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**Sagiyeva R.[1], Masalimova A.R.[2], Zhuparova A.[3], Zhaisanova D.[4]**

[1]d.e.s., Professor, Dean High School of Economic and Business
al-Farabi Kazakh National University, Kazakhstan, Almaty, e-mail: rimmasagiyeva@gmail.com
[2]d.p.s, Professor, Institute of Pedagogy and Psychology,
Kazan Federal University, Kazan, Russia, e-mail: alfkazan@mail.ru
[3]PhD, researcher of the Department of Science and Innovation Activity
al-Farabi Kazakh National University, Kazakhstan, Almaty, e-mail: aziza_z@mail.ru
[4]PhD student of the department "Management and Marketing" of the Higher School of Economics and Business,
al-Farabi Kazakh National University, Kazakhstan, Almaty, e-mail: zhaisanova15@gmail.com

# FACTORS OF KNOWLEDGE ECONOMY AFFECTING ON INCOME INEQUALITY IN POST-SOVIET COUNTRIES

The importance of knowledge in the economy is so remarkable that many economists consider their role to be even stronger than traditional production factors such as labor and capital. The significance of this issue is a knowledge-based term. Consequently, the identification of the components of the knowledge. This study examines the impact of the components of the knowledge-based economy on income inequality in the Post-Soviet countries. Therefore, using the model of panel data, the influence of such variables as education, innovation, information and communication technologies (ICT) and institutional modes of income inequality was studied. A significant and positive effect was achieved for the components of knowledge, the index of institutional economic regimes; positive, but insignificant effect for the index of innovation and creativity; negative and significant effect on the education index; and a negative and insignificant effect on ICT in relation to income inequality in the Post-Soviet countries. Moreover, it was found that the relationship between income inequality and per capita income is similar to an inverted U-shape over time.

**Key words:** Knowledge economy. Education. Innovation. ICT. Institutional regimes. Post-Soviet countries.

Сагиева Р.К.[1], Масалимова А.Р.[2], Жупарова А.С.[3], Жайсанова Д.С.[4]

[1]э.ғ.д, профессор, Экономика және бизнес жоғары мектебінің деканы,
әл-Фараби атындағы Қазақ ұлттық университеті, Қазақстан, Алматы қ., e-mail: rimmasagiyeva@gmail.com
[2]п.ғ.д, профессор, Педагогика және психология институты,
Қазан федералды университеті, Ресей, Қазан, e-mail: alfkazan@mail.ru
[3]PhD, Ғылыми қызметкер, Ғылым және инновация департаменті,
әл-Фараби атындағы Қазақ ұлттық университеті, Қазақстан, Алматы қ., e-mail: aziza_z@mail.ru
[4]Экономика және бизнес жоғары мектебінің «Менеджмент и маркетинг» кафедрасының PhD докторанты,
әл-Фараби атындағы Қазақ ұлттық университеті, Қазақстан, Алматы қ., zhaisanova15@gmail.com

**Посткеңестік елдердегі табыс теңсіздігіне әсер ететін білім экономикасының факторлары**

Қазіргі заманғы экономикада жоғары технологияларды дамытудың нақты процестері мен ақпараттық өндіріс салаларының өсуі жүріп жатыр, бұл сапалы трансформациялық процестердің қалыптасуын көрсетеді. Осы келесі кезеңнің өзгерістері: білім өндірістің ең маңызды ресурсы болып табылады, өндіріс еңбек ресурстарынан тәуелсіз болып келеді және ақырында, жоғары технологиялар саласы экономиканың негізгі секторының рөлін атқарады. Сондықтан, білім экономикасының құрамдас бөліктерін анықтау және олардың макроэкономикалық көрсеткіштерге әсер етуі экономикадағы оның маңыздылығын нығайтуына алғашқы қадамы болуы мүмкін. Бұл зерттеу жұмысында кеңес үкіметі кезеңінің елдеріндегі табыс теңсіздігіне білімге негізделген экономиканың дамуының әсері қарастырылады. Сонымен қатар, білімнің компоненттері, институционалдық экономикалық режимдер индексі бойынша айтарлықтай және жағымды әсерге

қол жеткізілді; инновация мен шығармашылық индексі жағымды, бірақ елеусіз әсер; білім беру индексіне теріс және елеулі әсер ету; ал посткеңестік елдердегі табыстардың теңсіздігіне қатысты АКТ-ге теріс және елеусіз әсер тигізеді. Оның үстіне табыс теңсіздігі мен жан басына шаққандағы кірістің арасындағы уақыт аралығындағы түрлендірілген U-пішініне ұқсастығы бар екені анықталды.

**Түйін сөздер:** білім экономикасы, білім беру, инновациялар, АКТ, институционалдық режимдер, кеңес үкіметі заманындағы елдер.

Сагиева Р.К.[1], Масалимова А.Р.[2], Жупарова А.С.[3], Жайсанова Д.С.[4]

[1]д.э.н, профессор, Высшая школа экономики и бизнеса, Казахский национальный университет им. аль-Фараби, Казахстан, г. Алматы, e-mail: rimmasagiyeva@gmail.com
[2]д.п.н., профессор Института педагогики и психологии, Казанский федеральный университет, Россия, г. Казань, e-mail: alfkazan@mail.ru
[3]PhD, научный сотрудник Департамента науки и инновационной деятельности, Казахский национальный университет им. аль-Фараби, Казахстан, г. Алматы, e-mail: aziza_z@mail.ru
[4]докторант PhD кафедры «Менеджмент и маркетинг» Высшей школы экономики и бизнеса, Казахский национальный университет им. аль-Фараби, Казахстан, г. Алматы, e-mail: zhaisanova15@gmail.com

## Факторы экономики знаний, влияющие на неравенство доходов в постсоветских странах

В современной экономике идут реальные процессы развития высоких технологий и роста отраслей информационного производства, что свидетельствует о качественных трансформационных процессах. Эти изменения следующего порядка: знания становятся наиболее существенным ресурсом производства, всё большую независимость от труда получает производство и, наконец, роль первичного сектора экономики выполняет сфера высоких технологий. Следовательно, идентификация компонентов экономики знаний и их влияние на макроэкономические показатели могут стать шагом вперед, чтобы подчеркнуть свою значимость в экономике. В этом исследовании рассматривается влияние становления наукоёмкой экономики на неравенство доходов в постсоветских странах. Значительный и положительный эффект был достигнут для компонентов знаний, индекса институциональных экономических режимов; положительный, но несущественный эффект для индекса инноваций и творчества; негативное и значительное влияние на индекс образования; и негативное и незначительное влияние на ИКТ в отношении неравенства доходов в постсоветских странах. Более того, было обнаружено, что зависимость между неравенством доходов и доходом на душу населения аналогична перевернутой U-образной форме с течением времени.

**Ключевые слова:** экономика знаний, образование, инновации, ИКТ, институциональные режимы, постсоветские страны.

**Introduction**

The position of income distribution in each society appears to be important not only in economic aspects, but also in political and social dimensions, and every economic approach to income inequality inevitably affects political and social consequences. The history of the economy points to this reality, that in addition to various points of view among economists on the distribution of income, this issue has always been stressed. The vast experience and literature in the field of growth and development underscore this reality that any long-term actions in the field of economic growth and development are subject to consideration of distribution policies, such as the fair distribution of income in society (Asongu S.A., 2016: 667). The problem of income inequality is often addressed on equitable social issues and poverty, in which case short-term solutions should be recommended to address this problem, while the implementation of short-term policies and the lack

of definition of effective factors have an undesirable effect on income distribution and economic growth. On the other hand, economic growth depends not only on physical factors of production, such as physical capital and labor, but also depends on other factors, such as the productivity of production factors, and this factor is influenced by several factors such as knowledge. A phenomenon, such as the development of information technology and globalization, has created new economic structures in developed countries that are called the new network economy or a knowledge-based economy after the primary focus is on the primary economy, agriculture and industry. The high effectiveness of this new structure to reduce the growth and development gap in developing countries, especially in Post-Soviet countries, and the narrowing of the gaps in societies have attracted the attention of these countries to this issue; the product of which in recent decades has been rapid economic growth and increased per capita income, without relying on

natural resources and reducing income inequality in these countries.

**Methodology**

Information base of the research of this paper includes information about statistics from the official sources of the agency of statistics, internet sources, as well as data collected from the database of Springerlink.com, Scopus and Web of Science.

The methodological aspects of the study are general scientific methods as analysis, classification, system approach and comparison. In the research the study was conducted at the level of Post-Soviet countries, including the model of panel data, the affect of such variables as education, innovation, information, communication technologies and others.

**Literature Review**

In a knowledge-based economy, knowledge is the main factor in growth, earning money, employment and reducing inequalities in all activities. According to this definition, the knowledge economy is not limited to the number of industries based on advanced technologies, but in this type of economy all economic activities, even mining and agriculture, to some extent rely on knowledge. In addition, the required knowledge to build a knowledge-based economy is not only technological. It includes cultural, social and managerial knowledge (Ertmer P., 2012: 426; Shabani A., 2012: 98; Moahi K.H., 2007: 6; Shahabadi A., 2013: 2; Abramson N., 1963).

Since 1980, the topic of income distribution and analysis of the distribution policy used to increase economic growth has become important in the scientific context, as well as in policy issues. Thus, the achievement of an acceptable level of income distribution, the evaluation of the developing proliferation policy, the search for the position and well-being of people, and finally the planning to promote social justice all depend on the current situation of income distribution in society and the situation of people in different income groups. This case is impossible unless proper research is done on the distribution of income and the definition of effective factors. If effective factors of income inequality are identified, it becomes possible to achieve social justice and sustainable development. In other words, the present era is an era of knowledge-based industries, and on this basis the richest country is a country that has the ability to produce more knowledge. Thus, these countries have achieved success, which can quickly transfer the way of production and dissemination of knowledge (Garrison D.R., 2011: 33; Domingo M.G., 2016: 24, Glušac D., 2015: 137; Rolando L.G., 2013: 46) In accordance with the mentioned cases of the importance of the topic, this study explores the role of the components of the knowledge economy in relation to income inequality in the sample of Post-Soviet countries during 2005-2013. To this end, the second part, firstly, introduces literature, and then offers some empirical research conducted in this area. The third part is devoted to models and methodology. The fourth part deals with model tests and results analysis, and the fifth part deals with policy conclusions and recommendations.

There is considerable literature on socio-economic factors that determine income inequality. Research Kuznets began studying the influence of growth and development on inequality. The smith defined modern economic growth for a steady increase in per capita income or production per worker, which is often associated with an increase in population and large structural changes. According to the hypothesis of Kuznets, income inequality increases at the first stages of economic growth, then is equalized and ultimately reduced. In other words, the relationship between income inequality and per capita income is similar to an inverted U-shaped over time. Two factors are effective in increasing inequality to a certain level of economic development: first, the concentration of savings on the groups with the highest incomes, and secondly, the structure of employment as a process of industrialization and urbanization. After five decades from the main article of Kuznets, many researchers studied the impact of development, economic growth and other economic indicators of inequality from different points of view. But the place for knowledge elements and a knowledge-based economy, and its impact on income inequality, seems empty.

**Discussion and Results**

In this chapter, we briefly discuss the concept of the knowledge and knowledge economy and its impact on income inequality, and then mention some of the studies conducted in this context. The Organization for Economic Cooperation and Development (OECD 1996: 15) regards a knowledge-based economy as an economy that is directly created in accordance with the production, distribution and consumption of knowledge, and investments in knowledge and industry for basic knowledge will be of particular interest. Asia-Pacific Economic Cooperation (APEC 2000: 14)

introduces the acquisition, dissemination and use of knowledge as key components of a knowledge-based economy. But the World Bank provides the most complete definition of a knowledge-based economy. According to the World Bank, a knowledge-based economy is an economy with four basic principles, which is: (1) trained labor and experts, (2) an effective innovation system, (3) an appropriate information and communication infrastructure and (4) Institutional regime and economic incentive. Figure 1 shows the definition of the World Bank.

Education index

To ensure the education, dissemination and use of knowledge, trained and trained people and specialists are needed, since experts can improve the efficiency of factors of production and, ultimately, economic growth. Education can determine which firms or economies should perform their processes, as well as the effective implementation of new technologies for domestic demand, and also through

the use of technology, this can be a big driving force for innovation and the development of new products to meet the specific culture of the country (Guerrero A.B., 2014: 170, Chen D.H.C., 2005: 7, Oliner S.D., 2003: 18, Wilson M., 2015: 72, Yilmaz F.G.K., 2015: 292). The adult literacy rate, enrollment ratio and secondary school are the education variables that the World Bank has presented to assess this indicator. The presence of education is considered a signal about the ability and efficiency in the labor market. In this regard, the theorists of human capital believe that in the long run, the best way to change income distribution is to invest in human capital. They believe that in order to ensure a more equitable distribution of income, structures must be changed, and one way to change the structure is to invest in education and training skills, respectively. In this regard, Asongu (2017: 10) believes that investment in education can lead to a more equitable distribution of income.
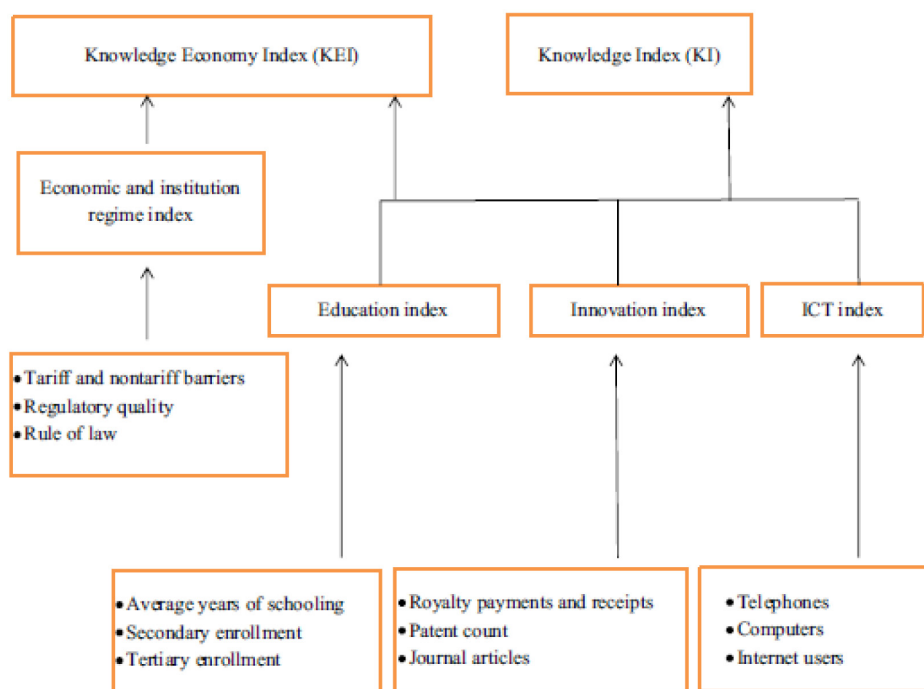


**Figure 1** – Indices of knowledge in the World Bank definition

**ICT Index**

Information and communication technologies are the backbone of the knowledge economy, which in recent years have been introduced as a means of improving economic growth and sustainable development and reducing economic disparity due to advantages such as lower costs, overcoming

geographical boundaries, increasing the flow of information, increasing confidence in transactions from for quick access to information and increased competitiveness (Yilmaz F.G.K., 2015: 294).

The variables that the World Bank presents as an indicator for information and communication technologies (ICT) include the number of Internet

users, the number of fixed telephone lines and the personal computers used. Technical changes can change the share of employment and wages of groups with different skills (provided that the society consists of two groups of skilled and unskilled). Technology reduces the share of employment, and wages for low-skilled workers and the share of employment and wages for skilled workers increases, and, consequently, inequality increases.

4. Index of institutional and economic conditions

The knowledge-based economy should have the least fluctuations in price, free trade and domestic industries that do not receive any supporting laws that could increase competition, which will lead to jobs in the domestic economy (Zadja J., 2015: 107; Wood A.1994: 56, Gregorio J.D., 2002: 402, Sylvester K., 2002: 46). The World Bank introduces tariff and non-tariff barrier variables, the rule of law and the quality of regulations as an approximate index of the institutional and economic regime. Openness can affect people by creating business opportunities and new jobs more than anything else. The ability and merit of people contribute significantly to the use of new jobs when working with world markets. Thus, the level of human capital plays a significant role in changing the distribution of income. However, many economists believe that those who have a higher level of knowledge and skills receive higher interests from openness, while those with fewer skills get less interest from openness and new opportunities for work. With three types of illiterate labor, less literate, and literate, it can be concluded that openness increases inequality in poor countries by helping people with basic education; they can reduce the proportion of deciles when the poor learn skills in order to benefit from the increased demand for labor (Park W., 2003: 20; Aesaert K., 2014: 330; Gu X., 2015: 16; Hung M.-L., 2016: 123; Skryabin M., 2015: 53; Valtonen T., 2015: 56; Susar G.C., 2014: 2298, Littlewood K.E., 2013: 1007). Therefore, the impact of trade openness on income inequality is somewhat blurry.

A lot of research has been done on a knowledge-based economy that some of them are mentioned below. Gregorio and Lee (2002: 396) studied the level of education and income in terms of income inequality in Asian countries, Africa and Latin America in the period 1990-1960. Using data models on the panel, they examined the impact of average years of study, enrollment rates on different levels of education, the adult literacy rate, and Income Gini coefficient. The results showed that income has a negative effect, and education has a positive effect on reducing inequalities. Sylvester (2002: 43-

44). focused on the impact of the cost of education on inequality. Using data from 50 countries, the results show that countries that allocate more financial resources for general education will face less income inequality in future periods, and this effect will be stronger in OECD countries than in developing countries. Park (2003: 12-14) studied factors that affect economic inequality in 54 countries. Their research shows that, in addition to economic growth, one of the main variables that affect income inequality is the cost of research and development. Results showing that research and development cause an increase in production costs and, consequently, with an increase in production, producers' incomes increase, and this ultimately reduces income inequality.

As can be seen, extensive studies have been carried out to determine the determinants of income inequality in the international space. However, most of them simply focus on the impact of education or innovation on income inequality, and there was no comprehensive study of the impact of education, innovation, openness, information technology and communications on income inequality. Similarly, most of the previous studies are largely considered by both European and American countries, and relatively, studies of Post-Soviet countries are less. In addition, the HDI neglected the modeling of most previous studies. Therefore, this study attempts to cover such shortcomings, taking into account the given samples of Post-Soviet countries based on the economic basis of knowledge and to consider such issues from a different angle.

The main purpose of this study was to investigate the impact of education on income inequality. In this regard, using the model of panel data, the relationship between income, trade openness, ICT, innovation and education with countries with the Income Gini coefficient were examined for 15 Post-Soviet countries. The results of the panel data model showed that some components have a negative effect, and some have a positive effect by income inequality. The greatest effect relates to the variable income. In fact, according to Kuznets's hypothesis, inverted U, the increase in incomes leads to the first increase in income inequality in the studied countries and ultimately leads to a reduction. After income, education has the greatest impact on inequality, which is negative and significant. Education by improving the abilities of people provides individual and social incomes and reduces income inequality. Therefore, investment in education can help reduce the gap in society. Institutional and economic regimes that

are considered in the trade openness index also have a positive and significant impact on income inequality. In fact, trade liberalization and the reduction of tariff support for factory goods that use relatively more unskilled labor will lead to a reduction in the real wages of this group of workers compared to the wages of skilled workers, and as a result, income inequality increases. Innovation is another variable that affects income inequality. In this study, the number of scientific papers published in the country is used as an indicator for measuring this variable. The coefficient for this variable was positive, but insignificant. In fact, since in many Post-Soviet countries, as in many developed countries, the knowledge market is active and supplied to a large extent and abounds, supported by the public sector, but the demand for it is small (due to the discrepancy between the demand policy and the general supply policy) for them, there seems to be no significant relationship between demand and supply of knowledge; so this variable was insignificant. The ICT index is another variable that can affect the level of income inequality. The number of Internet users is the index that is used to measure ICT in this study. This factor is not significant for the countries studied, which is the reason that ICTs have not been introduced in these countries and have not found their place.

**Conclusion**

Analyzing the reports of UNDP, this fact will be made on the grounds that the existence of income inequality is due to the lack of economic development as a whole. Among the 15 countries participating in the current study (Table 1), 4 of them are classified as very high HDI rankings, 7 – high HDI rankings, and the remaining ones are among the 107th-129th. The best result belongs to Estonia with 0.865 as the 30th country, and the worst of them is Tajikistan with an HDI of 0.627 and a rating of 129. It is that Post-Soviet countries are far from economic development. The inequality of Post-Soviet countries can be caused from different sources, lack of effective and responsible institutions, lack of government rules and political equality, lack of coordination with the information and communication process, inefficient wage and income systems, which all these factors in a way connected with economic indicators based on knowledge. Thus, if Post-Soviet countries want to solve their development obstacles and achieve Development, then they must meet agreed supply-side demand policies to develop an

economic foundation based on knowledge. The achievements of such a policy will be reflected in the opportunities for obtaining higher incomes for current low-income economic agents. In this connection, and because of this fact, that in such countries the activity of knowledge factors is active, then one should pay more attention to the factors of knowledge related to demand, in order to prevent depletion of resources, and this is precisely the moment that is neglected. This means that new technologies that can increase labor productivity are not yet developed in the countries mentioned, and there are many illiterate and illiterate people who have not yet had to learn to improve their skills and reduce the gap in inequality in education. The necessary human capital, based on knowledge, has not yet been formed, and the current infrastructure is primitive. That is why many young innovative people and people with high IQ emigrate from such countries to more develop and brain drain. This leads to the fact that developing countries (including Post-Soviet countries) face the difficulties of lack of development more than ever in the future.

**Table 1** – List of Post-Soviet Countries

| № | Country | Human development index | HDI Rank |
|---|---------|-------------------------|----------|
| 1 | Estonia | 0.865 | 30 |
| 2 | Lithuania | 0.848 | 37 |
| 3 | Latvia | 0.830 | 44 |
| 4 | Russia | 0.804 | 49 |
| 5 | Belarus | 0.797 | 53 |
| 6 | Kazakhstan | 0.794 | 56 |
| 7 | Azerbaijan | 0.759 | 78 |
| 8 | Georgia | 0.769 | 80 |
| 9 | Ukraine | 0.743 | 84 |
| 10 | Armenia | 0.743 | 84 |
| 11 | Uzbekistan | 0.701 | 105 |
| 12 | Moldova | 0.699 | 107 |
| 13 | Turkmenistan | 0.691 | 111 |
| 14 | Kyrgyzstan | 0.664 | 120 |
| 15 | Tajikistan | 0.627 | 129 |

Therefore, the governments of Post-Soviet countries should take measures to adopt a coordinated demand policy with an economic supply policy to control the formation of a knowledge-based

development model, so low-income producers can find better opportunities to receive money, Therefore, given that usually in these countries the proposal knowledge components are active, they should pay more attention to the prevention of loss of resources.

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