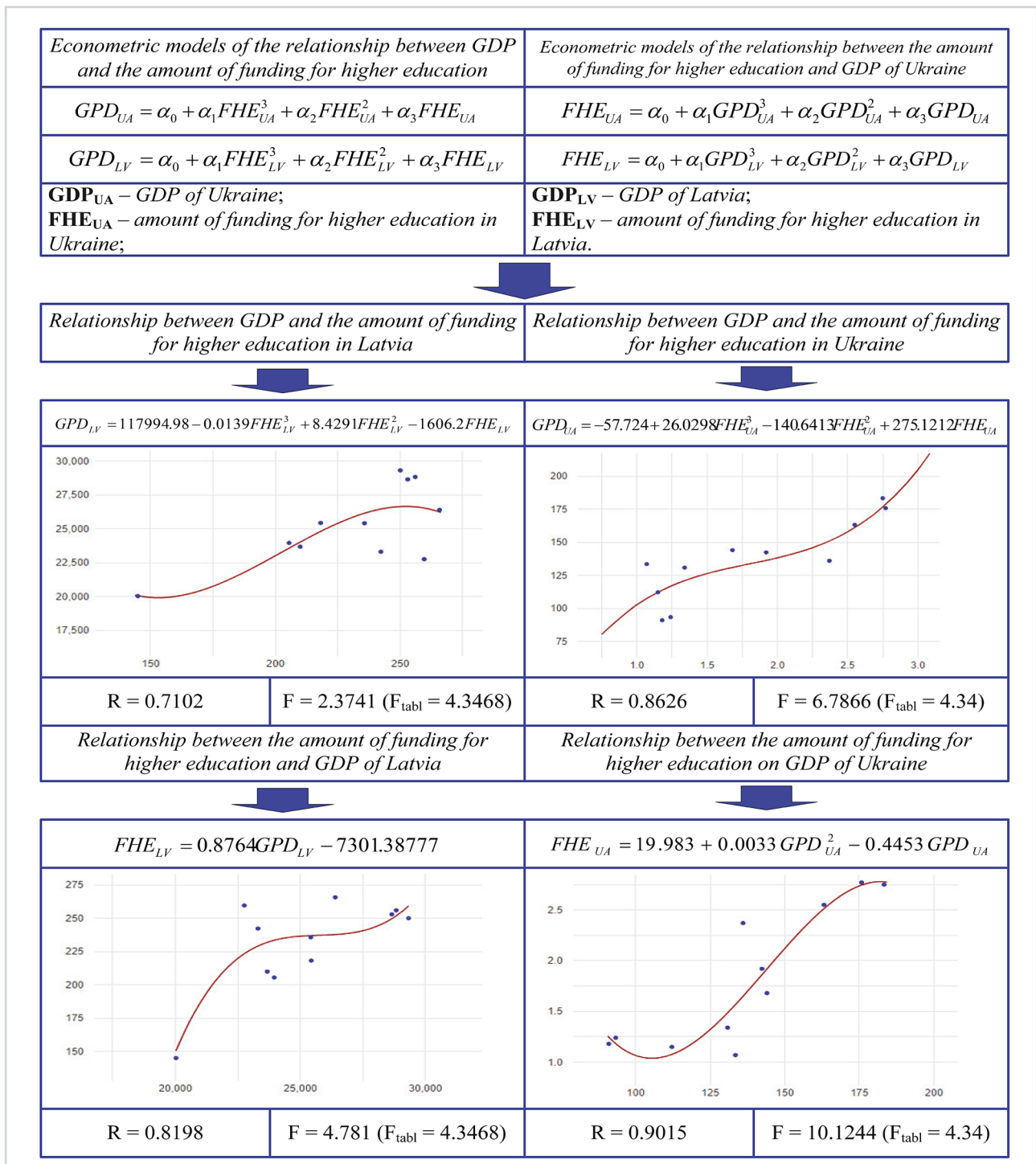


Figure 4:
Modeling of the coevolutionary relationship between GDP and the amounts of funding for higher education in Latvia and Ukraine

Source: Compiled by the authors

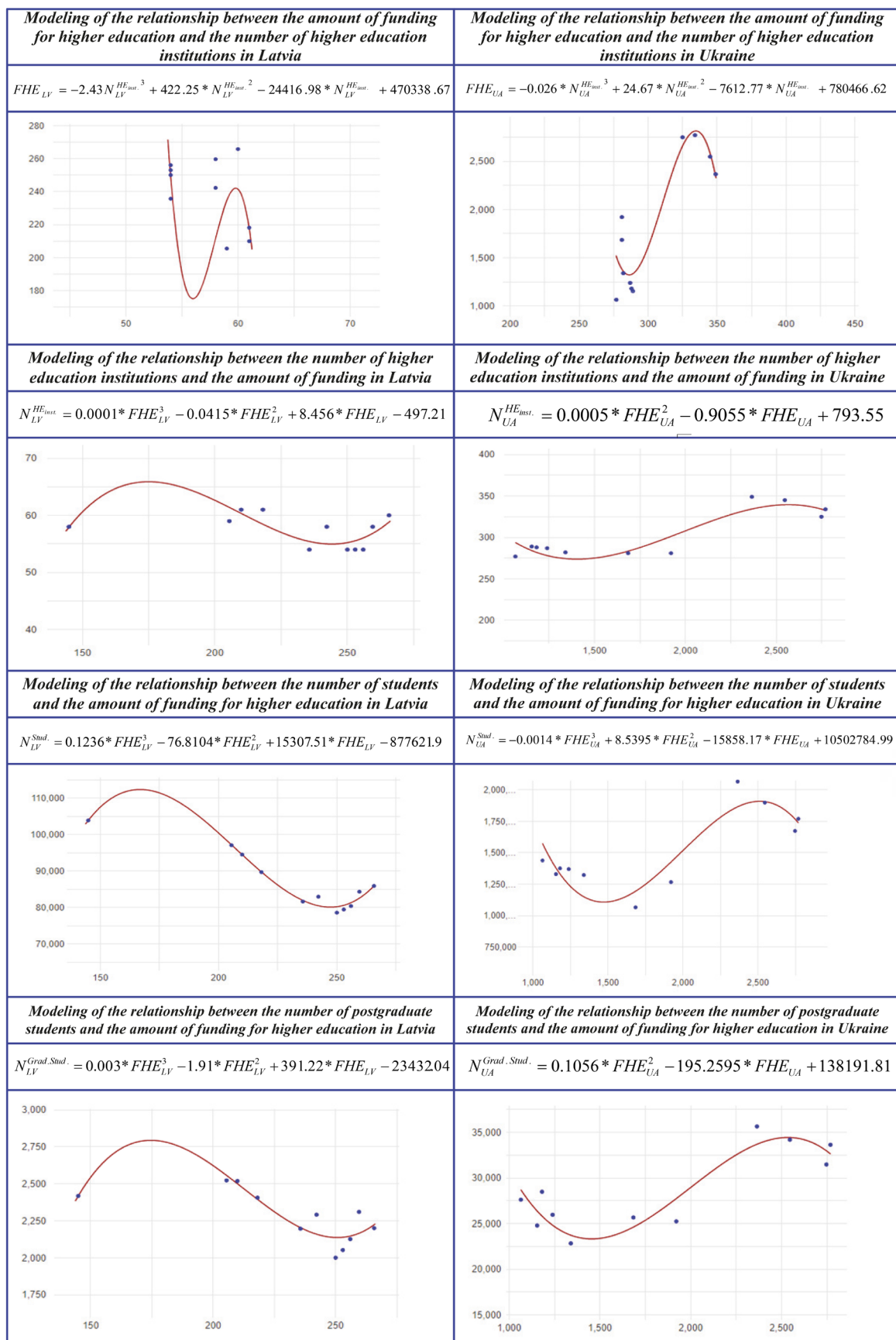


Figure 5:

Modeling of the relationship features between financing of the higher education development in Latvia and Ukraine

Source: Compiled by the authors

2. Unequivocally, the number of students in both countries depends on the amount of public funding, which indicates the important role of the state in the higher education development, increasing the level of accessibility for citizens to study in higher education institutions of the III-IV accreditation levels. We'd like to note that in both Latvia and Ukraine, education also takes place at private expenses. However, the role of the state in funding students' education is important. In particular, this tendency is more pronounced in Latvia ($R = 0.99$; $F = 109.4$) than in Ukraine ($R = 0.91$; $F = 11.11$). In this way, the outlined countries are trying to make access to higher education for their citizens more accessible. In addition, we'd like to note that in Latvia at the same time, against the background of the constant decrease in the number of students (for 2010-2020 -24.36%), the amounts of funding increase (for 2010-2020- +72.49%). In Ukraine, this tendency is not stable, there is a gradual resumption of funding for higher education after a difficult period of social and economic shock during the period 2014-2015 (for 2010-2019 -18.8%). At the same time, the number of students decreased during 10 years for 1 million people (for 51.53%).

3. It is worth noting the close relationship between the amounts of funding for higher education in Latvia and Ukraine and the number of postgraduate students. It also indicates the important role of the state in funding the research. The outlined relationship is strong both for Latvia ($R = 0.88$; $F = 8.78$), and Ukraine ($R = 0.92$; $F = 13.86$). Thus, we can state the leading role of the state in financing postgraduate education, investing in the development of science and finding new innovation ideas and technologies. However, it is also worth noting that the outlined funding is based on the following trends: in Latvia during 2010-2020 the number of postgraduate students decreased for 418 persons by increasing the amount of expenditures for higher education financing. In Ukraine during 2010-2020 the number of postgraduate students decreased for 9,98 thousand persons by decreasing the amounts of higher education financing. Thus, it can be argued that underfunding for the development of higher education institutions of the III-IV accreditation levels in Ukraine has led, first of all, to the reduction in government spending and training of postgraduate students, which negatively affects scientific potential of the state.

In addition, within the article, in order to identify further trends in the financing of higher education in Latvia and Ukraine, a forecast of government spending in this area is conducted. The results of this modeling are presented in Figure 6.

The data analysis of Figure 6 indicates a positive trend of increasing the amount of funding for higher education in Latvia and Ukraine. It is also clear that, given the retrospective trend in this indicator, the growth of public spending on higher education in Latvia will increase faster than in Ukraine. However, the positive general trend of gradual growth of these expenditures gives ground to assert the further active development of higher education in both countries, increased funding in this area, which should promote scientific development, actively involve countries in the global processes of the society digitalization.

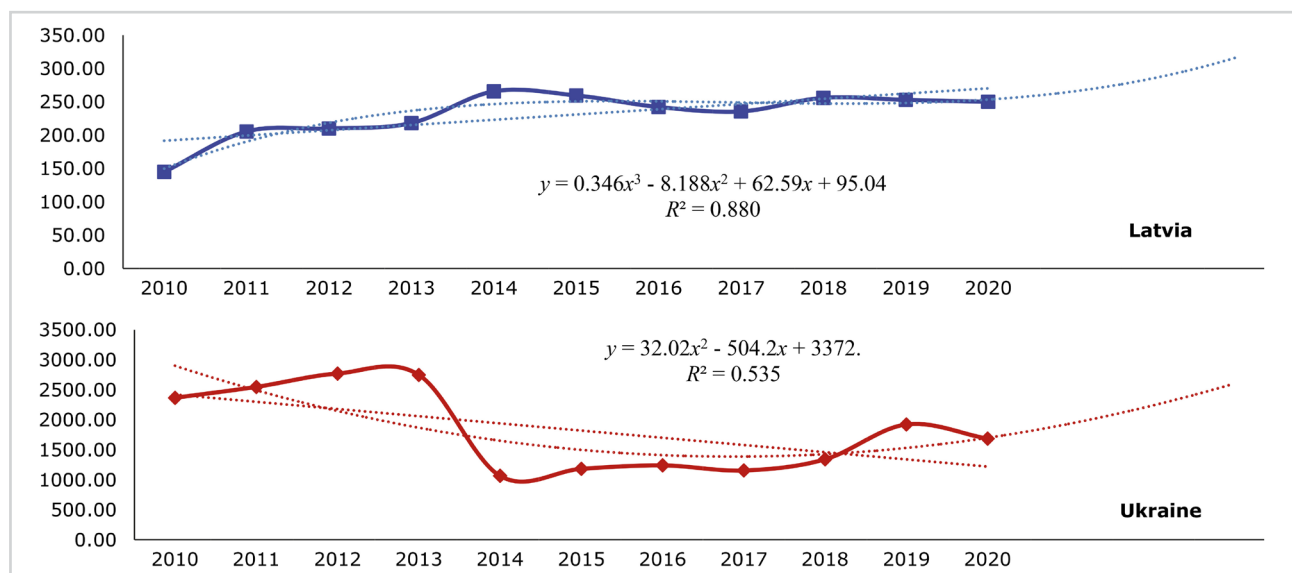


Figure 6:
Forecasting the amounts of funding for higher education in Latvia and Ukraine till 2022
Source: Compiled by the authors

Summing up, we should note the results of the comparative analysis of the higher education development in Latvia and Ukraine. By financing this area, we can indicate the important role of education in the information society development. This is logical given the fact that it is higher education institutions that train the staff capable of acting and thinking innovatively, as well as conducting research aimed at generating innovations and producing the latest technologies. In other words, universities prepare the basis not only for staffing the development of information economy in the country, but also lay the foundation for innovative development of the national economy, creating conditions for the introduction of new information and communication technologies in the activities of economic entities. The results of modeling the pace of economic development of Latvia and Ukraine and the amount of funding for higher education confirm this statement.

The detailed analysis allows us to formulate the following basic and current problems in the development of this sphere in Ukraine:

- difficult geopolitical situation in the country, which deepens social and economic problems and negatively affects solvency of the population (including services consumers of higher education institutions) and etc.;
- demographic situation, which leads to the decrease in the number of entrants and applicants for higher education in the country;
- migration processes, which are manifested, on one hand, in the departure of young people to study at foreign universities; on the other hand-in the departure of scientific personnel abroad for work;
- low competitiveness level of the domestic universities in the global educational space;
- lack of funding for higher education institutions in Ukraine, low level of the diversification of funding sources;
- insufficient use of public costs for the higher education development;
- rather low autonomy level of higher education institutions, which complicates the processes of using budget funds, the over-regulation of this process.

In our opinion, it is expedient to support the information economy development at the national level on the basis of stimulating the higher education development. After all, it is universities that manage to integrate educational, research and innovation activities, as well as to ensure the transfer of innovation research results to the real sector of the national economy.

5. Conclusion

Ukraine has regulations aimed at informatization of the national economy, but in practice they are implemented rather slowly and do not bring the expected effects. The implementation of measures to digitalize the economy is often inconsistent, fragmentary.

The digitalization of Latvia is carried out systematically and with the involvement of a wide range of stakeholders. The Government of Latvia is gradually implementing a set of measures to digitalize social and economic processes, which are the result of the well-thought-out and agreed with scientists, business and community strategy. In 2013 The Cabinet of Ministers adopted The Information Society Development Guidelines 2014-2020. Much attention in this document is paid to higher education as a determining factor in the information economy development. In particular, the Government highlighted The Action Direction «ICT Education and E-Skills» and The Action Direction «ICT Research and Innovation». These directions and corresponding measures are not separated from the general strategic plan on the country's digitalization, but are harmonized with all other measures within the framework of the Information Society Development Guidelines. A research component is integrated in the general strategy of the country's digitalization. The planned measures to digitalize the economy and improve e-skills are aimed at the broad target audience, namely: civil servants, entrepreneurs, the unemployed, employers, teachers, universities, students, the employed population. The institutions responsible for these measures' implementation include ministries, specialized agencies, research institutes and higher education institutions. The advantage, in our opinion, is that Latvia does not have a separate independent strategy for the e-skills development. Instead, it is an integrated part of a number programs and strategies on the information society development in Latvia. This ensures the complexity and unity of the digitalization of the social and economic process in the country.

The strengths of the digitalization processes management in Latvia include effective fundraising. Some of the measures to digitalize the economy in Latvia (including measures to develop e-government) were implemented with the financial support of the European Union (The

EU Structural Funds). For Ukraine, being a non-EU member, an access to the EU programs is limited. However, Ukraine has open access to participate in a number of EU grant programs on a competitive base. Therefore, it is advisable to intensify the participation of the Ukrainian institutions in such programs (higher education institutions that concentrate the strong intellectual potential of the country have special prospects in this direction).

Implementation and coordination of the measures for the development of digital and ICT skills by the population is the mission of LIKTA (Latvian Information Communication Technologies Association), which unites IT companies, research institutes, higher education institutions. On the incentive of LIKTA, the Memorandum on promoting the development of e-skills in Latvia was created. Through LIKTA's efforts, dozens of the latest ICT courses have been developed and implemented for students of different ages (more than 1.500 participants). One of the main LIKTA's achievements is the consolidation of efforts of various stakeholders, namely: public sector (ministries), entrepreneur sector (IT industry; enterprises having ICT specialists; enterprises developing information technologies); sector of higher education (universities which form digital and e-skills by students and which carry out research in the ICT sphere); non-governmental sector (NGO's in the ICT sphere). Latvia has managed to develop a stakeholder partnership, which is an important experience for Ukraine, which is currently characterized by an imbalance in the interests of universities, research institutes, business, community and government. It should be emphasized that the effectiveness of measures on the economy digitalization is directly dependent on the level of information, communication, innovation, research infrastructure, which in Latvia is given special attention by authorities at the local and national levels.

The described above positive experience of the Republic of Latvia can be successfully implemented in Ukraine provided that it is adapted for domestic social and economic trends. An important prerequisite should be the intensification of stakeholder cooperation, ensuring a proactive position of universities in such collaboration, the intensification of state influence on the digital transformation processes of the higher education digitalization. The latter should be focused on the implementation of a set of measures to guarantee the compliance with intellectual property rights; to expand support for innovative economic entities; to develop the innovation infrastructure (including on the basis of higher education institutions); to stimulate the growth of private investments in the development of education and science; to increase the applied value and investment attractiveness of the research results; to accelerate the pace of the commercialization of the research results of higher education institutions.

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