MINISTRY OF EDUCATION AND SCIENCE OF REPUBLIC OF KAZAKHSTAN
Kazakh National Research and Technical University named after K.I. Satbayev
Project Management Institute
Scientific and Educational Centre of Mathematical Economics

Admitted to the defence
Head of the Scientific and
Educational Centre of
Mathematical Economics
_____ Aubakirova S.K.
"4th" of June 2021

DIPLOMA PROJECT

Construction of Lorenz curve by Consumption Inequality

Major 5B070500 – Mathematical and Computer modelling

Completed by: Smolyakova Yekaterina

Research supervisor:
Khruschev Sergey,
Doctor of Physics and Mathematics,
Professor
Sergey Khrushchev Digitally signed by Sergey Khrushchev
DN: cn=Sergey Khrushchev, o=Satbaev University, ou=New School of Economics, email=sergey.khrushchev@yahoo.com, c=KZ
Date: 2021.06.04 09:26:59 +06'00'
"___" _____ 2021

Almaty, 2021

MINISTRY OF EDUCATION AND SCIENCE OF REPUBLIC OF KAZAKHSTAN
Kazakh National Research and Technical University named after K.I. Satbayev
Project Management Institute
Scientific and Educational Centre of Mathematical Economics

Major 5B070500 – Mathematical and Computer Modelling

Admitted to the defence
Head of the Scientific and
Educational Centre of
Mathematical Economics
_____ Aubakirova S.K.
4th of June 2021

ASSIGNMENT
for the diploma project

Full name of the student: Smolyakova Yekaterina
Full title of the project: Construction of Lorenz curves by Consumption Inequality
Approved by the Order from the Rector of Satbayev University №2131-b from 24.11.2020
Deadline for the completion of the diploma project: 23.05.2021
Summary of the diploma project:

1) *Income inequality*
2) *Consumption and Income inequality*
3) *Test for Lorenz curve*
4) *Housing*
5) *Test for Lorenz curve of Kazakhstan*

The list of graphical material (with an exact indication of the mandatory drawings) shown in: *10* slides of presentation work
Recommended main bibliography: *33 references*

Almaty, 2021

Schedule
for preparation of the diploma project

Section name	Submission deadline	Notes
Literature review	11.01.2021 – 25.01.2021	
Hypothesis and research plan	26.01.2021 – 08.02.2021	
Research and analysis	09.02.2021 – 22.03.2021	
Conclusions	23.03.2021 – 05.04.2021	
Compilation of the work according to standards	06.04.2021 – 21.05.2021	

Signatures
of the consultants and normcontroller on the finished diploma project
based on the sections that applied to them

Section name	Consultant's full name (academic degree, job title)	Date of signature	Signature
Literature review	S.V. Khrushchev, Doctor of Science, professor	25.01.2021	
Hypothesis and research plan	S.V. Khrushchev, Doctor of Science, professor	08.02.2021	
Research and analysis	S.V. Khrushchev, Doctor of Science, professor	22.03.2021	
Conclusions	S.V. Khrushchev, Doctor of Science, professor	05.04.2021	
Normcontroller	S.K. Aubakirova, MSc, head of the centre	21.05.2021	

Research supervisor _____ Khrushchev S.V.
Signature Full name

Student accepts all the assigned tasks  Smolyakova Y.I.
Signature Full name

Date 11th of January 2021

MINISTRY OF EDUCATION AND SCIENCE OF REPUBLIC OF KAZAKHSTAN
SATBAYEV UNIVERSITY

REVIEW

OF THE RESEARCH SUPERVISOR

to the diploma project of Yekaterina Smolyakova
(Full name of the student)
5B070500 - "Mathematical and Computer Modelling"
(code and name of the major)

Title of the diploma project: Construction of Lorenz curves by Consumption Inequality

Lorenz curves and related indices are fundamental parameters of the economy of any country. They describe the level of the social inequality and are important for the policy of any Government. The main problem of Lorenz's curves is that to draw them one requires the full information concerning incomes of every citizen. The shadow economy does not allow to get it. The purpose of this diploma project was to find tools, which can be used to recover the true Lorenz curve for Kazakhstan. The paper includes a detailed theoretical part, a careful analysis of the indices involved, an analysis of the data, which can be used and, which cannot, to eliminate the influence of the shadow economy, and finally the algorithm for Kazakhstan. I must say that Yekaterina Smolyakova did everything herself. We only discussed with her once per week possible directions of her research. I evaluate this work as extraordinary and deserving the highest grade. On my opinion, it can be published.

Research supervisor
Sergey Khrushchev, Doctor of fiz.-math sciences, Professor of the NSE

Sergey Khrushchev
Digitally signed by Sergey Khrushchev
DN: cn=Sergey Khrushchev, o=Satbaev University, ou=New School of Economics, email=sergey.khrushchev@yahoo.com, c=KZ
Date: 2021.06.04 09:26:59 +06'00'

(signature)
«03» June 2021

Аңдапта

«Тұтыну теңсіздігі үшін Лоренц қисықтарын салу» тақырыбындағы дипломдық жұмыс 24 кестеден тұрады, оның ішінде 6 кесте мен 6 графиктері бар және келесі компоненттерден тұрады: Кіріспе; Табыстардың теңсіздігі; Тұтыну теңсіздігі; Лоренц қисық сызығы; Тұрғын үй теңсіздігі; Қамыс-қаңқалы және саманды үйлер; Қазақстанның Лоренц қисығына арналған тест; Қорытынды; Пайдаланылған әдебиеттер тізімі.

Аннотация

Дипломная работа на тему « Построение кривых Лоренца по неравенству потребления» содержит 24 страницы текста в том числе 6 таблиц и 6 графиков, и включает в себя следующие составные части: Введение; Неравенство по доходу; Неравенство по потреблению и по доходу; Тест для кривой Лоренца; Жилищное неравенство; Каркасно-камышитовые и саманные дома; Тест для кривой Лоренца Казахстана; Заключение; Список использованной литературы.

Annotation

The thesis on “Construction of Lorenz curves by Consumption Inequality”. The project contains 24 pages of text, including 6 tables and 6 graphs, and includes the following components: Introduction; Income Inequality; Consumption and Income inequality; Test for Lorenz curve; Housing inequality; Reed and Saman houses; Test for Lorenz curve of Kazakhstan; Conclusion; References.

Contents

Introduction

Economic inequality is defined as a difference in social status, wealth, or opportunity between people. In most cultures, equality and fairness are the key concepts. In general, these two are highly valued elements of the moral deliberations of any person, regardless of ideology, political views, and religion. Nowadays, inequality is the forefront topic of many public and political debates.

Fairness is understood as an opportunity to take a prestigious place in the social hierarchy according to personal merits, abilities, hard work, talents, knowledge, education, and regardless of parents' social status and their level of well-being. The concept of equality is very close to the idea of fairness. Inequality of social groups is often regarded as unfair. However, unlike the concept of fairness, equality focuses on coincidence, similarity, interchangeability of goals, values, positions, prestige, and the availability of benefits of various social groups. The specific meaning of the concepts of fairness and equality is always changeable and depends on historical circumstances.

Fairness does not imply perfect equality. At some point, perfectly equal distribution among people deprives an incentive to develop, transcend, compete, invest in education, and work as hard as possible to achieve better results and increase their quality of life. For instance, returns to education and differentiation in labor earnings can encourage human capital accumulation and economic growth, notwithstanding being associated with higher income inequality.

Inequality stimulates people to do their best to achieve a higher status. Besides, by giving preference to specific groups, society gains confidence that the work will be done well. Simultaneously, it is a mechanism of social control that regulates and does not allow unfairness, which will have devastating consequences for society. Hence fairness implies inequality up to some degree. The principle of social equity can be interpreted as the concept of "fair inequality." “Economic inequality is seen as fair when people believe it to be the result of fair processes, or in other words, in accordance with normative rules about resource allocation” (Trump K. 2020)

Social inequality is characterized by unequal access to social benefits such as money, power, prestige, education. It is reflected in the inequality of living conditions, inequality of opportunities in achieving the desired goals, and the inequality of outcomes. Inequality of opportunities is generally perceived to be unfair. A person born in a wealthy family can get an education in prestigious institutions and climb up the social ladder faster than a person from the lower classes. The mechanism of social mobility helps mitigate social inequality, although it does not eliminate it. Certain aspects of inequality are regarded as unfair in different societies, and hence inequality of opportunities requires elimination or mitigation up to some point.

Hence it is crucial to determine the level of economic inequality, consider and study reasons that lead to any change in it, to achieve a fair and developed society. Nevertheless, already at the point when determining the level of inequality, significant problems arise. Most of the existing indices measure income inequality, which does not reflect the whole picture.

Income inequality

Broadening inequality is the central issue in the modern world. Income inequality is a litmus test of a deficiency of income mobility and equality of opportunities, which cause the continuous disadvantage of specific strata of humanity. It also may have harmful consequences for sustainable economic development and political stability. It can increase the concentration and the accumulation of political and decision-making power. Solt (2011) states: "Societies with higher levels of economic inequality are concomitantly more hierarchical, making experiences that reinforce vertical notions of authority more common and so authoritarianism more widespread." Dictatorship is much more likely to flourish under the unequal distribution of welfare, while societies in which the level of equality is higher are more likely to be democratically stable. Muller (1995), using regression analysis, revealed that the effect of inequality on democracy is significantly negative. He concluded that "income inequality hinders democratization."

Furthermore, inequality can trigger the reduction of investments and contribute to sub-optimal use of human capital. Therefore, in a country with a higher degree of equality, the productivity of labour could be higher. Many economic studies also demonstrate the significance of family members' vocational education on the improvement of their living standards. As was mentioned by Kudasheva, Kunitsa, and Mukhamediyev (2015), higher-educated people are more likely to enter the high-income groups of the population since education offers manifold advantages.

Considering the negative effects on modern society that inequality has, it is also important to mention that there is a correlation between inequality and economic growth. According to Berg, Ostry, Tsangarides, and Yakhshilikov (2018), there is evidence that higher level of inequality implies lower education and expected life span, and higher fertility. Hence, inequality affects economic growth. They found out that "lower net inequality is strongly and robustly correlated with faster and more durable growth, controlling for the effect of redistribution."

Greater income inequality means that people with a higher marginal propensity to consume have less share of income, since wealthy people have a higher propensity to save and spend a lower fraction of income than people with low incomes. Therefore, increasing inequality decreases aggregate demand and undermines economic growth.

On the other hand, up to some degree, inequality may be pro-competitive and even increase human capital accumulation and improvement. Hence inequality may have positive effects on economic growth. If wage differentiation due to education is high, people have more incentive to invest in human capital. According to Lazear and Rosen (1981), paying wage based on the rank order of worker (wages in this case which differ from the value of marginal products of worker) when monitoring costs are so high and moral hazard becomes a serious problem under some conditions is the best way to achieve an efficient incentive structure. Even Pareto optimal allocation of resources can be achieved through tournaments when workers are risk-neutral, as does the optimal piece rate, but compensating workers on the basis of their relative position is less costly, which means that inequality may provide incentives for innovation, entrepreneurship, and investments.

Broader income inequality deprives households with low-income of their ability to go to higher-quality schools and colleges and to get high-quality health services which are usually quite expensive. Also, it inhibits the accumulation of physical and human resources for such families. However, it is applicable mostly for developed economies. According to Garol and Moav (2004), "the effect of inequality on growth depends on the relative return to physical and human capital." In the case of developing countries, inequality might even boost growth. It is important for physical capital accumulation. Since capital owners who have a higher propensity to save also have higher income and a greater portion of wealth also are more likely to undertake investments. However, later, as the economy becomes more industrialized, returns on investments in the human capital increase, and human capital becomes the key driver of economic growth because of the complementary nature of human and physical capital. This suggests that inequality may have a positive impact on developing economies, while for developed ones it is harmful.

Hence, the drivers, consequences, magnitude of inequality, and what to do about it have become the highly discussed issues in the community of politicians and researchers.

Measures of Income inequality:

There exist a variety of different approaches to measure inequality. Most of the existing indices are based on the idea of the Lorenz curve.

The problem with existing indices, including the Lorenz curve, is that accurate, complete data on income distribution is not available. The "shadow economy" exists, and some incomes can not be taken into account since the illegal economic activity is tax-free and unaccounted for the gross domestic product.

As Darimbetov and Spanov (2001) stated in their article most interviewed experts believe that in Kazakhstan, the share of the shadow economy takes from 30 to 50% (66.4% of respondents).

Estimated size of the shadow economy of Kazakhstan as a percentage of GDP over the period 1996 to 2015:

1996	**1997**	**1998**	**1999**	**2000**
47.35	45.99	45.66	44.61	43.20
2001	**2002**	**2003**	**2004**	**2005**
42.73	40.89	39.58	38.41	36.39
2006	**2007**	**2008**	**2009**	**2010**
35.12	34.21	32.66	34.65	33.03
2011	**2012**	**2013**	**2014**	**2015**
31.61	31.92	30.77	30.06	32.82

(Medina, L. & Shneider, F. 2018).

Moreover, the level of inequality can be both overestimated and underestimated due to the presence of the shadow economy.

People in most impoverished strata are usually self-employed and do not pay taxes from these activities; therefore, this money is not considered when drawing the big picture. Hence, the Lorenz curve built based on this information overestimates inequality.

According to Kapitanov, Ivanova, and Maximova (2018), tools to conceal income are not a special secret. The formal withdrawal of the local business is not difficult. There are even websites offering such services. However, such tools are available only to large businesses. That is, information about the incomes of not everyone, namely the wealthiest groups, is hidden.

Inequality index must meet the following principles:

1. The principle of redistribution, also known as the Pigou-Dalton principle. According to this principle, if money is transferred from a wealthy individual to a poorer one, then the inequality rate should decrease, and vice versa.

Pigou-Dalton and Minimal Pareto principles, like Adler, Professor of Law, and Horvitz, Professor of Economics, Philosophy, and Public Policy Duke University, noticed, "are the twin pillars of justice." (2013)

2. The principle of scale invariance. The inequality measure should not respond to proportional changes in all income. So there is no money illusion.

3. Population principle of duplication of observations. The inequality measure should not change with a uniform increase in the sample.

4. Anonymity. If two arbitrary individuals are permuted, then the inequality measure should not change. This means that all individuals are interchangeable, and all that matters is their level of income, not their name.

The following indices do correspond to the principles outlined above. However, they are not perfect measures of inequality.

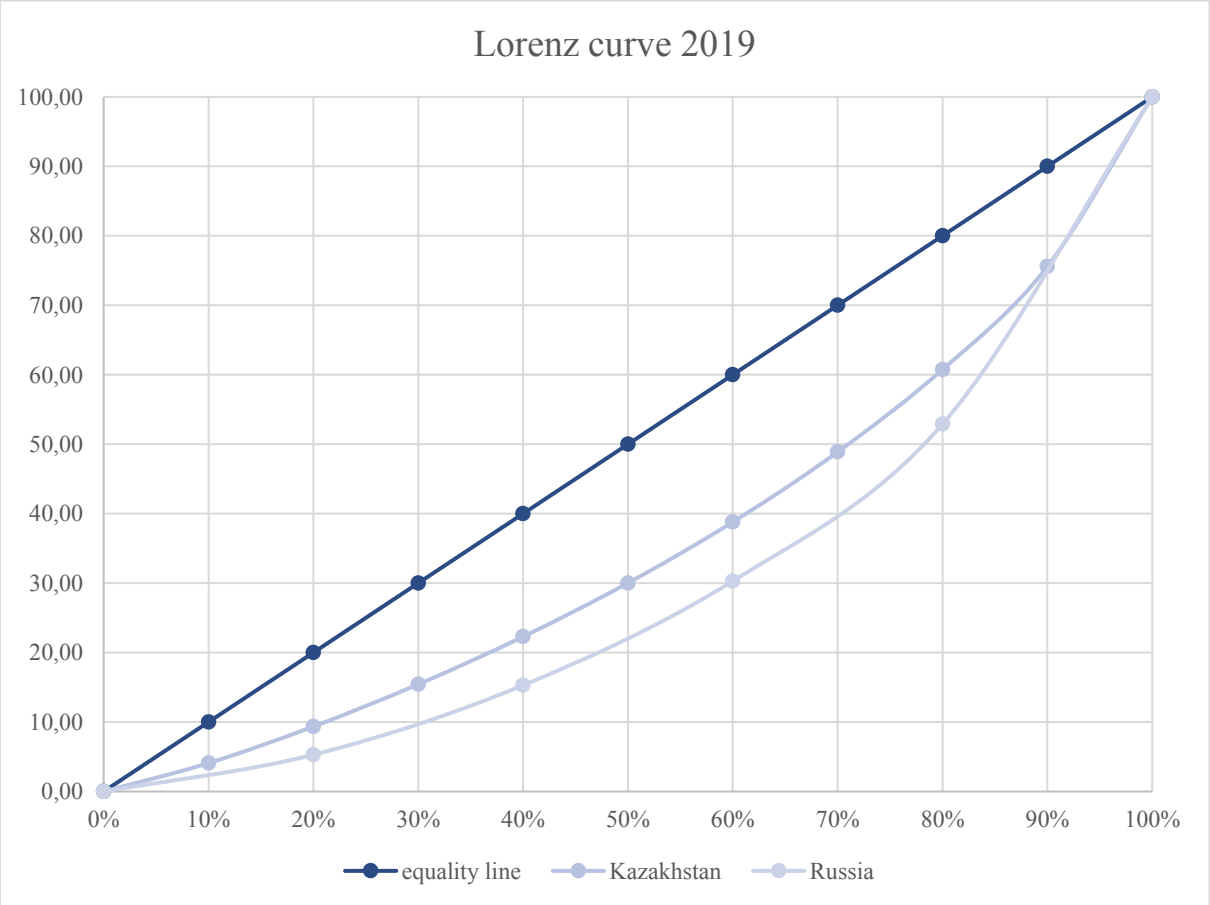
Lorenz curve, which is a primary concept related to income inequality, was developed in 1905 by Max Lorenz to characterize the distribution of wealth among the society. It is frequently used to compare the levels of inequality between different countries. The horizontal axis represents the proportion of the population ranked from poorest person to the richest one. The vertical axis depicts the cumulative distribution of total income.

Lorenz curve has the following properties:

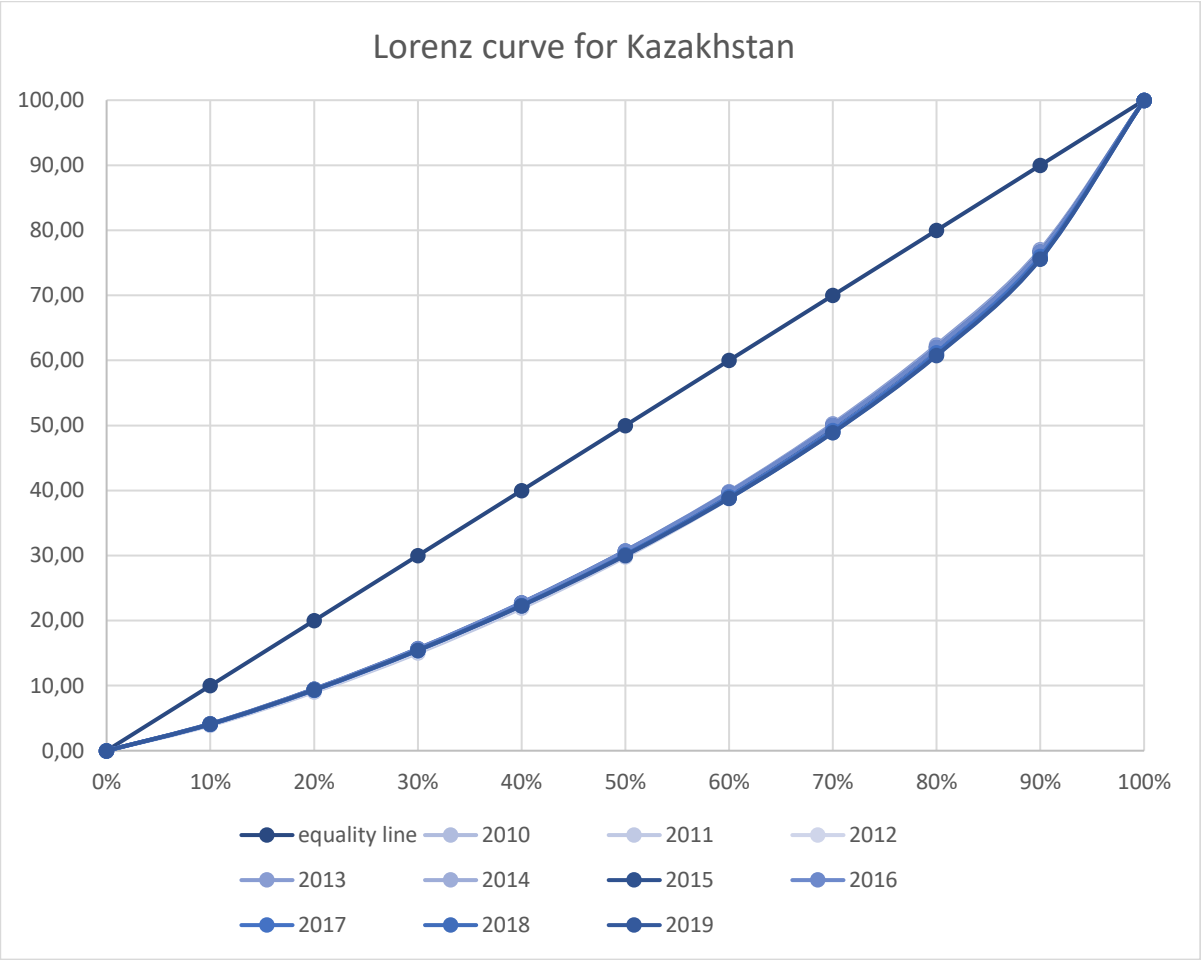
1. Lorenz curve is continuous on [0,1]; L(0)=0; L(1)=1.
2. Lorenz curve is increasing.
3. Lorenz curve is convex.

Lorenz curves are very useful to compare income distribution between countries.

As can be seen from the graph below income distribution in Kazakhstan was more equal than in Russia in 2019.



However, it might be very difficult to make any conclusion about inequality trends in one country through the years.



From the graph above it can be concluded that according to official data provided by the committee on statistics income distribution in Kazakhstan didn't change during the last decade.

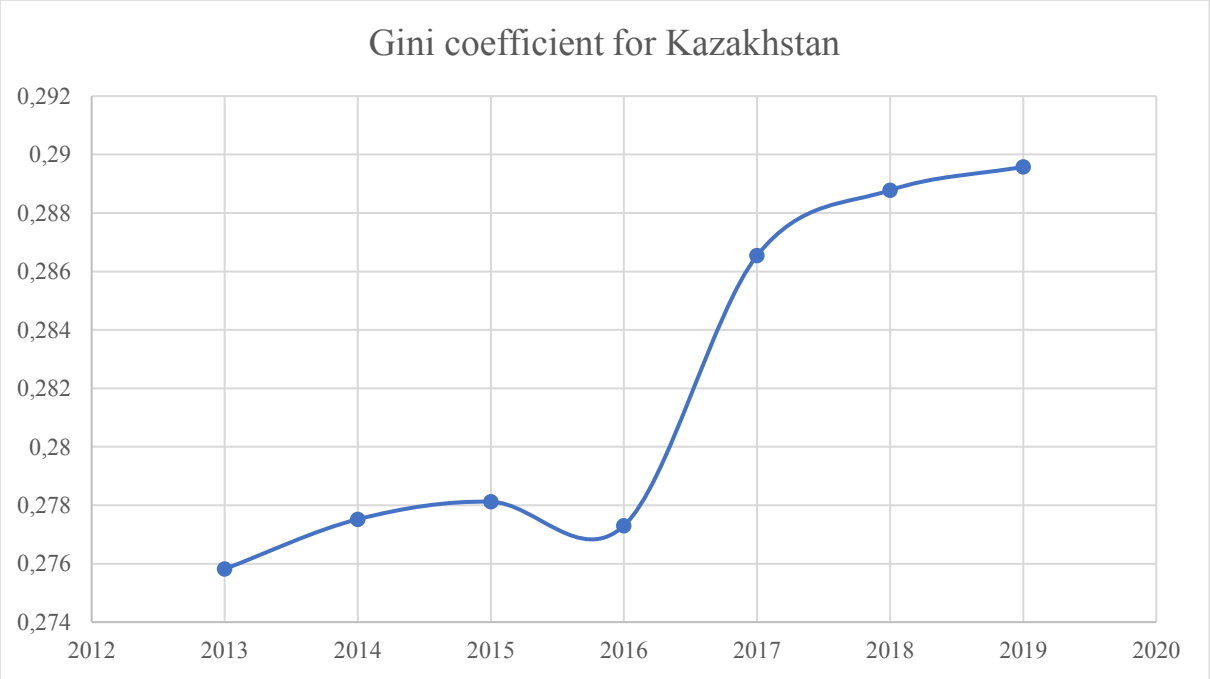
Lorenz curve is a mathematical model based on adapting a continuous curve to incomplete and discontinuous data. Hence, it is a potentially inaccurate measure of the actual inequality level.

Also, as it already was mentioned above, researchers do not and will not have complete data on the distribution of the population by income. Hence it is impossible to construct a Lorenz curve that will precisely reflect income distribution.

Gini coefficient is the most popular measure used to operationalized income inequality. It is derived from the Lorenz curve. It shows the area between the 45° line (perfect equality) and the Lorenz curve. It takes values between 0 and 1. Where 0 indicates perfect equality and 1 represents perfectly unequal society

According to the committee on statistics, the Ministry of National Economy of the RK in 2019 was 0.29.

Year	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Gini index	0,27582	0,27752	0,27812	0,2773	0,28654	0,28878	0,28958



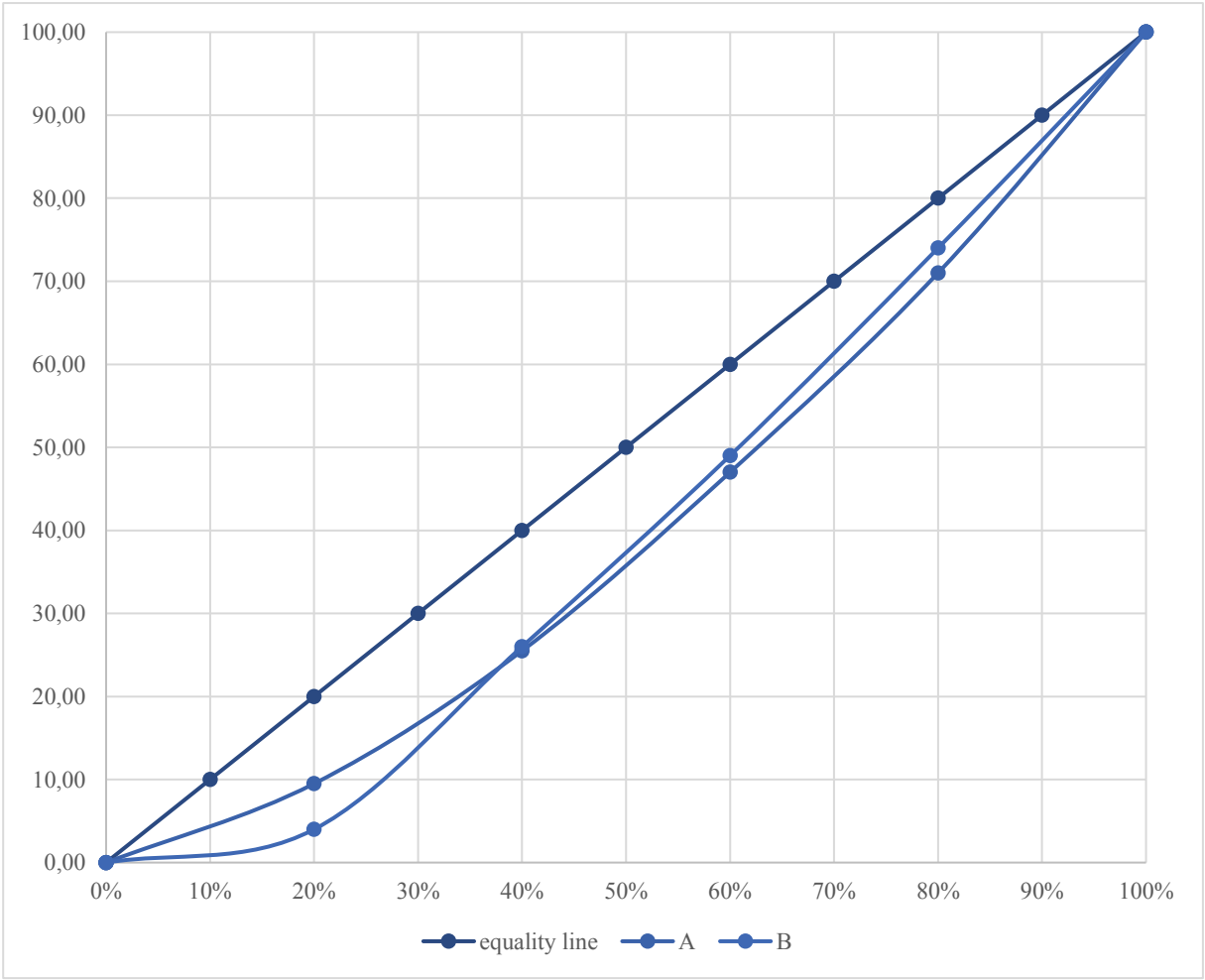
The main weakness is that the Gini coefficient does not distinguish different kinds of inequality.

The Gini inequality index is not additive, and its decomposition is generally problematic. Nevertheless, it is widely used. The index has recently been criticized since the same Gini index value can characterize two societies with very different income distributions. As can be seen from the example shown below:

Assume that there are two countries A and B. Income distribution is given by the table.

Quantile	1st	2nd	3rd	4th	5th
Country					
A	9.5%	16%	21.5%	24%	29%
B	4%	22%	23%	25%	26%

Construct Lorenz curves for these two countries:



For both countries, the Gini index is 0.188. But in country B, 20% of the poorest people are in a much worse position than in A.

Also, the Gini index has the same problem as the Lorenz curve - it requires complete data.

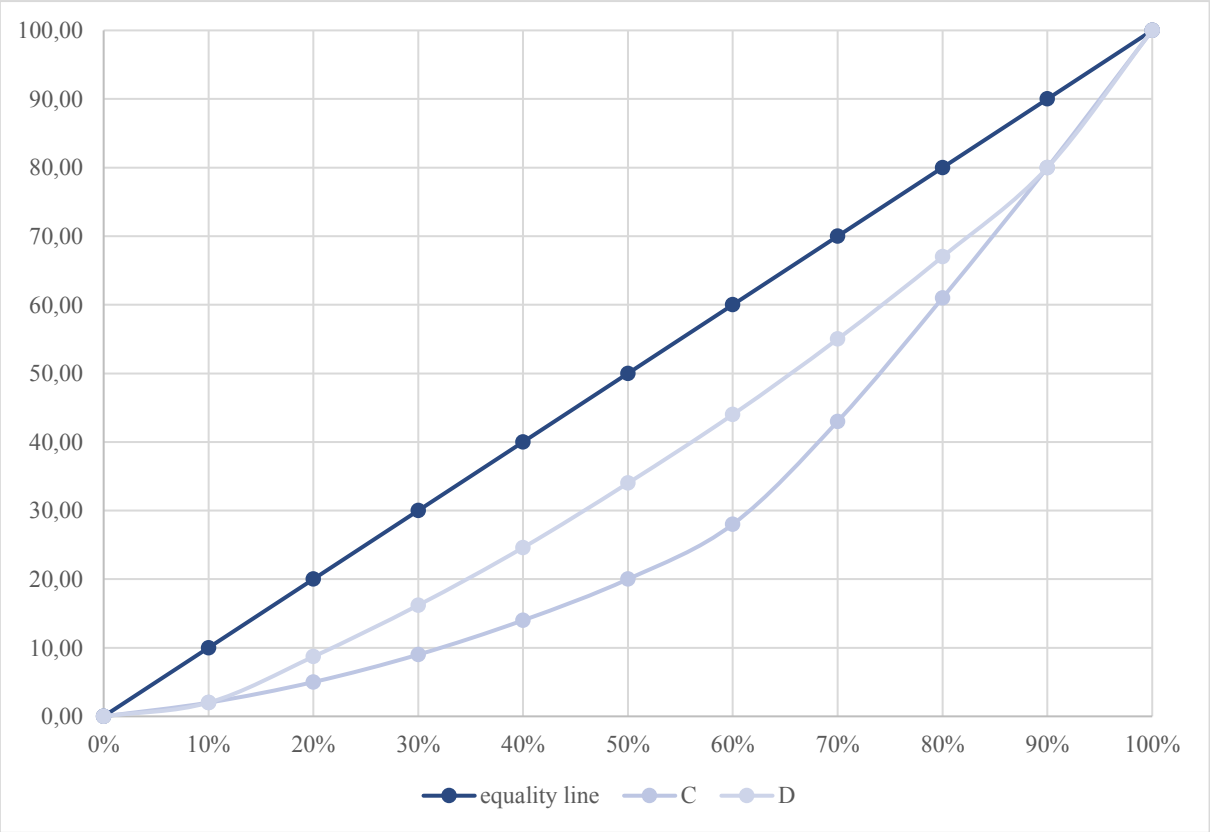
Decile Ratio calculation is a simple but effective way to evaluate income inequality. The income of the top 10% of households is divided by the income of the poorest 10% of households. In Kazakhstan in 2019, it was 5.97066.

Year	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Decile ratio	5,611	5,665	5,62	5,619	5,894	5,99	5,97

Problem is that two countries may have same decile ratios, but very different income distributions.

Decile	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**9th**	**10th**
Country										
C	2%	3%	4%	5%	6%	8%	15%	18%	19%	20%
D	2%	6.7%	7.5%	8.4%	9.4%	10%	11%	12%	13%	20%

Construct Lorenz curves:



The decile ratio for both countries equal to 8, but for the country C Gini index is 0.376, while for country D it is equal to 0.237.

Robin Hood index is the maximum vertical distance between the 45 degree line of equal incomes and the Lorenz curve. It can be understood as the proportion of total income that should be redistributed from those who are above the mean to those below to maintain equal distribution.

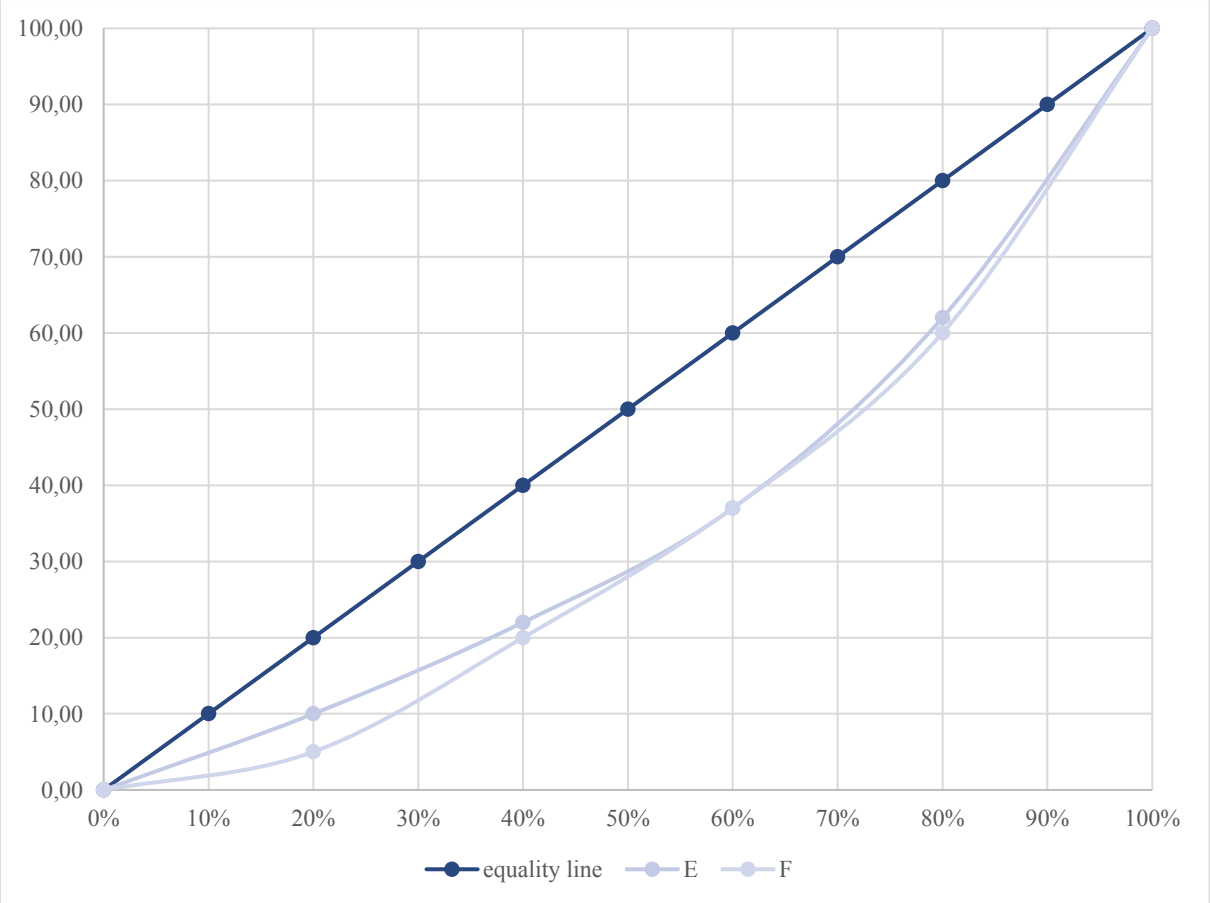
For Kazakhstan in 2019, it was 21,2%.

Comparison of two countries by Robin Hood index:

For example, if Income distribution for countries A and B is given by the table below, then in both countries Robin Hood index is 23%.

Quantile	**1st**	**2nd**	**3rd**	**4th**	**5th**
Country					
A	10%	12%	15%	25%	38%
B	5%	15%	17%	23%	40%

Construct Lorenz curves:



It can be seen from the graph above that in A income distribution is far more equal than in the country B, while for both countries Robin Hood index is 23%.

Coefficient of variation is calculated by dividing the standard deviation of the income distribution by its mean. More equal income distributions will have smaller standard deviations. Hence, the CV will be smaller in more equal societies.

$$CV = \frac{\sigma}{\mu}$$

CV does not have an upper bound. Therefore, the interpretation and comparison are quite difficult. It can only be used if income data approaches the normal distribution.

Atkinson index is a value of social utility that can be obtained from income redistribution. It could be used to calculate the proportion of total income that would be required to achieve an equal level of social welfare as at present if incomes were perfectly distributed. The range of values is 0 to 1, with 0 being a state of equal distribution.

$$A_\varepsilon(y_1, \ldots, y_N) = \begin{cases} 1 - \frac{1}{\mu}\left(\frac{1}{N}\sum_{i=1}^{N} y_i^{1-\varepsilon}\right)^{\frac{1}{1-\varepsilon}} & for\ 0 \leq \varepsilon \neq 1 \\ 1 - \frac{1}{\mu}\left(\prod_{i=1}^{N} y_i\right)^{1/N} & for\ \varepsilon = 1 \end{cases}$$

Where ε is an inequality aversion parameter, y_i is individual income, μ - mean income. ε is quite a subjective parameter of disgust (rejection) of inequality. Therefore, Atkinson index is more sociological than an economic index.

Generalized entropy index incorporates a sensitivity parameter α. Greater α, the more sensitive GE(α) is to inequalities at the top of the income distribution. Usually, GE is measured for $\alpha = -1,0,1,2$. GE can take values form 0 to infinity, where 0 represents perfect equality.

$$GE(\alpha) = \begin{cases} \frac{1}{N\alpha(\alpha-1)}\sum_{i=1}^{N}\left[\left(\frac{y_i}{\bar{y}}\right)^{\alpha} - 1\right], & \alpha \neq 0, \alpha \neq 1 \\ \frac{1}{N}\sum_{i=1}^{N}\frac{y_i}{\bar{y}}\ln\frac{y_i}{\bar{y}}, & \alpha = 1 \\ -\frac{1}{N}\sum_{i=1}\ln\frac{y_i}{\bar{y}}, & \alpha = 0 \end{cases}$$

Its main problem is that the Generalized entropy index depends on the method of quantizing the initial data to a much greater extent than all the other considered inequality indices.

Kakwani index does not measure inequality itself, but it is used to evaluate the performance of the social intervention. It is calculated as a difference between the Gini index for the social intervention and the Gini index for incomes prior to the policy intervention. It takes values between -1 and 1. The larger index means, the more progressive is the social intervention.

$$K_t = 2 \sum_{k=1}^{n} \frac{1}{n} \left(\frac{k}{n} - \sum_{i=1}^{k} \gamma_i \right) - G$$

i= 1,2,…,k – individual i

n- total number of individuals

γ_i - share of total taxes paid by individual i

G- before tax, Gini coefficient

Consumption and income inequality

In economics, the utility function is calculated in terms of consumption and leisure. However, the degree of inequality is usually measured in terms of income. It happens because the level of households' consumption is much more challenging to be observed and calculated precisely than the level of income. Hence these two may vary significantly from each other.

The level of consumption in most families is smoothed out due to income redistribution (for example, parents can financially support students during their studies), making the level of income unrepresentative in measuring inequality.

According to Attanasio and Pistaferri (2016), consumer spending also do not accurately represent consumption due to the following reasons:

1. Costs will be reduced for those who have already purchased durable goods. Typically, such sales are not included in surveys.

2. Researches do not include such services as support from relatives, friends, or charitable organizations, medical care received under state quotas, and so on.

3.Some services or goods are produced by the households themselves (for example, childcare provided by parents, siblings, or other relatives).

4. It is assumed that all consumers face the same prices for the same goods, which does not occur in the real world where price discrimination exists, at least to some extent.

Another obstacle that occurs when researchers try to measure consumption to evaluate inequality is that minor and infrequent purchases are seldom mentioned in surveys. In contrast, large and frequent purchases are frequently reported.

Also, prices may differ in different stores, change due to discounts, which leads to a change in the same consumers' preferences over time. For different consumers, the consumer basket varies significantly. For instance, the proportion of necessities would be more significant for the poorer. That makes the CPI unsuitable for tracing price changes.

It can lead to both overestimating and underestimating inequality in society.

According to the Permanent Income Hypothesis created by Milton Friedman in 1957, consumers are not inclined to take risks. They choose their level of consumption to be part of the income received over their entire life, not over a certain period. So, if a consumer borrows money, then his consumption will exceed his income in the current period. If he saves (lends), the level of income will be higher than the consumption level. However, in reality, for each family, the problem of resource distribution through time is much more complex. Also, taxes and subsidies from the state can affect the fact that the level of income and level of consumption may differ.

Research completed by Attanasio and Pistaferri (2016) has also shown that less educated people spend more time on leisure than college graduates. For both groups, leisure consumption has increased over the past few decades. Assumption can be made that the rise in inequality in consumption was offset to some extent by the increase in leisure time among the poor, implying that the rise in inequality in wealth is less severe than the consumption data alone would suggest. The lack of opportunities in the labor market may force an increase in leisure consumption. They concluded that since consumption is more evenly distributed than income, there is greater intergenerational mobility when looking at consumption than income.

Deeping inequality and lack of intergenerational mobility increase social tension in society associated with limited prospects and hopelessness among the "lower classes" of society and create a lack of confidence in the future among the top strata.

Although inequality in the consumption of non-durable goods and services follows the trends in income inequality, an increase in income inequality reflects an increase in wealth inequality. However, still, the values differ for the reasons given above. Hence using consumption is better than income to measure inequality.

However, for a full analysis of inequality, economists also need to consider the value that people place on time and the quality of the goods they consume.

Indices for consumption inequality

Any index that attempts to estimate consumption inequality is exceptionally intricate. In a perfect world, such measure catches all consumption streams during the period and does not include any forms of savings or deferred consumption. It should incorporate all non-durable expenditures plus the consumption flows from durables.

Unfortunately, typically it is an impossible task to accurately separate durables from non-durables and estimate the durables' consumption flow perfectly.

Hence, the lack of information becomes an obstacle that makes it impossible to calculate an index for consumption inequality that would be representative.

Test for Lorenz curve

Housing inequality

Housing is a very important determinant of each person's life quality. Housing wealth is a significant component of person's wealth. It is linked to non-housing consumption (durable and non-durable goods) through the logic of the budget constraint. By moving to a smaller and cheaper or larger, better, and more expensive house, it is possible to free up or use resources. Hence existing data on housing can be used to determine whether the Lorenz curve is constructed properly.

Housing is viewed as both a consumption and an investment good. Measure that is built in the same way as a Lorenz curve but represents the inequality in housing wealth must be less convex.

Construct the variable x to evaluate inequality in housing and compare its mean value to the point of the Lorenz curve that corresponds to the first three deciles of the population of Kazakhstan.

$$x_i = \frac{0.3 * (Price_i / Area_i)}{\overline{P\_sqm}}$$

The line of perfect equality is a 45-degree line. In this context, it represents a situation in which the price per square meter is the same for the house of every person.

The Lorenz curve estimates income inequality. Therefore, it overestimates inequality and theoretically the mean value of x that is greater than the value of the Lorenz curve that corresponds to the first three deciles of the population.

Hence, using x, we can test official data provided by the committee on statistics, Ministry of National Economy of the RK, whether it is representative (the point is above) or not.

Reed and saman houses

In houses with frame-reed walls, the crate serves as a prop for the reed filling of the frame of the wall holding the clay coating.

The wood frame burns well. That is why the fire hazard of frame houses causes much negativity in their direction. Wooden structures are also susceptible to decay. The manifestation of this effect will primarily depend on humidity. Compared with houses made of brick or concrete, the frame structure has low sound isolation.

The walls of a frame house may well contain lots of pests. In the process of finishing the walls of a frame house, their crate is made. In the empty places of the crate, it is filled with insulation. This makes excellent warm shelters for rodents.

Saman is a building material made of clay soil, straw, and sand. Clay is kneaded and then dry in the open air. Most of the houses are made of straw so that saman houses are sag much more often than wood or brick buildings. The wet walls of the home are soft. Just a little pressure is enough to wreck. These houses are livable only for 30, and a maximum of 50 years.

Due to the reasons listed above it is reasonable to assume that the people living in saman or reed houses are in the first deciles of the Lorenz curve (those who have the least part of the total income).

According to the information contained in statistical collections on the housing stock and national censuses compiled by the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, approximately 31% of the Kazakhstan population live in houses made of reed or saman. Hence it can produce the point which can be compared to the point of the Lorenz curve that corresponds to the first three deciles.

It is feasible to use existing information to test whether income inequality measure is representative.

Sample

The average cost of a square meter of housing in Kazakhstan in February 2021 is 322 968. (kursiv.kz)

In order to determine the average cost per square meter of saman and frame-reed houses, a sample of 260 houses for sale was used.

```
> summary(House)
    place               price               area            ground
 Length:260         Min.   :  800000   Min.   :  9.00   Min.   : 0.050
 Class :character   1st Qu.: 5675000   1st Qu.: 53.90   1st Qu.: 5.000
 Mode  :character   Median :10000000   Median : 72.40   Median : 7.000
                    Mean   :11337500   Mean   : 86.82   Mean   : 8.061
                    3rd Qu.:15000000   3rd Qu.:107.00   3rd Qu.:10.000
                    Max.   :47000000   Max.   :400.00   Max.   :90.000
                                                        NA's   :10
```

To check whether the area of the land plot affects the price of a house linear model is used.

Linear model

$$Price = \beta_0 + \beta_1\, House\ area + \beta_2\, Land\ plot\ area + \beta_3 Region + u_i$$

P-value is 3.679e-11 which is less than 0.05, so we reject the hypothesis of homoskedasticity and assume heteroskedasticity.

Hence Huber-White correction of standard errors is conducted.

```
t test of coefficients:

             Estimate Std. Error t value  Pr(>|t|)
(Intercept)   7647633    3868064  1.9771  0.049207 *
placeAktR    -1542173    4058882 -0.3800  0.704328
placeAlmaty    317803    3855467  0.0824  0.934376
placeAlmR    -4394579    3767199 -1.1665  0.244590
placeAtyR      754522    5087346  0.1483  0.882224
placeEKR     -8501321    3765074 -2.2579  0.024875 *
placeJamR     -389872    4534470 -0.0860  0.931556
placeKarR    -2520367    6161882 -0.4090  0.682897
placeKosR    -4758361    3833433 -1.2413  0.215751
placeKyzR    -7613088    3884673 -1.9598  0.051214 .
placeManR   -11427540    4184502 -2.7309  0.006799 **
placeNKR     -8723162    3737948 -2.3337  0.020464 *
placePavR    -2115607    3937412 -0.5373  0.591567
placeTurR     1550632    4054504  0.3824  0.702479
placeWKR     -2308358    3850676 -0.5995  0.549443
area            85817      11065  7.7557 2.727e-13 ***
ground         -40858      16664 -2.4519  0.014945 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

It is reasonable to assume that houses with greater land plots cost more. However, as we can see from the results is negative, which is a counterintuitive result. It might signalize that houses with smaller land plots are located in better places or, in general, better by some other quality characteristics.

The only variable that affects the price of saman and reed framed houses at 0.001 level of significance is its area.

Test for Lorenz curve of Kazakhstan

Using one sample t-test, check whether the mean value of x is equal to the value of the point of the Lorenz curve that corresponds to the third decile that is 0.1543.

Null hypothesis: true mean is equal to 0.1543

Alternative hypothesis: true mean is not equal to 0.1543

t = -6.0169, df = 259, p-value = 6.041e-09

95 percent confidence interval: [0.1208914 0.1373669]

sample estimate of mean is equal to 0.1291291

P-value is very low, the null hypothesis that the true mean is equal to 0.1543 is rejected at 0.001 level of significance. The true mean of x is lower than the corresponding point of the Lorenz curve for Kazakhstan 2019. With 95 percent probability it is between 0.1208914 and 0.1373669.

Which is a signal that actual level of inequality in Kazakhstan is higher. The reason for such a result may be in the existence of the shadow economy or incompleteness of the official data.

Conclusion

Equity and fairness imply some level of inequality. Hence, it is very important to evaluate economic inequality and study reasons that lead to any change in its level, especially in the level of inequality of opportunities, to achieve a fair and developed society. Nevertheless, determining the level of inequality, significant problems occur. Most of the existing indices measure income inequality, which does not reflect the whole picture. Consumption inequality is smoother than income. However, income inequality is widely used as a proxy for social inequality.

The main problem with evaluating both income and consumption inequality is the lack of information. Hence, it is almost impossible to construct an index that fully reflects consumption inequality.

Housing is a significant determinant of each person's life quality. Housing wealth is a significant component of each person's wealth. It is linked to non-housing consumption through the logic of the budget constraint. Hence existing data on housing can be used to determine whether the Lorenz curve is constructed properly.

According to the information from the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, approximately 31% of the Kazakhstan population live in houses made of reed or saman.

Using the average price of one square meter of houses in Kazakhstan and a sample of saman and frame-reed houses, the variable that evaluates the difference in quality of reed and saman houses compared to average level for Kazakhstan. And its mean value was compared to the point of the Lorenz curve, which corresponds to the third decile of the population of Kazakhstan.

There is significant evidence that the estimated point is lower than the point of the Lorenz curve of Kazakhstan in 2019 that corresponds to the third decile. Theoretically, it must be the other way. It indicates that the actual level of inequality is higher than the one presented by the Lorenz curve. The presence of a shadow economy may cause such divergence.

Hence it is essential to improve collecting statistical data on both consumption and income to make possible the construction of indices that would reflect the real level of economic inequality in Kazakhstan.

References:

Attanasio, Orazio P., & Pistaferri L. (2016). "Consumption Inequality." Journal of Economic Perspectives, 30 (2): 3-28.

Atkinson. A. (1970). “on the Measurement of Inequality. Journal of economic theory 2, 244-263

Meyer, B. D., & Sullivan, J. X. (2011). Viewpoint: Further results on measuring the well-being of the poor using income and consumption. Canadian Journal of Economics/Revue Canadienne D’économique, 44(1), 52–87. doi:10.1111/j.1540-5982.2010.01623.x

De Maio, F. G. (2007). Income inequality measures. Journal of Epidemiology & Community Health, 61(10), 849–852.

Iacoviello, M. M. (2011). Housing Wealth and Consumption. SSRN Electronic Journal.

Muller, E. N. (1995). Economic Determinants of Democracy. American Sociological Review, 60(6), 966.

Bollen, K. A., & Jackman, R. W. (1995). Income Inequality and Democratization Revisited: Comment on Muller. American Sociological Review, 60(6), 983.

Berg, A., Ostry, J. D., Tsangarides, C. G., & Yakhshilikov, Y.
(2018). Redistribution, inequality, and growth: new evidence. Journal of Economic Growth, 23(3), 259–305.

Milanovic, B. (2011). A short history of global inequality: The past two centuries. Explorations in Economic History, 48(4), 494–506.

Kudasheva, T., Kunitsa, S., & Mukhamediyev, B. (2015). Effects of Access to Education and Information-communication Technology on Income Inequality In Kazakhstan. Procedia - Social and Behavioral Sciences, 191, 940–947.

Solt, F. (2011). The Social Origins of Authoritarianism. Political Research Quarterly, 65(4), 703–713

Galor, O., & Moav, O. (2004). From Physical to Human Capital Accumulation: Inequality and the Process of Development. Review of Economic Studies, 71(4), 1001–1026

Lorenz M. O. (1905). Methods of Measuring the Concentration of Wealth, Publications of the American Statistical Association, 9:70, 209-219

Kleiber K., (2007). The Lorenz curve in economics and econometrics, WWZ Working Paper, No. 09/07, University of Basel, Center of Business and Economics (WWZ), Basel

Pyatt G., (1976). On the Interpretation of Gini Coefficients. The Economic Journal, Vol. 86, No. 342 (Jun., 1976), pp. 243-255

Darimbetov B., & Spanov M. (2001). Shadow economy in Kazakhstan: sources and realization mechanisms. № 12, 46-53

Medina, L. & Shneider, F. (2018). Shadow Economies Around the World: What Did We Learn Over the Last 20 Years?, IMF WP 18/17

Adler M. (2013). The Pigou-Dalton Principle and the Structure of Distributive Justice. Duke University . Working paper, May 2013.

De Maio, F. G. (2007). Income inequality measures. Journal of Epidemiology & Community Health, 61(10), 849–852.

Stiglitz, J. E. (2012). Macroeconomic Fluctuations, Inequality, and Human Development. Journal of Human Development and Capabilities, 13(1), 31–58.

Lazear, E. P., & Rosen, S. (1981). Rank-Order Tournaments as Optimum Labor Contracts. Journal of Political Economy, 89(5), 841–864.

Temkin, L. (2015). Equality as Comparative Fairness. Journal of Applied Philosophy, 34(1), 43–60.

Trump, K. (2020). When and why is economic inequality seen as fair. Current Opinion in Behavioral Sciences, 34, 46-51

Filandri, M., & Olagnero, M. (2014). Housing Inequality and Social Class in Europe. Housing Studies, 29(7), 977–993.

Dobbie F., Arthur S., & Jones N. 2010 Building understanding of fairness, equality and good relations in Scotland. Equality and Human Rights Commission Research report 54

Dabla-Norris E., Kochhar K., Ricka F., Suphaphiphat N., & Tsounta E. (2015). Causes and Consequences of Income Inequality: A Global Perspective. https://www.imf.org/external/pubs/ft/sdn/2015/sdn1513.pdf

Zakon.kz, (2020). “On the differentiation of incomes of the population in the Republic of Kazakhstan in 2019”, Paragraph 2020 / 5.0.6.23

https://www.zakon.kz/5019356-o-differentsiatsii-dohodov-naseleniya-v.html

Zakon.kz, (2014).On the differentiation of incomes of the population in the Republic of Kazakhstan for 2014, www.stat.gov.kz

https://online.zakon.kz/Document/?doc_id=39882799#pos=16;-29&sdoc_params=text%3D%25D0%25BE%2520%25D0%25B4%25D0%25B8%25D1%2584%25D1%2584%25D0%25B5%25D1%2580%25D0%25B5%25D0%2

5BD%25D1%2586%25D0%25B8%25D0%25B0%25D1%2586%25D0%25B8%25D0%25B8%2520%25D0%25B4%25D0%25BE%25D1%2585%25D0%25BE%25D0%25B4%25D0%25BE%25D0%25B2%2520%25D0%25BD%25D0%25B0%25D1%2581%25D0%25B5%25D0%25BB%25D0%25B5%25D0%25BD%25D0%25B8%25D1%258F%26mode%3Dindoc%26topic_id%3D39882799%26spos%3D1%26tSynonym%3D0%26tShort%3D0%26tSuffix%3D1&sdoc_pos=0

Kursiv.kz, (2021). “Prices on housing continue to rise in Kazakhstan”

https://kursiv.kz/news/otraslevye-temy/2021-03/ceny-na-zhile-prodolzhayut-rasti-v-kazakhstane

Meyer B., & Sullivan J., (2017). Consumption and Income Inequality in the U.S. Since the 1960s*

Crossley T., & Pendakur K. (2002). Consumption inequality

Costa R. & Perez-Duarte S. (2019). European Central Bank “The measurement of wealth inequality, its decompositions, and an application to European household wealth”

Milanovich B. (2013) Clobal Income Inequality in Numbers:in History and Now. Global policy Volume 4. Issue 2. World Bank.

Hamanaka S. (2008) Inequality and Authoritarianism in the Developing Countries. MPRA Paper No.16798.

Aguiar M. & Bils M. (2015). Has Consumption Inequality Mirrored Income Inequality? American Economic Review 2015, 105(9): 2725–2756

Kapitanov V.A., Ivanova A.A., Maksimova A.Y. (2018) The problems of numerical inequalities estimates. Statistics and Economics. 15(4):4-15.

Протокол анализа Отчета подобия заведующего кафедрой

Заведующий кафедрой заявляет, что ознакомился (-ась) с Полным отчетом подобия, который был сгенерирован Системой выявления и предотвращения плагиата в отношении работы:

Автор: Смолякова Екатерина Ильинична
Название: Construction of Lorenz curves by Consumption Inequality
Координатор: Хрущев Сергей Витальевич
Коэффициент подобия 1: 9%
Коэффициент подобия 2: 2.2%
Замена букв: 0
Интервалы: 0
Микропробелы: 67
Белые знаки: 0

После анализа Отчета подобия констатирую следующее:

☒ обнаруженные в работе заимствования являются добросовестными и не обладают признаками плагиата. В связи с чем, признаю работу самостоятельной и допускаю ее к защите;

☐ обнаруженные в работе заимствования не обладают признаками плагиата, но их чрезмерное количество вызывает сомнения в отношении ценности работы по существу и отсутствием самостоятельности ее автора. В связи с чем, работа должна быть вновь отредактирована с целью ограничения заимствований;

☐ обнаруженные в работе заимствования являются недобросовестными и обладают признаками плагиата, или в ней содержатся преднамеренные искажения текста, указывающие на попытки сокрытия недобросовестных заимствований. В связи с чем, не допускаю работу к защите.

Обоснование:
Все цитаты были оформлены верно и источники указаны корректно в библиографии. Заимствование из одного источника не превышало 1%. Плагиат не был обнаружен после анализа всего текста. Вся работа была выполнена самостоятельно.

4 июня 2021 _____ Аубакирова С.К.
Дата Подпись заведующего кафедрой

Окончательное решение в отношении допуска к защите, включая обоснование:

Допускаю Смолякову Е.И. к защите дипломной работы, согласно анализам отчёта подобия научного руководителя и заведующего кафедрой. Все цитаты были оформлены верно и источники указаны корректно в библиографии. Заимствование из одного источника не превышало 1%. Плагиат не был обнаружен после анализа всего текста. Вся работа была выполнена самостоятельно.

4 июня 2021 _____ Аубакирова С.К.

Дата Подпись заведующего кафедрой

Протокол анализа Отчета подобия Научным руководителем

Заявляю, что я ознакомился (-ась) с Полным отчетом подобия, который был сгенерирован Системой выявления и предотвращения плагиата в отношении работы:

Автор: Смолякова Екатерина Ильинична
Название: Construction of Lorenz curves by Consumption Inequality
Координатор: Хрущев Сергей Витальевич
Коэффициент подобия 1: 9%
Коэффициент подобия 2: 2.2%
Замена букв: 0
Интервалы: 0
Микропробелы: 67
Белые знаки: 0

После анализа Отчета подобия констатирую следующее:

☒ обнаруженные в работе заимствования являются добросовестными и не обладают признаками плагиата. В связи с чем, признаю работу самостоятельной и допускаю ее к защите;

☐ обнаруженные в работе заимствования не обладают признаками плагиата, но их чрезмерное количество вызывает сомнения в отношении ценности работы, по существу, и отсутствием самостоятельности ее автора. В связи с чем, работа должна быть вновь отредактирована с целью ограничения заимствований;

☐ обнаруженные в работе заимствования являются недобросовестными и обладают признаками плагиата, или в ней содержатся преднамеренные искажения текста, указывающие на попытки сокрытия недобросовестных заимствований. В связи с чем, не допускаю работу к защите.

Обоснование: Все цитаты были оформлены верно и источники указаны корректно в библиографии. Заимствование из одного источника не превышало 1%. Плагиат не был обнаружен после анализа всего текста. Студентка сделала очень хороший и полезный обзор разнообразных индексов, связанных с кривыми Лоренца. Она указала много ссылок и проанализировала много литературы. Вся работа была выполнена самостоятельно.

4 июня 2021 _____ Хрущев С.В.
Дата Подпись научного руководителя

Метаданные

Название
Yekaterina Smolyakova diploma project 2021.docx

Автор
Екатерина Смолякова

Научный руководитель
Сергей Хрущев

Подразделение
ИУП

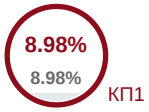
Список возможных попыток манипуляций с текстом

В этом разделе вы найдете информацию, касающуюся манипуляций в тексте, с целью изменить результаты проверки. Для того, кто оценивает работу на бумажном носителе или в электронном формате, манипуляции могут быть невидимы (может быть также целенаправленное вписывание ошибок). Следует оценить, являются ли изменения преднамеренными или нет.

Замена букв	ß	0
Интервалы	A→	0
Микропробелы	·	67
Белые знаки	ß	0
Парафразы (SmartMarks)	a	16

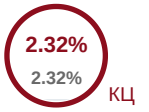
Объем найденных подобий

Обратите внимание!Высокие значения коэффициентов не означают плагиат. Отчет должен быть проанализирован экспертом.



КП1

КП2



КЦ

25
Длина фразы для коэффициента подобия 2

5313
Количество слов

34350
Количество символов

Подобия по списку источников

Просмотрите список и проанализируйте, в особенности, те фрагменты, которые превышают КП №2 (выделенные жирным шрифтом). Используйте ссылку «Обозначить фрагмент» и обратите внимание на то, являются ли выделенные фрагменты повторяющимися короткими фразами, разбросанными в документе (совпадающие сходства), многочисленными короткими фразами расположенные рядом друг с другом (парафразирование) или обширными фрагментами без указания источника ("криптоцитаты").

10 самых длинных фраз

Цвет текста

ПОРЯДКОВЫЙ НОМЕР	НАЗВАНИЕ И АДРЕС ИСТОЧНИКА URL (НАЗВАНИЕ БАЗЫ)	КОЛИЧЕСТВО ИДЕНТИЧНЫХ СЛОВ (ФРАГМЕНТОВ)	
1	http://journals.atu.ac.ir/article_8035.html	32	0.60 %
2	https://www.sciencedirect.com/science/article/pii/S2352154619301329	29	0.55 %
3	http://journals.ums.ac.id/index.php/JEP/article/view/8517	29	0.55 %
4	https://uea.rl.talis.com/lists/952C5B8E-BFED-2670-B504-51132877D183/bibliography.html?style=apa	27	0.51 %
5	**Revisiting the Efficiency-Equity Trade-off: A Muli-objective Linear Problem combined with an extended Leontief Input Output Model** Bernhard Mahlberg,Mikulas Luptacik;	23	0.43 %

6	https://www.cambridge.org/core/journals/social-science-history/article/inequality-and-growth-in-a-developing-economy-evidence-from-regional-data-spain-18601930/802599439621953BD012A8797A684DC7	21	0.40 %
7	https://revistas.javeriana.edu.co/files-articulos/UPSY/18-5%20(2019)/64762249001/	21	0.40 %
8	**The Distributional Impact of Recurrent Immovable Property Taxation in Greece** Panos Tsakloglou,Eirini Andriopoulou,Eleni Kanavitsa,Chrysa Leventi;	20	0.38 %
9	**Shadow Economy and the Related Issues of Tax Evasion in Azerbaijan** Məryəm Kazımlı **5/21/2020** Azerbaijan State University of Economics (UNEC) (Sabah qrupları)	19	0.36 %
10	**Economic growth, inequality and efficiency** Sona Stikarova;	18	0.34 %

из базы данных RefBooks (3.90 %)

ПОРЯДКОВЫЙ НОМЕР	НАЗВАНИЕ	КОЛИЧЕСТВО ИДЕНТИЧНЫХ СЛОВ (ФРАГМЕНТОВ)	
Источник: RePEC			
1	**The Distributional Impact of Recurrent Immovable Property Taxation in Greece** Panos Tsakloglou,Eirini Andriopoulou,Eleni Kanavitsa,Chrysa Leventi;	58 (6)	1.09 %
2	**Top Incomes, Rising Inequality, and Welfare** Agnieszka Markiewicz,Kevin J. Lansing;	32 (2)	0.60 %
3	**Revisiting the Efficiency-Equity Trade-off: A Muli-objective Linear Problem combined with an extended Leontief Input Output Model** Bernhard Mahlberg,Mikulas Luptacik;	23 (1)	0.43 %
4	**Inequality and Economic Development: An Overview** Oded Galor;	18 (1)	0.34 %
5	**Economic growth, inequality and efficiency** Sona Stikarova;	18 (1)	0.34 %
6	**Income inequality and economic growth: an empirical investigation in Mediterranean countries** Roberto Dell'Anno,Adalgiso Amendola;	16 (1)	0.30 %
7	**Is Global Equality the Enemy of National Equality?** Rodrik, Dani;	14 (1)	0.26 %
Источник: Paperity			
1	**Dilemas de la estabilidad democrática en América Latina** Alma ADIART;	19 (2)	0.36 %
2	**Income-related inequalities in diseases and health conditions over the business cycle** Tinna Laufey Ásgeirsdóttir, Hildur Margrét Jóhannsdóttir;	9 (1)	0.17 %

из домашней базы данных (0.00 %)

ПОРЯДКОВЫЙ НОМЕР	НАЗВАНИЕ	КОЛИЧЕСТВО ИДЕНТИЧНЫХ СЛОВ (ФРАГМЕНТОВ)

из программы обмена базами данных (0.56 %)

ПОРЯДКОВЫЙ НОМЕР	НАЗВАНИЕ	КОЛИЧЕСТВО ИДЕНТИЧНЫХ СЛОВ (ФРАГМЕНТОВ)

1	**Shadow Economy and the Related Issues of Tax Evasion in Azerbaijan** Məryəm Kazımlı **5/21/2020** Azerbaijan State University of Economics (UNEC) (Sabah qrupları)	19 (1)	0.36 %
2	**“Mortgage lending in Kazakhstan and its development in the Republic of Kazakhstan”** Alimova A, Sultangali A, Amangaliev S **5/3/2017** NARXOZ (NEU) (Кафедра СЭД (ФМОП))	11 (1)	0.21 %

из интернета (4.52 %)

ПОРЯДКОВЫЙ НОМЕР	ИСТОЧНИК URL	КОЛИЧЕСТВО ИДЕНТИЧНЫХ СЛОВ (ФРАГМЕНТОВ)	
1	https://edoc.unibas.ch/61243/1/20180305133542_5a9d399e439d0.pdf	48 (5)	0.90 %
2	https://www.sciencedirect.com/science/article/pii/S2352154619301329	46 (3)	0.87 %
3	http://journals.atu.ac.ir/article_8035.html	32 (1)	0.60 %
4	http://journals.ums.ac.id/index.php/JEP/article/view/8517	29 (1)	0.55 %
5	https://uea.rl.talis.com/lists/952C5B8E-BFED-2670-B504-51132877D183/bibliography.html?style=apa	27 (1)	0.51 %
6	https://revistas.javeriana.edu.co/files-articulos/UPSY/18-5%20(2019)/64762249001/	21 (1)	0.40 %
7	https://www.cambridge.org/core/journals/social-science-history/article/inequality-and-growth-in-a-developing-economy-evidence-from-regional-data-spain-18601930/802599439621953BD012A8797A684DC7	21 (1)	0.40 %
8	https://link.springer.com/article/10.1007/s10887-017-9150-2	16 (1)	0.30 %

Список принятых фрагментов (нет принятых фрагментов)

ПОРЯДКОВЫЙ НОМЕР	СОДЕРЖАНИЕ	КОЛИЧЕСТВО ИДЕНТИЧНЫХ СЛОВ (ФРАГМЕНТОВ)