Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Trade and Finance

Master's Thesis

Analysis of Energy Pricing: Case Study of Post-Soviet, Developed, and European Countries

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CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

DIPLOMA THESIS ASSIGNMENT

BSc. Jakhongir Khudayberganov

Economics and Management

Thesis title

Analysis of Energy Pricing: Case Study of Post-Soviet, Developed, and European Countries

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Objectives of thesis

The diploma thesis is focused on the analysis of the disparities that exists between three different categories of countries in the context of electricity prices – Post-Soviet republics, developed countries and countries situated in Europe. In addition to that, there is an emphasis put on one specific country from the Post-Soviet Environment – Uzbekistan.

Methodology

The methodology of the work is represented by an extensive econometric analysis involving the use of cross-sectional data capturing prices of electricity for both households and businesses in June 2023. In addition to the econometric analysis, the time series analysis is applied to the case of Uzbekistan. The time period covered in the time series analysis starts in 1991 and finished in 2013 for the majority of variables.

The proposed extent of the thesis

50-60

Keywords

Post-Soviet, Central Asia, energy, prices, post-pandemic, developed countries, Europe

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Recommended information sources

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Expected date of thesis defence

2023/24 SS – PEF

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Declaration

I declare that I have worked on my diploma thesis titled "Analysis of Energy Pricing: Case Study of Post-Soviet, Developed, and European Countries" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the master's thesis, I declare that the thesis does not break any copyrights.

In Prague on 31.03.2024 _____

Acknowledgement

I would like to thank Ing. Ghaeth Fandi, Ph.D. and all other persons, for their advice and support during my work on this thesis.

Analysis of Energy Pricing: Case Study of Post-Soviet, Developed, and European Countries

Abstract

The diploma thesis is focused on the analysis of the disparities that exist between three different categories of countries in the context of electricity prices – Post-Soviet republics, developed countries and countries situated in Europe. In addition to that, there is an emphasis put on one specific country from the Post-Soviet Environment - Uzbekistan.

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It is concluded that prices of electricity are lower in the Post-Soviet space for both businesses and households, while for both developed and European countries, the prices are higher. The highest prices are identified in Europe. When it comes to the country of focus, it is concluded that the situation with the energy industry is quite complicated and if the country will not lower the degree of dependency on fossil fuels, the environment is likely to deteriorate even more. It is vital for Uzbekistan to put additional emphasis on renewable energy sources.

Keywords: Post-Soviet, Central Asia, energy, prices, post-pandemic, developed countries, Europe

Analýza cen energií: Případová studie postsovětských, rozvinutých a evropských zemí

Abstrakt

Diplomová práce je zaměřena na analýzu rozdílů mezi třemi různými kategoriemi zemí v kontextu cen elektřiny – postsovětskými republikami, vyspělými zeměmi a zeměmi nacházejícími se v Evropě. Kromě toho je kladen důraz na jednu konkrétní zemi z postsovětského prostředí-Uzbekistán.

Metodiku práce představuje rozsáhlá ekonometrická analýza zahrnující využití průřezových dat zachycujících ceny elektřiny pro domácnosti i podniky v červnu 2023. Kromě ekonometrické analýzy je analýza časových řad aplikována na případ Uzbekistánu. Časové období zahrnuté v analýze časových řad začíná v roce 1991 a končí v roce 2013 pro většinu proměnných.

Dospělo se k závěru, že ceny elektřiny jsou v postsovětském prostoru nižší jak pro podniky, tak pro domácnosti, zatímco pro rozvinuté i evropské země jsou ceny vyšší. Nejvyšší ceny jsou uvedeny v Evropě. Pokud jde o zemi zaměření, dochází k závěru, že situace s energetickým průmyslem je poměrně komplikovaná a pokud země nesníží míru závislosti na fosilních palivech, životní prostředí se pravděpodobně ještě zhorší. Pro Uzbekistán je zásadní klást další důraz na obnovitelné zdroje energie.

Klíčová slova: Post-sovětský, střední Asie, energie, ceny, postpandemické, rozvinuté země, Evropa

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List of abbreviations

UN	United Nations
EU	European Union
USD	United States Dollar
CSTO	Collective Security Treaty Organization
NATO	North Atlantic Treaty Organization
EAEU	Eurasian Union
CIS	Commonwealth of Independent States
GDP	Gross Domestic Product
GNI	Gross National Income
OLS	Ordinary Least Squares
USSR	United Soviet Social Republics
ANOVA	Analysis of Variance
IT	Internet Technologies

1 Introduction

Electricity and energy are two elements that drive everything forward – economies, societies, firms and all other countless elements that exist within individual societies. Energy is an especially complex topic in countries that are not abundant in natural resources or do not possess developed an industrial sector, which is almost always inevitably accompanied by a strong energy sector. Yet, this is surely not the case for least developed and some developing countries that have just recently initiated the process of structural change and economic transformation.

However, as the world has managed to recover from the pandemic of coronavirus, it had to face another crisis that was strongly associated with the energy sector and energy-related resources that emerged as a response to the invasion of Russia in Ukraine. As a consequence of this, the prices for all types of energy have risen all over the world, thus driving the inflation rates up, notably in Europe and other non-abundant countries in natural resources. In the context of the ongoing energy crisis and astonishingly high inflation, the decision to conduct a similar kind of analysis was made (Borowski, 2022).

The diploma thesis is concerned with the quantification of disparities that exist between different countries in terms of the electricity pricing for both households and businesses, with the emphasis being put on the former Soviet republics, European countries and developed countries. The diploma has tremendous importance given that not much empirical contribution has been made based on the latest available data reflecting the energy pricing in Spring-Summer 2023.

Furthermore, the findings of the thesis, as well as the reflections dedicated to the specific state that is analyzed in the thesis separately – Uzbekistan, can help to shape robust recommendations that will help countries such as Uzbekistan to achieve long-run energy efficiency with the lowest possible external cost for inhabitants of the country. The methodology of the work is represented by the empirical analysis, where two specific techniques are implemented – the econometric analysis and the time series analysis. Both methods are used in tandem in order to provide a more comprehensive overview of the

studied topic. In the end, the results of the finding are compared with other relevant contributions generated by prominent scholars.

2 Objectives and Methodology

2.1 Objectives

The main objective of this diploma thesis lies in the analysis of the electricity market after the pandemic of COVID-19. The analysis aims at quantifying the disparities that exist between different groups (according to their economic classification) of countries, where the largest emphasis is put on the post-Soviet environment and republics that were once parts of the USSR.

Furthermore, the thesis has an additional objective of describing the situation with the energy development in one selected country from the post-Soviet environment – Uzbekistan, a state from the Central Asian region that has the largest population in the region with approximately 35 million inhabitants. The thesis seeks to fulfil both objectives through the implementation of empirical techniques that are discussed in more detail in the methodology sub-section.

2.2 Methodology

The methodology of the diploma thesis relies strongly on econometric estimation, where the technique of cross-sectional data analysis is the one that is used for the linear regression analysis. To be more specific, the empirical analysis aims at quantifying differences that exist between different groups of countries based on a predefined set of criteria, such as developed countries, European countries and countries once forming part of the Soviet Union. The application used for the estimation is Gretl, and the ordinary least squares method is applied, where estimated parameters are calculated according to the formula (1):

$$\begin{matrix}\beta_0 \\ \beta_1 \\ \beta_n\end{matrix} = (X^T X)^{-1} X^T Y \qquad (1)$$

Furthermore, the time series analysis is also applied, which is used for the descriptive analysis of Uzbekistan's energy industry and the situation with the development in that

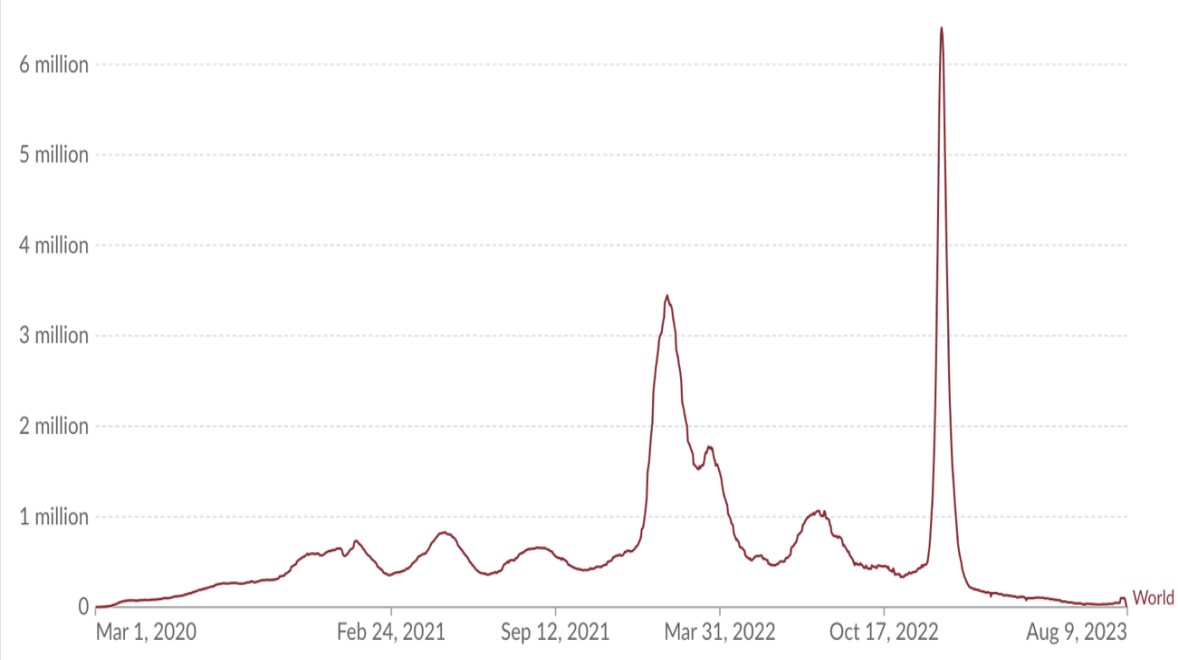
domain. For the time series analysis, Microsoft Excel is mainly used, where graphs and trends for specific selected variables are generated. The timespan covered in the time series analysis is between 1991 and 2013. For the cross-sectional data analysis, the data represents June 2023.

3 Literature Review

3.1 Economic Effects of the Pandemic

The emergence of the COVID-19 pandemic in the latter part of 2019 had significant and wide-ranging implications for the worldwide economy. This chapter examines the complex economic consequences of the epidemic, including interruptions in supply chains, changes in consumer behaviour, fluctuations in the labour market, and policy measures implemented by governments to alleviate the economic impact. This chapter provides a thorough analysis of the many problems and opportunities that arose in the economic sphere during this exceptional period. Before dwelling on the narrative, it is vital to introduce a chart that will describe the daily new confirmed COVID-19 cases, which is presented in Figure 1 (Nicola, 2020).

Figure 1, daily new confirmed COVID-19 cases in the world



Source: Our World in Data, 2023

The worldwide supply chains were significantly affected by the epidemic, so shedding light on the risks associated with just-in-time manufacturing and the considerable reliance on a few numbers of critical suppliers. The implementation of lockdown measures, imposition of mobility restrictions, and the occurrence of workforce shortages have had a

disruptive impact on industrial processes, resulting in a scarcity of essential commodities. Industries that exhibit a strong dependence on global commerce, such as the automobile and electronics sectors, encountered significant challenges as a result of these disruptions. The aforementioned experience emphasized the significance of diversifying supply chains and bolstering resilience by means of localizing and digitizing production processes (Al-Thaqeb et al., 2022).

The COVID-19 epidemic has acted as a catalyst for substantial transformations in consumer behaviour, leading to the redefinition of both spending habits and tastes. The implementation of lockdowns and social distancing measures has resulted in a significant increase in the utilization of e-commerce platforms, as consumers have actively sought out online alternatives. Simultaneously, expenditures on travel, hospitality, and entertainment experienced a significant decline. The implementation of remote work arrangements and the subsequent increase in time spent at home has resulted in a surge in demand for home remodelling and technology products. Conversely, there has been a fall in discretionary spending on luxury items. The alterations in behaviour not only presented difficulties for enterprises but also created opportunities for innovation and adjustment (Ceylan et al., 2020).

The global pandemic has had a significant and far-reaching effect on the labour market, resulting in widespread job losses and substantial changes to work arrangements. The implementation of lockdown measures resulted in the mandatory cessation of business operations, primarily within the service industry, which subsequently led to a significant increase in the number of employees being placed on furlough or experiencing job terminations. Individuals employed in informal and gig economies faced heightened vulnerability due to their limited job stability and inadequate access to social safety nets. The adoption of remote work has become commonplace for a significant number of individuals, resulting in notable consequences for office real estate, urban development, and the equilibrium between professional and personal life. Moreover, the crisis has brought attention to the significance of allocating resources towards reskilling and upskilling initiatives in order to tackle labour market disparities and enhance the adaptability of the workforce (Jackson et al., 2020).

Governments worldwide have implemented a variety of fiscal and monetary measures in response to the economic repercussions of the pandemic. Fiscal stimulus measures encompassed a range of interventions, such as direct monetary disbursements, unemployment assistance, and financial support allocated to enterprises. Central banks have implemented unconventional monetary policies, including the reduction of interest rates and the implementation of quantitative easing, in order to stabilize financial markets and enhance liquidity. The primary objective of these actions was to mitigate the risk of systemic collapse and establish the necessary foundation for economic revitalization. Nevertheless, these developments also presented certain obstacles, including the escalation of public debt levels and apprehensions regarding future inflationary forces (Fernandes, 2020).

The COVID-19 epidemic has exacerbated pre-existing socioeconomic disparities and has had a disproportionate impact on marginalized and disadvantaged groups. Job losses and shortened work hours disproportionately affected low-income individuals, minorities, and women. The virus's impact on underprivileged groups was intensified due to the combination of limited healthcare accessibility and densely populated living environments. The presence of disparities in digital access has brought attention to the concept of the "digital divide," which serves as a barrier to educational and economic prospects for individuals lacking dependable internet connectivity. The resolution of these gaps emerged as a central objective for policymakers seeking to promote a fair and just recuperation (Deb, 2022).

During the course of the pandemic, a number of significant structural alterations were apparent, which are expected to have enduring consequences. The phenomenon of accelerated digital transformation has been apparent in various industries, leading to the restructuring of business models and the alteration of customer relations. The popularity of remote employment has sparked debates regarding its long-term sustainability and its potential to reshape metropolitan environments. Moreover, the phenomenon of globalization has come under heightened examination, as there have been discussions regarding the possibility of reshoring production and the need to bolster self-sufficiency in key sectors. These modifications suggested possible adjustments in the economic environment following the epidemic. One example of an infographic about Indonesia containing the biggest implications of the pandemic is presented in Figure 2 (Weiss et al., 2020).

Figure 2, the costs of COVID-19 for Indonesia

Source: UNDP, 2023

3.2 Energy Market

The energy sector, on a worldwide scale, has experienced substantial changes in recent decades, mostly influenced by developments in technology, growing environmental awareness, and evolving geopolitical circumstances. The energy market and the electricity market are integral elements of the landscape, exerting significant influence on economic development, sustainability, and national security. This essay offers a thorough examination of the aforementioned marketplaces, exploring their interconnectedness and the fundamental factors that drive their operations (Regulator, 2021).

The energy market functions as a comprehensive platform that encompasses a wide range of energy resources, such as fossil fuels, renewable energy sources, nuclear power, and others. It functions as the fundamental basis by which societies fulfil their energy requirements for a multitude of uses, encompassing transportation, industrial operations, and household usage. The energy industry is significantly influenced by a key factor, namely the increasing acknowledgement of the limited availability of fossil fuels and the imperative to shift towards sources that are both sustainable and environmentally benign.

As a consequence, there has been a proliferation of energy sources within the portfolio, characterised by a growing proportion of renewable options such as solar, wind, and hydropower. Furthermore, the significance of energy security and self-sufficiency has been underscored by geopolitical factors, supply chain interruptions, and volatile global oil prices. As a result, countries have been compelled to reassess their energy composition and strategic reserves (Ebrahiamian et al., 2018).

The electricity market is a significant component within the larger energy market, with a specific focus on the production, transmission, and use of electrical energy. The relevance of the electrical market stems from its crucial function as a facilitator of economic endeavours and a fundamental pillar of contemporary civilization. The progression of technology in the field of power generation has resulted in increased efficiency, less emissions, and improved control of the electrical grid. The enhanced integration of smart grids and digital technology has facilitated more effective management of demand-response, real-time monitoring, and enhanced energy saving. In addition, there has been an increasing

adoption of regulations aimed at reducing carbon emissions in the electricity production sector. These policies aim to address the environmental consequences associated with conventional energy sources while also stimulating the development and utilisation of cleaner and more sustainable alternatives (Regulator, 2007).

The dynamic relationship between the energy market and the electrical market is complex and mutually supportive. The generation of electricity is dependent on a diverse range of energy sources, encompassing coal, natural gas, nuclear power, and renewable energy. The composition of energy sources utilised for electricity generation is substantially influenced by several factors within the energy market, such as availability, cost, and environmental considerations.

On the other hand, advancements in power generation technology and improvements in efficiency have a direct influence on the overall sustainability and resilience of the wider energy market. The increasing prevalence of electric vehicles has significant implications for both the transportation industry and the power sector since it requires a flexible and resilient electricity infrastructure to meet the evolving demand (Kong et al., 2020).

The functioning of these markets is underpinned by many essential aspects. The primary concern at hand is that of environmental sustainability. Given the increasing apprehension surrounding climate change and air quality, there exists a burgeoning necessity to mitigate the carbon emissions linked to energy generation and utilisation. Consequently, there has been a rise in regulatory interventions, the implementation of emissions trading systems, and the provision of incentives to encourage the use of renewable energy sources. The worldwide commitment of the Paris Agreement to limit temperature rise underscores the imperative for substantial transformations in energy production and consumption (Miskiewicz, 2018).

Technological innovation is another significant determinant. The transformation of electricity production and consumption is being driven by advancements in energy storage, grid management, and distributed energy resources. Energy storage devices, such as batteries and pumped hydro storage, contribute to the enhancement of grid stability by effectively storing surplus energy to be utilised during peak demand periods. Furthermore, the emergence of distributed energy resources, such as rooftop solar panels and microgrids,

enables customers to actively engage in energy generation and management, possibly alleviating the burden on centralised networks (Bremdal et al., 2017).

Policy and regulation exert significant influence in shaping the energy and electricity markets. Governments implement regulations with the aim of encouraging the adoption of renewable energy sources, fostering energy efficiency, and establishing equitable competition within the market. Regulatory frameworks play a crucial role in upholding the reliability of the grid, safeguarding consumer interests, and permitting the incorporation of emerging technology. Nevertheless, the task of achieving a harmonious equilibrium between market liberalisation and guaranteeing widespread availability of cost-effective energy persists as a formidable obstacle in numerous geographical areas (Immonen et al., 2020).

3.3 Development of the Post-Soviet Environment

The official collapse of the Soviet Union took place at the end of 1991, but the practical collapse started slightly earlier when the majority of republics who were not in favour of the Union in the first place decided to leave it without witnessing the future of the USSR and related republics. Such republics were the Baltic countries – Latvia, Estonia, Lithuania, Georgia and Azerbaijan. However, other countries did follow, so the fate of the Union was already decided. The map of the Soviet Union with individual republics forming the Union is presented in Figure 3 (Marples, 2011).

Figure 3, the map of the USSR

Source: Mappr, 2022

After the final collapse happened, the majority of countries decided to cooperate thus establishing the CIS – the Commonwealth of Independent States, where just the Baltic countries were absent from the newly established organization due to their preference for

European integration instead. Following the creation of the CIS, there were other organizations mainly dedicated to other spheres of governmental activity created, such as the CSTO, standing for the Collective Security Treaty Organization that aimed at uniting some countries from the post-Soviet environment in terms of military power, thus avoiding an excessive presence of the NATO in the region. Ultimately, one of the most recent organizations created between the countries was the EAEU, standing for the Eurasian Union that abolished tariffs and created a free trade area between Armenia, Belarus, Kyrgyzstan and the Russian Federation (Busygina & Filippov, 2021).

The effects of the created organizations and strengthened cooperation were diverse – some scholars claim that joining the organizations indirectly led by Russia can be considered to be a grave mistake by newly established states, but others indicate that this was the best decision under the circumstances of very high uncertainty. The following subchapters are aimed at the breakdown of specific spheres in which the post-Soviet environment was developing over the course of the last 30 years marking their independence and the collapse of the Soviet Union (Libman, 2011).

As it was mentioned slightly earlier in the narrative, there were numerous organizations that were created between the countries of the former Soviet Union, where two particular ones stand out in the context of this subchapter – the CIS and the EAEU. In essence, after the collapse of the Union, the republics managed to inherit not just industrial systems and specific specializations associated mainly with the abundance of each country but also economic ties between their former neighbours represented today by individual states (Libman & Vinokurov, 2012).

In addition to that, it is vital to specify that some countries had not never ever existed in their modern form with borders being drawn during the Soviet reign, which was especially the case in Central Asia, where newly drawn borders created a fair number of tensions and problems that soon led to major international conflicts. All those factors, to some extent, contributed to the development of countries and the relationships between them. Scholars who analyze the post-Soviet environment, when addressing the economic development of those republics after the collapse of the Union, tend to analyze some of those countries jointly, thus splitting 15 republics in specific categories and regions, respectively, to the

economic specialization of countries and their geographic position. The following paragraphs are aimed at briefly addressing each of such regions with regard to their economic development after the collapse of the Soviet Union (Libman, 2007).

1) Central Asia

Figure 4, the map of Central Asia

Source: Atkinson, 2016

The first category of countries that are often analyzed together are Central Asian states (Figure 4), which are Uzbekistan, Kazakhstan, Kyrgyzstan, Tajikistan and Turkmenistan. In essence, one of the most frequently encountered descriptions of those states in the academic world involves the utilization of the word "autocracy", which is seen as a major problem in the region without any exception. As a matter of fact, the early development of those republics was indeed marked by no change in the ruling class of those countries, where national elections were often nominal rather than having any real meaning (Rustemova, 2011).

On the other hand, the aforementioned problem did not prevent those republics from entering the path of rapid economic growth and recent industrialization that is aimed at decreasing the dependence of those countries on the agrarian sector. However, it is important to specify that in some countries of the region, the emphasis on the agrarian sector was not so strong, but it can be applied to just the case of Kazakhstan. The latter has an abundance of natural resources like oil and gas, so the country's focus for a very long time remained to be the oil and gas industry.

This abundance led to the fact that Kazakhstan's economic situation is significantly better than the situation of other countries from the region, which is also explained by the fact that the country tends to strongly cooperate not just with the Russian Federation and China but also with the West through direct export of oil and oil-related commodities. The country managed to make a huge leap forward and increase not just the size of its economy but also the level of development and national income (Myant & Drahokoupil, 2010).

Kyrgyzstan, compared to Kazakhstan, is less lucky in terms of the abundance of natural resources. The country that is significantly smaller than its counterpart has almost no oil and gas due to its mountainous geographic position, but the country has a lot of gold, so Kyrgyzstan does not hesitate to export the commodity elsewhere, which is one of the most exported commodities from the country.

However, in other industries and spheres of human activity, the country had considerable problems that were mainly explained by political instability and a large number of revolutions that took place over the course of its short history. The country remains significantly dependent on its cooperation with Kazakhstan, especially in the context of tensions that often arise with its other neighbour – Tajikistan, over disputed territories arising from the Soviet-drawn borders (Temurshoev, 2004).

Uzbekistan is one of the most promising states in the region that is often viewed as a potential candidate to replace the economic hegemony of Kazakhstan in the region. Uzbekistan has the highest population in the region, with almost 35 million people and a relatively young population which makes the country extremely abundant in the labour

factor of production. The country's main focus was concentrated on the agrarian sector until lately, but the country has recently started to pay a lot of attention to the program aimed at expanding the share of industry in the total GDP of the country, while the share of services has already been pretty high mainly due to the large population of the country (Tsereteli, 2018).

Tajikistan is a country that, for nearly a decade, suffered from the Civil War and its consequences that significantly deteriorated the economy of the newly established republic. As a consequence of the war, many people from the country had to flee and find their residence elsewhere, so the population of the republic diminished dramatically. However, high rates of fertility and demographic boom in the 00s and late 10s are expected to yield considerable results for the republic, thus increasing its economic potential. The country is largely focused on two specific specializations – the agrarian sector and the extraction and subsequent export of gold and other precious metals (Jha & Tashrifov, 2010).

The country's economy is considered to be one of the weakest ones due to its unfavourable geographic position with just a small number of countries with whom Tajikistan can directly cooperate. Afghanistan has always been a troubled neighbour not just for Tajikistan but for other countries from the region as well, while the relationship with Kyrgyzstan today is marked by an ongoing political and military conflict because of the disputed territory.

The country's relationship with Uzbekistan was pretty much absent during the presidency of Islam Karimov, but after the political change in the latter, the two countries opened the border and started to trade once more, thus resulting in a higher economic potential for both countries (World Bank Group, 2017).

Turkmenistan is often regarded as the worst country from all possible perspectives due to the totalitarian nature of the government in the country. The country is almost entirely closed to the rest of the world, with almost no opportunities for the domestic population to leave the country for work or another kind of immigration. The country's main specialization is the extraction and export of gas and other natural resources (Durdyev & Ismail, 2012).

2) South Caucasus

Figure 5, the map of the South Caucasus

Source: ReliefWeb, 2023

The South Caucasian region, whose map is presented in Figure 5, is one of the smallest regions in terms of both surface and population, as well as in terms of the economic output of the region. The total population of all countries combined is equal to just approximately 15 million people, with the total economic output being somewhat close to the level of 90 billion USD, which is quite low (Chang et al., 2013).

On the other hand, despite a relatively low level of economic output, the level of development of those countries is much more advanced than the level of Central Asian states due to higher figures of the GDP and GNI per capita in the region. However, the region itself is also torn from the inside by countless conflicts and international issues that arise within, where the two biggest ones are the war and consequent occupation of Georgian territory by Russia in 2008 and the war between Azerbaijan and Armenia that lasted for nearly 30 years thus significantly diminishing the potential of both countries to achieve economic growth in the long run (Dermendzhieva, 2011).

Georgia is often treated as the most promising country in the region mainly due to its geographic position and access to the Black Sea, which allows the country to be a huge

trading hub and also be highly specialized in tourism. The country's main specification lies in the service sector, but the share of agriculture is also quite high. The country has almost no abundance of natural resources, so it is largely dependent on cooperation with Azerbaijan due to the fact that cooperation with the Russian Federation is not viewed as something desirable by the country (De Waal, 2012).

Armenia is the smallest country in terms of both population and economic output, which is mainly explained by the fact that the majority of Armenians are scattered around the globe due to the events that took place earlier in the 20th century and resulted in almost no cooperation and relationship with Turkey. Unluckily for the country, there is also no trade with its other neighbour due to the ongoing military conflict over the disputed territory of Karabagh. The country is specialized in industry and services, with the share of agriculture being also pretty distinctive and considerable (Manucharyan, 2021).

Azerbaijan is the biggest economic powerhouse in the region, whose economy exceeds the level of both earlier mentioned countries combined, which is mainly justified by the country's explicit focus on the export of oil and gas, where the country has a huge degree of abundance. However, this abundance of the country is often treated as a curse due to the country's reluctance to diversify its economy, potentially achieving the case of the Dutch disease. Furthermore, the economic situation and potential of the country are constrained by the ongoing conflict with Armenia (Hasanov, 2013).

3) Moldova, Ukraine and Belarus

Figure 6, the map of Moldova, Ukraine and Belarus

Source: The Economist, 2023

The map of those countries is presented in Figure 6. After the dissolution of the Soviet Union in 1991, Moldova had significant obstacles in its shift towards an economy based on market principles. The sudden discontinuation of subsidies and economic connections originating from the former Soviet Union resulted in a significant decrease in industrial production and trade. The Moldovan economy, which heavily relies on agriculture, faced challenges in adjusting to the requirements of global markets, exacerbated by political instability and ethnic tensions.

The implementation of economic reforms encountered obstacles in the form of corruption, insufficient infrastructure, and a dearth of foreign investment. The economic landscape of Moldova has been significantly shaped by its dependence on remittances from its diaspora, with a special emphasis on those residing in Russia and Europe. Over the course of its development, the nation has made concerted efforts to foster industry diversification, facilitate international investment, and participate in regional trade accords. Notwithstanding these endeavours, enduring obstacles like political polarisation and the protracted Transnistrian conflict have hindered Moldova's complete realisation of its economic development capacity (Stratan & Chistruga, 2012).

Ukraine initiated a multifaceted economic transformation subsequent to the disintegration of the Soviet Union. Ukraine encountered challenges in the process of transitioning its industries towards market-oriented practices, despite the possession of a substantial industrial foundation inherited from the Soviet era. The sudden decline in conventional markets and the interruption of energy sources further intensified economic challenges. Despite facing initial challenges, Ukraine progressively implemented policies aimed at economic liberalisation, privatisation, and attracting foreign investment.

The nation's abundant agricultural resources and proficient labour force have played a significant role in fostering its potential for economic expansion, resulting in notable progress in industries such as information technology services and heavy machinery manufacturing. Nevertheless, the presence of political instability, institutional shortcomings, and corruption has impeded the achievement of lasting economic improvement. The economic development of Ukraine has faced additional hurdles due to persistent geopolitical conflicts, particularly with Russia. This highlights the complex relationship between political and economic elements in Ukraine's trajectory since the Soviet era (Pienkowski, 2020).

After the fall of the Soviet Union, Belarus pursued a unique economic trajectory that was characterised by the retention of state-controlled enterprises and more gradual implementation of liberalisation measures. During Alexander Lukashenko's tenure, Belarus upheld a significant level of governmental engagement in its economy, ensuring the protection of crucial sectors through state ownership and subsidies. Although this particular

method initially offered stability and mitigated the sudden economic downturn observed in certain adjacent states, it concurrently hindered the progress of innovation and efficiency. The economic sustainability of Belarus was supported by its reliance on subsidised energy resources from Russia, which simultaneously hindered its efforts to diversify its economy. In recent times, Belarus has encountered several obstacles pertaining to political repression, strained diplomatic ties, and a decline in support from Russia. These issues have led to a reassessment of the economic model, advocating for a more equitable strategy that maintains government intervention while promoting the expansion of the private sector and pursuing novel trade alliances (Ioffe, 2004).

4) The Baltic Region

Figure 7, the map of Baltic countries

Source: Britannica, 2023

The Baltic states, whose map is presented in Figure 7, are definitely the most developed ones out of the whole post-Soviet environment, which is explained by both the level of development and economic growth of all countries from the region. In essence, the degree of integration between the countries is so high that they are often viewed as an integral actor in international economy and politics, which is mainly justified by the fact that the countries managed to join the EU in 2004 after taking the path of the European integration (Erixon, 2010).

The countries' economies are not large, with an incredibly high emphasis on the service sector and huge progress in the IT industry, where the group of countries is especially regarded as the ones having outstanding progress in digital economies and digitalization of societies. Furthermore, the fact that the countries participate in both the Eurozone and the European single market allows those republics to enjoy the gains from their European integration even more (Streimikiene & Kacerauskas, 2020).

On the other hand, the pro-European orientation of those republics resulted in a relatively complicated relationship with the Russian Federation and Belarus that in 2022-2023 has become downright hostile and aggressive, with the volumes of trade dropping to absolutely insignificant figures (Chakars & Ekmanis, 2022).

5) The Russian Federation

The Russian Federation, in the context of the narrative, is discussed separately due to the fact that the country was the main heir of the central government of the USSR and inherited the majority of the ways that were exercised by the former Union. The map of the country is presented in Figure 8.

Figure 8, the map of the Russian Federation

Source: Britannica, 2023

The shift from a centrally planned economy to a market-oriented system in Russia's post-Soviet economic environment was characterised by its sudden nature. The initial stages of this shift were characterised by significant economic contraction, including hyperinflation, a drastic decrease in industrial production, and a notable fall in living conditions. The swift process of pricing and trade liberalisation, along with the breakdown of economic connections established during the Soviet era, played a significant role in fostering an economic climate marked by disorder and unpredictability (Brainerd, 1998).

In light of these obstacles, the Russian authorities initiated a sequence of economic changes guided by the ideas of shock therapy and liberalisation. The objective of the "voucher privatisation" initiative was to facilitate the transfer of state-owned firms to private ownership, with the purported intention of promoting competition and enhancing market efficiency. Nevertheless, the aforementioned process was tainted by instances of corruption, the practice of asset stripping, and the consolidation of economic influence within a limited

group of privileged individuals. The state's lack of efficient regulation and oversight of the privatisation process impeded fair economic progress and facilitated the rise of an oligarchic elite (Zinchenko et al., 2017).

Moreover, the fiscal condition in post-Soviet Russia was marked by insufficient revenue and budget deficits. The dissolution of centralised fiscal processes inside the Soviet Union posed a significant obstacle for the Russian Federation in its efforts to build a novel tax and revenue collecting system. Over the course of time, there have been endeavours to optimise tax policy and enhance methods for revenue collection. However, challenges such as tax evasion and the prevalence of informal economic activities have remained, hindering the government's ability to fund public services and infrastructure.

The role of the global oil market was of significant importance in influencing Russia's economic trajectory over the specified time. Russia possesses considerable amounts of energy resources, specifically oil and natural gas, which have bestowed upon the country a major cash stream. During the late 1990s and early 2000s, there was a notable increase in world oil prices, which had a positive impact on Russia's budgetary situation and facilitated its economic recovery. Nevertheless, the heavy dependence on energy exports has raised apprehensions regarding the susceptibility of the Russian economy to variations in commodity prices, thereby emphasising the imperative need for diversification (Cooper, 2006).

In the face of these obstacles, measures were implemented to initiate reforms in Russia's financial system and facilitate the attraction of international investment. The objective of banking and financial market reforms was to establish openness and stability in the financial system. However, challenges such as corruption, insufficient investor trust, and regulatory deficiencies continued to exist. The creation of the Moscow International Currency Exchange and the Russian Trading System was a significant step in the process of incorporating Russia into the worldwide financial framework (Kudrin & Gurvich, 2014).

During the early 2000s, the Russian economy demonstrated indications of recuperation and expansion, which can be attributed, at least in part, to the implementation of cautious budgetary measures, the escalation of oil prices, and the enhancement of macroeconomic

stability. This particular time frame aligned with the tenure of Vladimir Putin as the President, during which there was a notable occurrence of endeavours aimed at augmenting governmental authority over significant economic domains, particularly the oil industry. State-owned firms, notably as Gazprom and Rosneft, have played a crucial role in the economy, solidifying the government's control over vital industries (Bobylev & Solovyeva, 2017).

4 Practical Part

4.1 Households Model

The essence of the practical part of the model mainly lies in the estimation of econometric models that will help to quantify disparities between the selected categories of countries. In the first subchapter of the practical part of the diploma thesis, the main focus is paid to the price of one kilowatt of electricity per hour used by households. Before proceeding to the estimation, itself, it is vital to lay the basis of the econometric model by formulating the preceding economic model.

Given the fact that the cross-sectional data is concerned with the total number of observations well above 100, it is essential to find the main criteria that are expected to properly address factors creating disparities in prices of electricity in the selected sample containing prices as of June 2023. The main focus of the thesis is describing the situation in the post-Soviet environment, so for this purpose, the first category of countries included in the linear estimation are former republics of the Soviet Union.

Additionally, it is wise to anticipate that developed countries will have a higher price for electricity, which directly arises from higher price levels and a greater purchasing power of households. Henceforth, the second category of countries included in the econometric estimation are developed countries, according to the classification of the UN.

At last, in order to draw additional interesting insights, the third category representing the countries directly situated in Europe is included. This category is used for the quantification purpose of the European region and not just the members of the EU. It is also anticipated that European countries will have a higher price of electricity. At last, the economic model formulated in the diploma thesis for the household electricity price has the following structure:

$$P_e = f(SOVIET, DEV, EUR)$$

Now, after formulating the theoretical model, it is essential to proceed to the specification of the estimation technique and other traits of the econometric model that will be estimated in the diploma thesis. The model will definitely have a linear structural form due to the fact that there will be dummy variables having the values of either "0" or "1". In addition to that, the model does not contain any quantitative variables, so it is possible to suggest that the model that will be estimated is the three-way ANOVA, where the effect of three factors – common history in the USSR, developed country classification and European location influence the selected response variable – the price of electricity. Furthermore, it is anticipated that the sign of the Soviet history factor will be negative since the majority of countries once forming part of the USSR have a relatively lower price level than the developed world; the sign of the developed factor will have a positive sign due to higher price level in developed countries, and the sign of Europe variable will also have a positive sign due to the fact that Europe is not really abundant in energy resources, and the price level in those countries are higher. Henceforth, the econometric model has the following form:

$$P_e = \beta_{11} - \beta_{12}SOVIET + \beta_{13}DEV + \beta_{14}EUR + U_e$$

The error term included at the end of the model has huge importance due to the fact that similar ANOVA models are quite commonly not able to fully explain the majority of variation in the dependent variable, so there are quite many variables not included in the model and the error term describes all of those variables that are not included.

In addition to that, there are additional assumptions for the model, such as homoscedastic residuals that have no serial correlation, but this will almost certainly be violated due to the potential high presence of outliers, which is quite common. For this purpose, the original OLS methodology used in the diploma thesis will be modified, and robust standard errors that will yield unbiased results will be implemented in the thesis. Based on the data from GlobalPetrolPrices, the dataset presented in Table 1 was created.

Table 1, the households dataset

Country	KwH	Soviet	Developed	Europe
Lebanon	0.001	0	0	0
Iran	0.002	0	0	0
Syria	0.005	0	0	0
Ethiopia	0.006	0	0	0
Sudan	0.008	0	0	0
Kyrgyzstan	0.01	1	0	0
Libya	0.011	0	0	0
Angola	0.014	0	0	0
Zimbabwe	0.015	0	0	0
Iraq	0.015	0	0	0
Bhutan	0.016	0	0	0
Suriname	0.016	0	0	0
Uzbekistan	0.025	1	0	0
Oman	0.026	0	0	0
Egypt	0.027	0	0	0
Burma	0.029	0	0	0
Kuwait	0.029	0	0	0
Nigeria	0.029	0	0	0
Zambia	0.03	0	0	0
Cuba	0.03	0	0	0
Laos	0.031	0	0	0
Qatar	0.032	0	1	0
Argentina	0.033	0	0	0
Ukraine	0.039	1	0	1
Algeria	0.04	0	0	0
Afghanistan	0.043	0	0	0
Nepal	0.044	0	0	0
Venezuela	0.046	0	0	0
Azerbaijan	0.047	1	0	0
Saudi Arabia	0.048	0	0	0
Bahrain	0.048	0	0	0
Kazakhstan	0.048	1	0	0
Malaysia	0.049	0	0	0
Bangladesh	0.052	0	0	0
Trinidad & Tobago	0.052	0	0	0
Pakistan	0.053	0	0	0
Russia	0.055	1	0	0
Paraguay	0.055	0	0	0
Tunisia	0.069	0	0	0
DR Congo	0.069	0	0	0
Ghana	0.072	0	0	0
China	0.076	0	0	0
Georgia	0.077	1	0	0
India	0.079	0	0	0

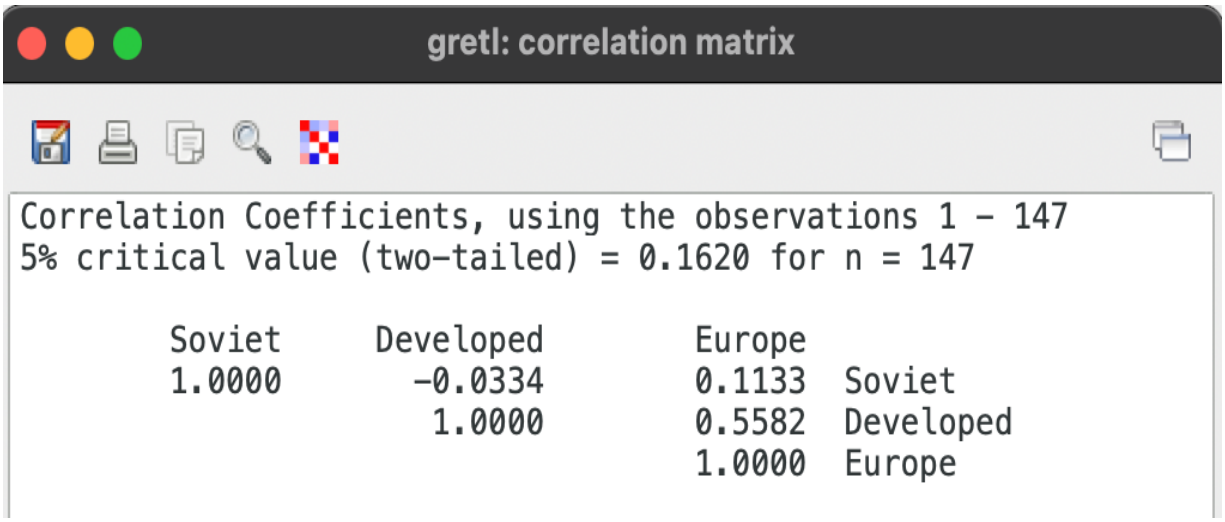
Vietnam	0.079	0	0	0
UAE	0.08	0	1	0
Turkey	0.081	0	0	0
Cameroon	0.086	0	0	0
Sri Lanka	0.09	0	0	0
Jordan	0.09	0	0	0
Taiwan	0.091	0	1	0
Belarus	0.092	1	0	1
Tanzania	0.094	0	0	0
Lesotho	0.095	0	0	0
Ecuador	0.096	0	0	0
Botswana	0.096	0	0	0
Indonesia	0.096	0	0	0
Maldives	0.1	0	0	0
Swaziland	0.101	0	0	0
Mexico	0.101	0	0	0
Bosnia & Herz.	0.102	0	0	1
Armenia	0.103	1	0	0
Malawi	0.107	0	0	0
South Korea	0.109	0	1	0
Serbia	0.109	0	0	0
Hungary	0.118	0	0	1
Namibia	0.12	0	0	0
Morocco	0.12	0	0	0
N. Macedonia	0.12	0	0	1
Dom. Republic	0.122	0	0	0
Ivory Coast	0.124	0	0	0
Albania	0.125	0	0	1
Canada	0.125	0	1	0
Mozambique	0.127	0	0	0
Madagascar	0.129	0	0	0
Mauritius	0.134	0	0	0
Bulgaria	0.142	0	0	1
Thailand	0.145	0	0	0
Cambodia	0.148	0	0	0
Malta	0.15	0	1	0
Costa Rica	0.15	0	0	0
Sierra Leone	0.155	0	0	0
Iceland	0.156	0	1	0
South Africa	0.156	0	0	0
Macao	0.158	0	1	0
Brazil	0.171	0	0	0
Israel	0.171	0	1	0
Panama	0.171	0	0	0
USA	0.174	0	1	0

Nicaragua	0.175	0	0	0
Senegal	0.177	0	0	0
Uganda	0.178	0	0	0
Kenya	0.178	0	0	0
Philippines	0.181	0	0	0
Romania	0.182	0	0	1
Chile	0.182	0	0	0
Hong Kong	0.183	0	1	0
Colombia	0.185	0	0	0
New Zealand	0.192	0	1	0
Norway	0.193	0	1	1
Togo	0.198	0	0	0
Poland	0.206	0	1	1
Burkina Faso	0.211	0	0	0
Gabon	0.211	0	0	0
Belize	0.217	0	0	0
Rwanda	0.22	0	0	0
Mali	0.224	0	0	0
Aruba	0.227	0	0	0
France	0.227	0	1	1
Slovakia	0.228	0	1	1
Singapore	0.24	0	1	0
El Salvador	0.242	0	0	0
Australia	0.243	0	1	0
Slovenia	0.243	0	0	1
Uruguay	0.249	0	1	0
Japan	0.251	0	1	0
Peru	0.252	0	0	0
Honduras	0.262	0	0	0
Barbados	0.271	0	0	0
Moldova	0.272	1	0	0
Greece	0.289	0	1	1
Portugal	0.29	0	1	1
Guatemala	0.292	0	0	0
Liechtenstein	0.3	0	1	1
Bahamas	0.31	0	0	0
Spain	0.311	0	1	1
Cape Verde	0.324	0	0	0
Jamaica	0.327	0	0	0
Luxembourg	0.342	0	1	1
Switzerland	0.35	0	1	1
Cyprus	0.376	0	1	1
Finland	0.38	0	1	1
Bermuda	0.427	0	0	0

Source: GlobalPetrolPrices, 2023

Now, after collecting data and preparing the dataset, it is possible to perform linear estimation. However, in ANOVA models, there is quite a frequent problem with multicollinearity, which will inevitably affect the linear model and result in distorted standard errors. For this purpose, the model will first undergo multicollinearity verification, which will be done with the help of a correlation matrix. The correlation matrix is presented in Table 2.

Table 2, the correlation matrix for the households model



Source: own processing based on GlobalPetrolPrices, 2023

According to the results of the correlation matrix, it is possible to say that the correlation between the Soviet and developed categories is almost non-existent. The same can be suggested about the relationship between the Europe category and the Soviet one, whilst the correlation between Europe and Developed is definitely present, but it is still too low to confirm the presence of the multicollinearity problem since the level of 0.8 is usually regarded as problematic. Henceforth, the estimation can continue, and the OLS method can finally be implemented, whose result is presented in Table 3.

Table 3, the estimated parameters of the households model

gretl: model 1

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```
Model 1: OLS, using observations 1-147
Dependent variable: KwH
Heteroskedasticity-robust standard errors, variant HC1

             coefficient   std. error   t-ratio   p-value
  ---------------------------------------------------------
  const        0.105424     0.0103641    10.17     1.27e-18 ***
  Soviet      -0.0205716    0.0342714    -0.6003   0.5493
  Developed    0.131605     0.0262195     5.019    1.52e-06 ***
  Europe       0.160421     0.0325055     4.935    2.20e-06 ***

Mean dependent var   0.177415   S.D. dependent var   0.162461
Sum squared resid    2.018359   S.E. of regression   0.118804
R-squared            0.476223   Adjusted R-squared   0.465235
F(3, 143)            25.20333   P-value(F)           3.78e-13
Log-likelihood       106.5949   Akaike criterion    -205.1898
Schwarz criterion   -193.2281   Hannan-Quinn        -200.3296

Excluding the constant, p-value was highest for variable 3 (Soviet)
```

Source: own processing based on GlobalPetrolPrices, 2023

The estimated model is:

$$P_e = 0.105 - 0.02SOVIET + 0.13DEV + 0.16EUR + U_e$$

The model that was estimated has the signs of estimated parameters that fully coincide with the original expectations stated earlier. The sign of the Soviet variable is negative, the sign of the developed variable is positive, as well as the sign of the Europe variable. Further interpretation of parameters is:

- If a country does not belong to any specified category (former Soviet republics, developed countries and European countries), the average price per kWh is 0.105 USD.

- If a country belongs to the category of countries once forming part of the Soviet Union, the average price per kWh is 0.02 USD lower.

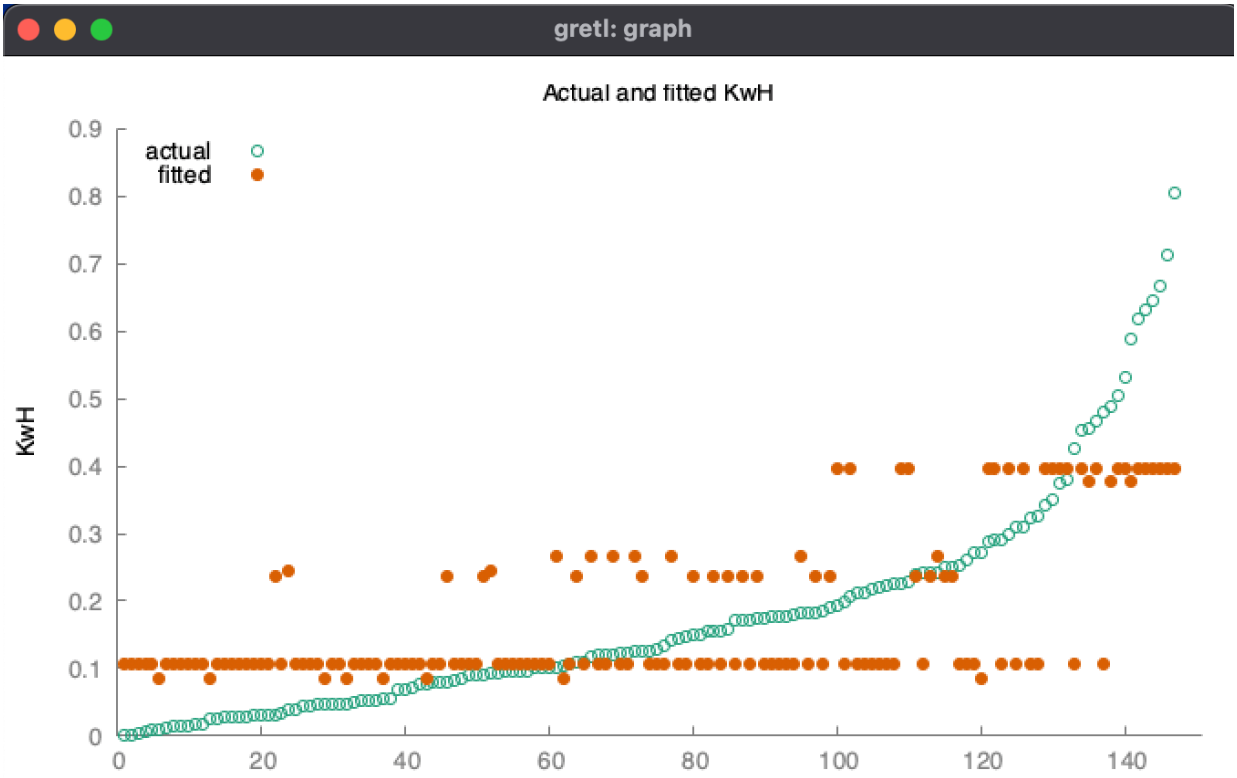
- If a country belongs to the category of developed countries, the average price per kWh is 0.13 USD higher.

- If a country belongs to the category of European countries, the average price per kWh is 0.16 USD higher.

The estimated model does not really strike as the most precise one due to the fact that the coefficient of determination is equal to just 0.46 or 46% when judging by the adjusted version of the coefficient. This is not surprising because there are definitely many different variables that were omitted from the model.

Nevertheless, even despite the fact that the precision if not so good, the majority of identified factors have a particular degree of statistical significance. Out of 4 regressors, the constant is significant, the European category is significant, and the developed category is also significant at the levels of 0.01, 0.05 and 0.10. On the other hand, the main variable of the analysis – the Soviet category is not significant because the P-value is greater than 0.54, which leads to the non-rejection of the hypothesis about the insignificance of the parameter. The visual representation of the model is presented in Figure 9.

Figure 9, the overview of the estimated households model



Source: own processing based on GlobalPetrolPrices, 2023

4.2 Businesses Model

The second model is also concerned with the price of electricity per kilowatt hour, but this time the price for businesses is concerned. The same set of factors is implemented, meaning that the model that will be estimated is of the three-way ANOVA kind once again. For this purpose, a new dataset was created, which can be found in Table 4.

Table 4, the businesses dataset

Country	KwH	Soviet	Developed	Europe
Lebanon	0.001	0	0	0
Angola	0.012	0	0	0
Syria	0.015	0	0	0
Lesotho	0.02	0	0	0
Bhutan	0.02	0	0	0
Ethiopia	0.022	0	0	0
Kyrgyzstan	0.032	1	0	0
Algeria	0.035	0	0	0
Qatar	0.036	0	1	0
Egypt	0.037	0	0	0
Libya	0.042	0	0	0
Sudan	0.044	0	0	0
Zambia	0.045	0	0	0
Argentina	0.045	0	0	0
Paraguay	0.046	0	0	0
Nigeria	0.046	0	0	0
Iraq	0.046	0	0	0
Kuwait	0.049	0	0	0
Uzbekistan	0.052	1	0	0
Venezuela	0.053	0	0	0
Trinidad & Tobago	0.053	0	0	0
Kazakhstan	0.064	1	0	0
Swaziland	0.064	0	0	0
Azerbaijan	0.065	1	0	0
Saudi Arabia	0.069	0	0	0
Nepal	0.07	0	0	0
Iceland	0.072	0	1	1
Indonesia	0.074	0	0	0
South Africa	0.074	0	0	0
Vietnam	0.075	0	0	0
Bahrain	0.077	0	0	0
Burma	0.078	0	0	0
Mozambique	0.08	0	0	0

DR Congo	0.08	0	0	0
Russia	0.082	1	0	0
Rwanda	0.082	0	0	0
Bangladesh	0.083	0	0	0
Armenia	0.084	1	0	0
Ecuador	0.085	0	0	0
China	0.088	0	0	0
Ghana	0.089	0	0	0
Tanzania	0.097	0	0	0
Malaysia	0.098	0	0	0
Madagascar	0.099	0	0	0
South Korea	0.099	0	1	0
Sri Lanka	0.101	0	0	0
Canada	0.102	0	1	0
Ukraine	0.107	1	0	1
UAE	0.11	0	1	0
Morocco	0.11	0	0	0
Botswana	0.115	0	0	0
Taiwan	0.115	0	1	0
Tunisia	0.116	0	0	0
Bosnia & Herz.	0.116	0	1	1
Serbia	0.117	0	0	1
Georgia	0.118	1	0	1
India	0.118	0	0	0
Belarus	0.118	1	0	1
Mauritius	0.119	0	0	0
Uruguay	0.119	0	1	0
Jordan	0.123	0	0	0
Uganda	0.132	0	0	0
Chile	0.135	0	0	0
Albania	0.139	0	0	1
Thailand	0.143	0	0	0
USA	0.146	0	1	0
Luxembourg	0.147	0	1	1
Kenya	0.147	0	0	0
Malawi	0.148	0	0	0
Brazil	0.151	0	0	0
Philippines	0.158	0	0	0
Cameroon	0.158	0	0	0
Mali	0.162	0	0	0
Pakistan	0.163	0	0	0
Macao	0.163	0	1	0
Oman	0.166	0	0	0
Malta	0.167	0	1	1
Sierra Leone	0.171	0	0	0
Belize	0.173	0	0	0
Colombia	0.173	0	0	0

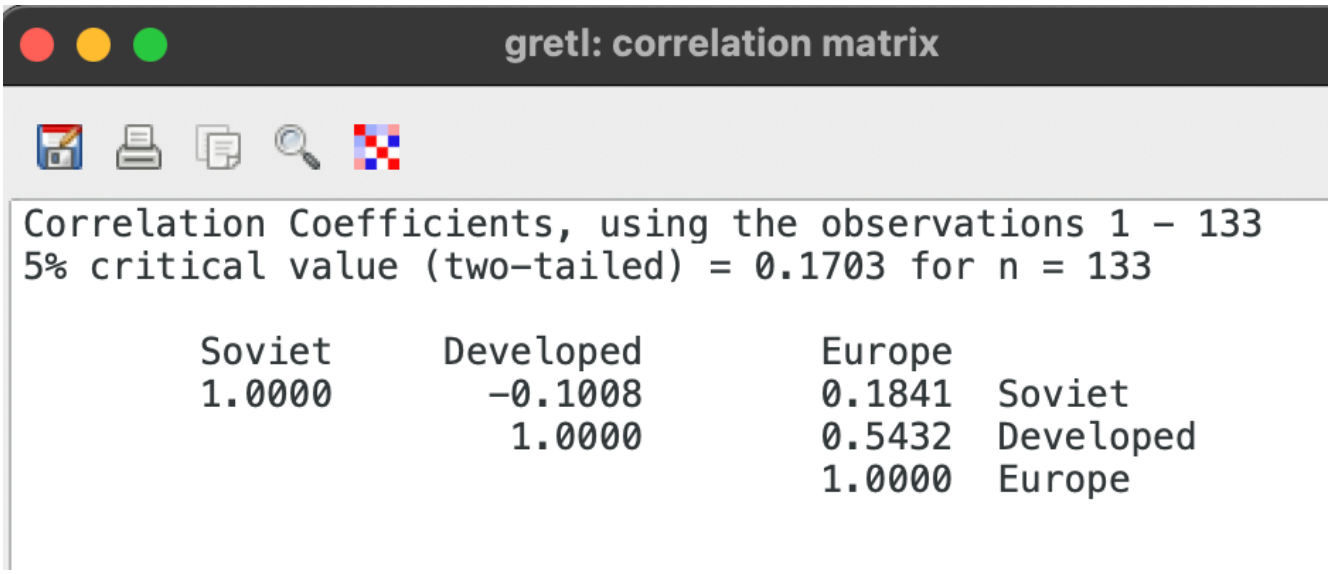
Hong Kong	0.175	0	1	0
Guatemala	0.177	0	0	0
Israel	0.178	0	1	0
Dom. Republic	0.181	0	0	0
Togo	0.183	0	0	0
Costa Rica	0.185	0	0	0
Turkey	0.19	0	0	1
Panama	0.191	0	0	0
Slovenia	0.193	0	1	1
Peru	0.194	0	0	0
El Salvador	0.195	0	0	0
Bulgaria	0.195	0	0	1
Liechtenstein	0.197	0	1	1
Cape Verde	0.207	0	0	0
Norway	0.209	0	1	1
Ivory Coast	0.211	0	0	0
Nicaragua	0.212	0	0	0
Finland	0.213	0	1	1
Mexico	0.214	0	0	0
Portugal	0.218	0	1	1
Spain	0.22	0	1	1
Romania	0.227	0	0	1
Honduras	0.233	0	0	0
Japan	0.242	0	1	0
Moldova	0.252	1	0	1
Bermuda	0.256	0	0	0
N. Macedonia	0.27	0	0	1
Switzerland	0.272	0	1	1
Estonia	0.278	1	0	1
Jamaica	0.284	0	0	0
Bahamas	0.301	0	0	0
Australia	0.309	0	1	0
Singapore	0.321	0	1	0
Greece	0.328	0	1	1
Barbados	0.328	0	0	0
Czech Republic	0.329	0	1	1
Aruba	0.341	0	0	0
Belgium	0.342	0	1	1
Cyprus	0.376	0	1	1
France	0.383	0	1	1
Hungary	0.41	0	0	1
Latvia	0.422	1	1	1
Poland	0.427	0	1	1
Denmark	0.438	0	1	1

Cayman Islands	0.443	0	0	0
UK	0.459	0	1	1
Burkina Faso	0.466	0	0	0
Lithuania	0.477	1	1	1
Netherlands	0.57	0	1	1
Slovakia	0.586	0	1	1
Austria	0.598	0	1	1
Italy	0.724	0	1	1
Germany	0.936	0	1	1

Source: GlobalPetrolPrices, 2023

Consequently, the same estimation process will be performed, where it will first be identified if there is such a problem as multicollinearity present in the collected dataset. This will be once again verified with the help of a correlation matrix presented in Table 5.

Table 5, the correlation matrix for the businesses model



Source: own processing based on GlobalPetrolPrices, 2023

According to the results of the correlation matrix, it is possible to say that the correlation between the Soviet and developed categories is almost non-existent as it is extremely low, with a figure of negative 0.10. The same can be suggested about the relationship between the Europe category and the Soviet one with the value of positive 0.18, whilst the correlation between Europe and Developed is definitely present, but it is still too low to confirm the presence of the multicollinearity problem since the level of 0.8 is usually regarded as

problematic. Thus, the estimation can continue, and the OLS method can finally be implemented, whose result is presented in Table 6.

Table 6, the estimated parameters of the businesses model

gretl: model 1

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```
Model 1: OLS, using observations 1-133
Dependent variable: KwH
Heteroskedasticity-robust standard errors, variant HC1

              coefficient   std. error   t-ratio   p-value
  ---------------------------------------------------------
  const        0.122023     0.0105738    11.54     1.33e-21 ***
  Soviet      -0.0457812    0.0276861    -1.654    0.1006
  Developed    0.0810423    0.0259911     3.118    0.0022   ***
  Europe       0.142540     0.0286293     4.979    2.01e-06 ***

Mean dependent var   0.182038   S.D. dependent var   0.150716
Sum squared resid    1.927508   S.E. of regression   0.122237
R-squared            0.357159   Adjusted R-squared   0.342209
F(3, 129)            12.19834   P-value(F)           4.44e-07
Log-likelihood       92.85023   Akaike criterion    -177.7005
Schwarz criterion   -166.1391   Hannan-Quinn         -173.0023

Excluding the constant, p-value was highest for variable 3 (Soviet)
```

Source: own processing based on GlobalPetrolPrices, 2023

The fitted model is:

$$P_e = 0.122 - 0.045SOVIET + 0.08DEV + 0.14EUR + U_e$$

The model that was estimated has the signs of estimated parameters that fully coincide with the original expectations stated earlier. The sign of the Soviet variable is negative, the sign of the developed variable is positive, as well as the sign of the Europe variable. Further interpretation of parameters is:

- If a country does not belong to any specified category (former Soviet republics, developed countries and European countries), the average price per kWh for businesses is 0.122 USD, which is higher than for households.

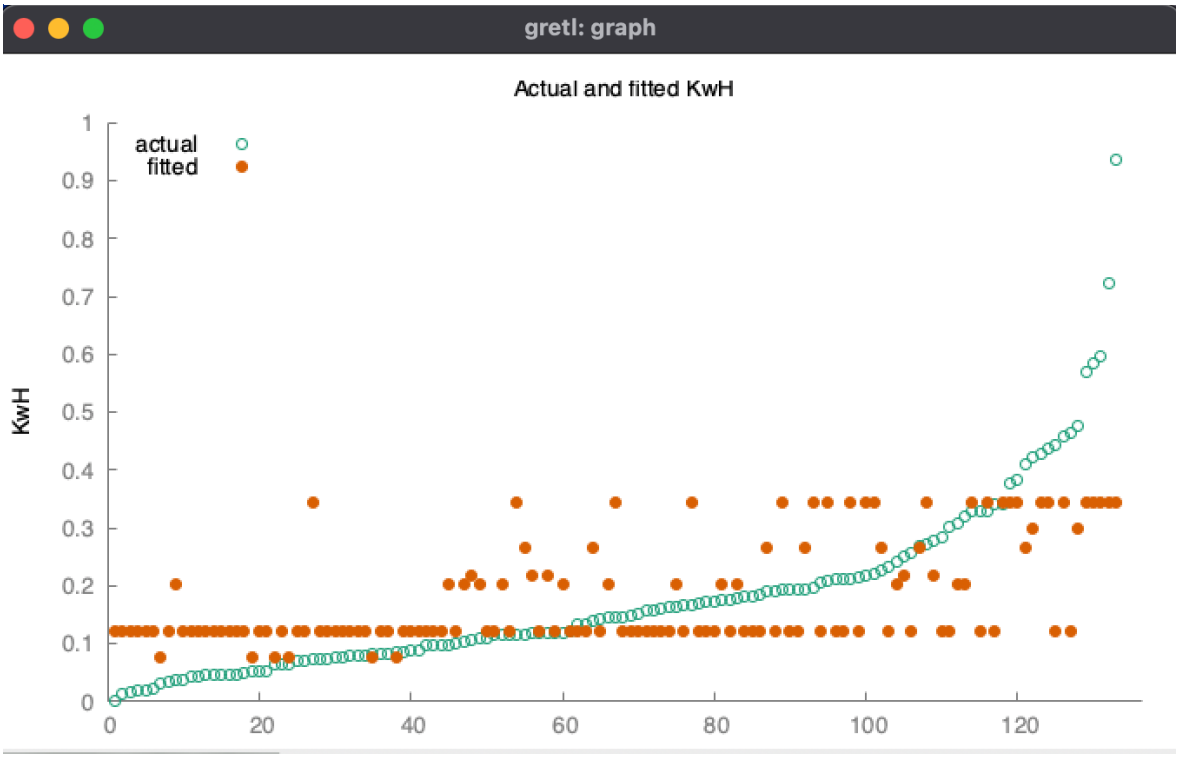
- If a country belongs to the category of countries once forming part of the Soviet Union, the average price per kWh for businesses is 0.045 USD lower.

- If a country belongs to the category of developed countries, the average price per kWh for businesses is 0.08 USD higher.

- If a country belongs to the category of European countries, the average price per kWh for businesses is 0.142 USD higher.

The second model is even less precise than the first one, with the variation in the price of electricity equal to 0.34 or 34%, according to the adjusted coefficient of determination explained. Furthermore, it is possible to suggest that out of 4 regressors, three are significant, notably the constant, the developed category and the European category. The Soviet category is once more not significant since the P-value of 0.1006 higher than 0.01, 0.05 and 0.10, which indicates the non-significance of the parameter. The comparison of fitted and observed values is presented in Figure 10.

Figure 10, the overview of the estimated businesses model



Source: own processing based on GlobalPetrolPrices, 2023

4.3 Time Series Analysis: Uzbekistan

The second part of the analysis is concerned with a specific country from the post-Soviet environment – Uzbekistan. The choice of the country is explained by both the personal motives of the researcher, as well as by the fact that Uzbekistan represents a pretty interesting case since the country is not really abundant in natural resources and is keen on buying energy elsewhere, such as in Kazakhstan, the Russian Federation or Turkmenistan. For this purpose, a specific dataset containing the selected variables was created. The following list of variables is considered: energy use in kg of oil equivalent per capita, fossil fuel energy consumption in % of total, alternative and nuclear energy in % of total energy use and access to electricity in % of population. The dataset is presented in Table 7.

Table 7, the dataset for time series analysis of Uzbekistan

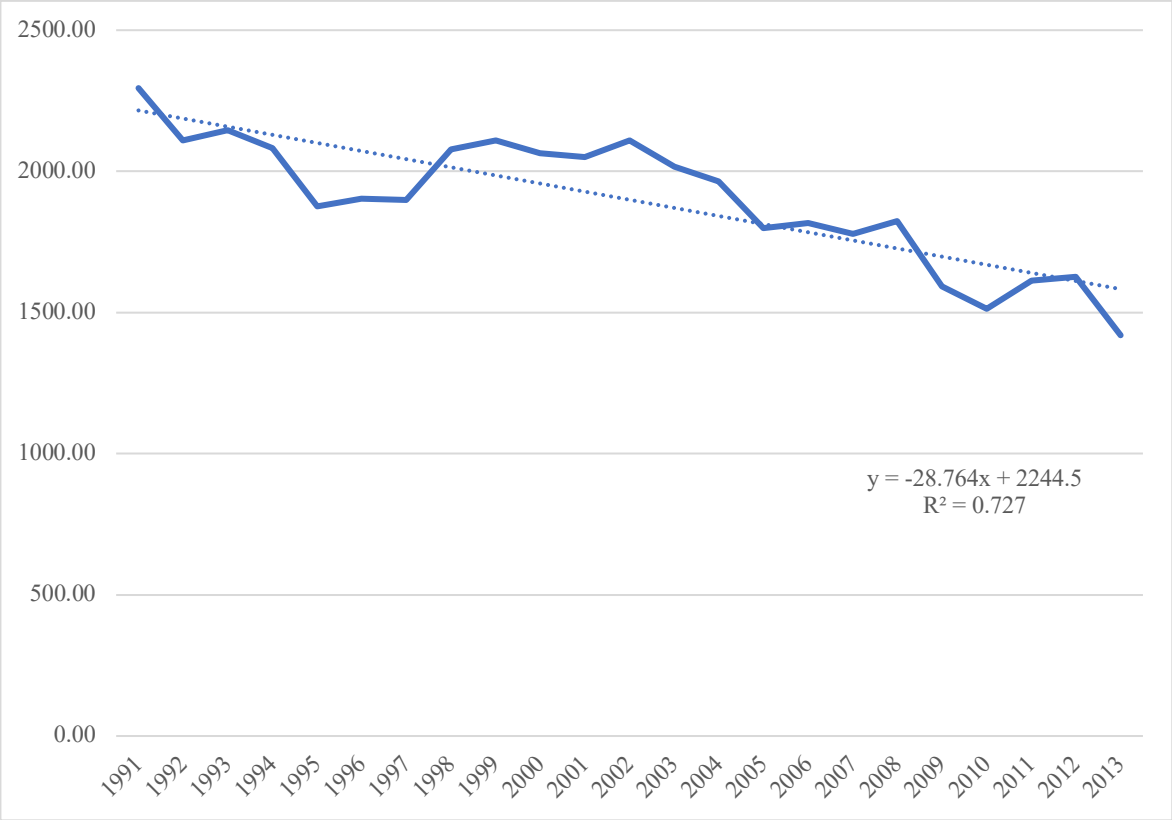
Year	Energy use	Fossil fuel energy consumption	Alternative and nuclear energy	Access to electricity
	kg of oil equivalent per capita	% of total	% of total energy use	% of population
1991	2294.82	98.98	0.86	-
1992	2110.50	98.89	0.94	-
1993	2146.18	98.72	1.07	-
1994	2082.15	98.74	1.06	-
1995	1876.04	99.01	0.99	-
1996	1903.22	98.51	1.08	99.60
1997	1899.61	98.71	0.93	99.38
1998	2077.57	98.82	0.84	99.45
1999	2110.55	98.84	0.81	99.51
2000	2063.59	98.78	0.84	99.63
2001	2050.22	98.91	0.84	99.59
2002	2109.32	99.01	0.82	99.70
2003	2015.77	98.71	1.05	99.51
2004	1964.13	98.45	1.26	99.47
2005	1799.40	98.40	1.30	99.45
2006	1815.95	98.34	1.36	99.49
2007	1777.91	98.82	0.95	99.46
2008	1823.31	98.02	1.62	99.49
2009	1591.99	98.16	1.50	99.54
2010	1512.82	97.82	1.79	99.60

2011	1613.81	98.12	1.54	99.66
2012	1625.99	97.98	1.65	99.72
2013	1419.48	97.74	1.92	99.78

Source: The World Bank, 2023

The first analysed variable is energy use, whose time series plot is presented in Figure 11.

Figure 11, the time series plot of energy use

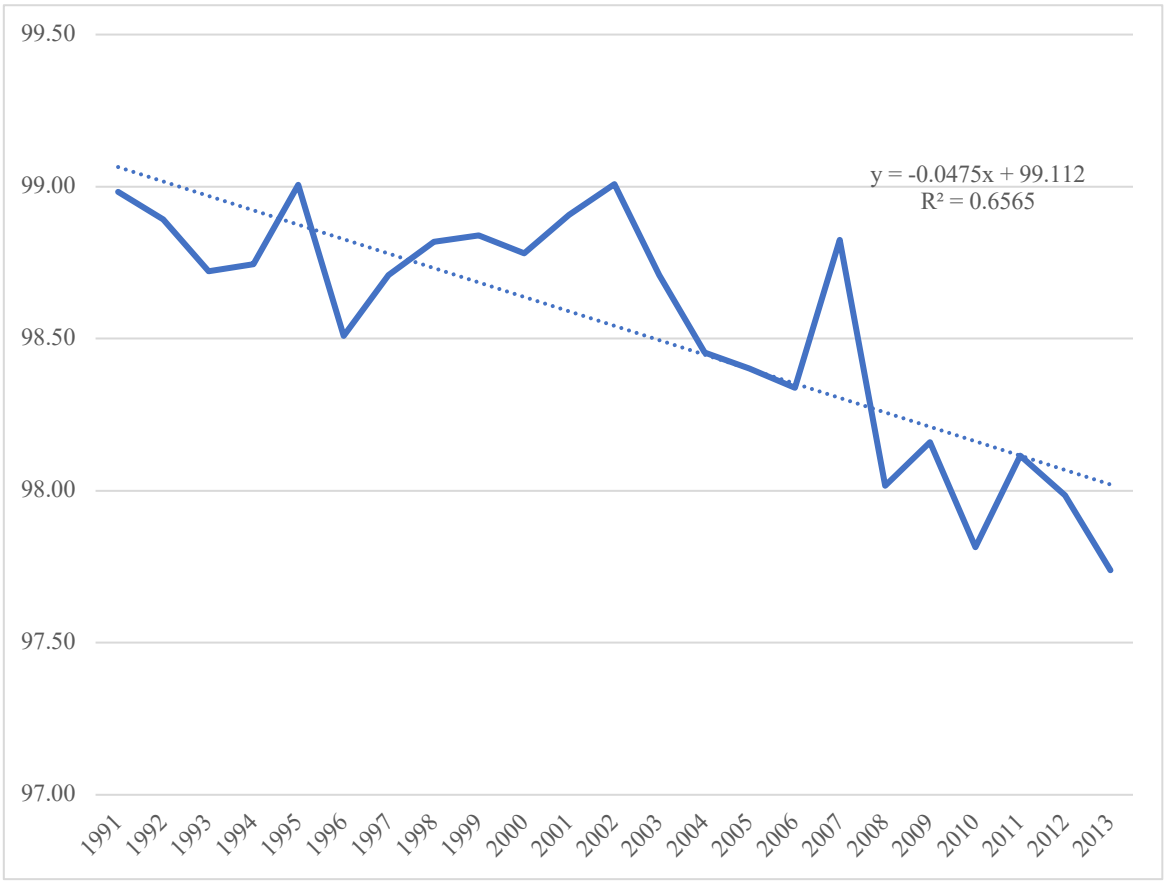


Source: own processing based on The World Bank, 2023

According to the time series plot generated from the dataset, it becomes evident that energy use in Uzbekistan started to deteriorate rapidly in 1999 when the downward-sloping tendency of the variable was initiated. This can either be explained by two different aspects – it is either the total energy production in the country that decreased, or it is the population of the country that saw a huge increase over the span of the last 14 years analyzed. Effectively, it becomes pretty evident when taking an insight into the background of the graph that the second aspect is the main reason for this decline. Uzbekistan has already been the most populated country in Central Asia, but the tendency for growing population

continued in the 00s when there was an evident improvement in the economic well-being of the country as a result of the success of the transition from the centrally planned economy to the market one. The next addressed variable concerns the consumption of fossil fuels, whose time series plot is presented in Figure 12.

Figure 12, fossil fuel consumption

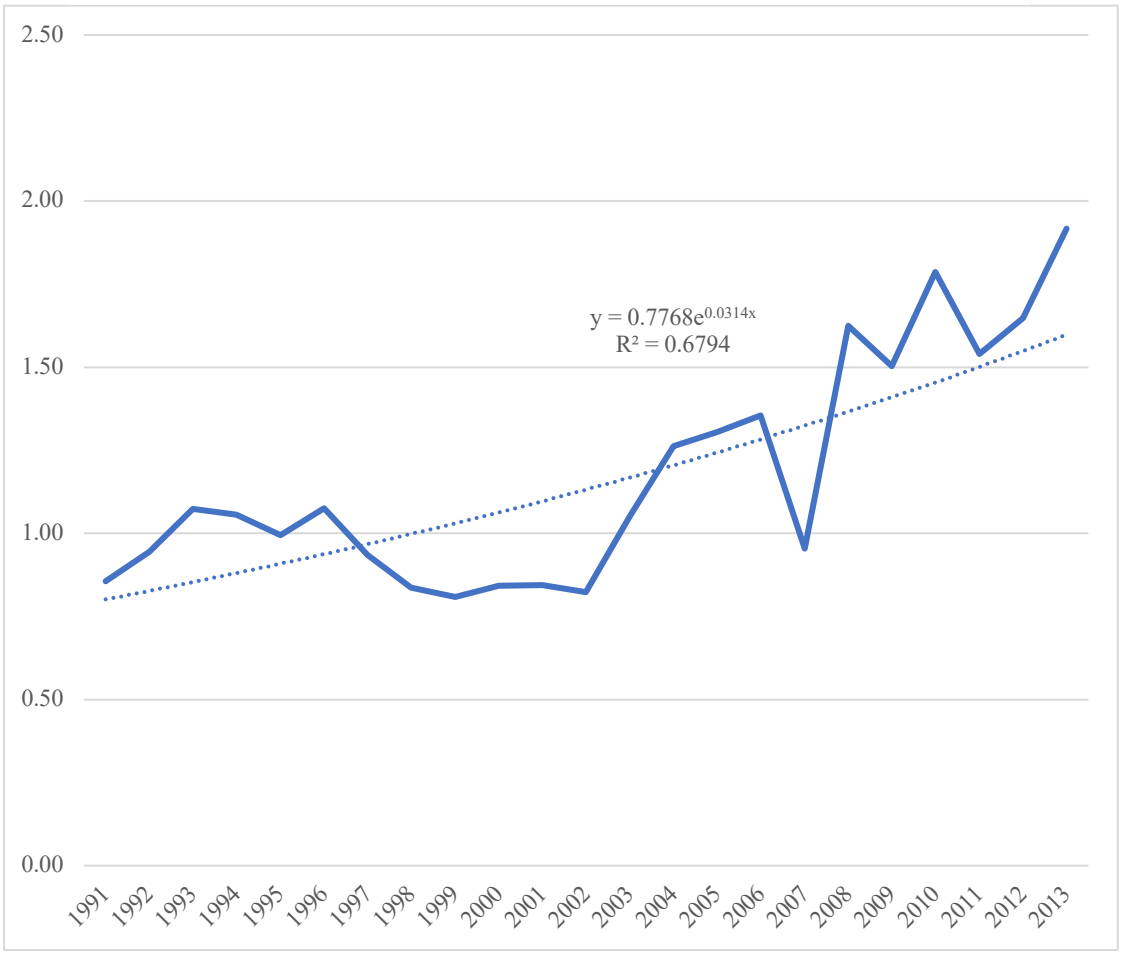


Source: own processing based on The World Bank, 2023

Based on the time series plot, it becomes pretty evident that the country is extremely dependent on fossil fuels, which arises from the fact that the total share of energy consumed produced from fossil fuels between 1991 and 2013 was ranging between approximately 97.70% and 99%, which is an enormous figure. This is mainly influenced by the heritage that the USSR left for Uzbekistan, where all Soviet republics were strongly dependent on power stations producing electricity. There were obvious exceptions when alternative energy was used, such as the nuclear one in the Russian Federation, but the move towards alternative energy was made in the late 80s, so the Union was not able to initiate the transition. The

problem with the transition to clean energy that is less harmful to the environment was inherited by almost all former Soviet republics, and based on the graph, Uzbekistan is surely not an exception. Yet, it is important to appraise the recent effort made by the company towards the transition to alternative energy, which is especially visible after noticing the downward-sloping tendency of the variable. The third variable is alternative and nuclear energy consumption in % from the total, whose time series plot is presented in Figure 13.

Figure 13, alternative and nuclear energy consumption

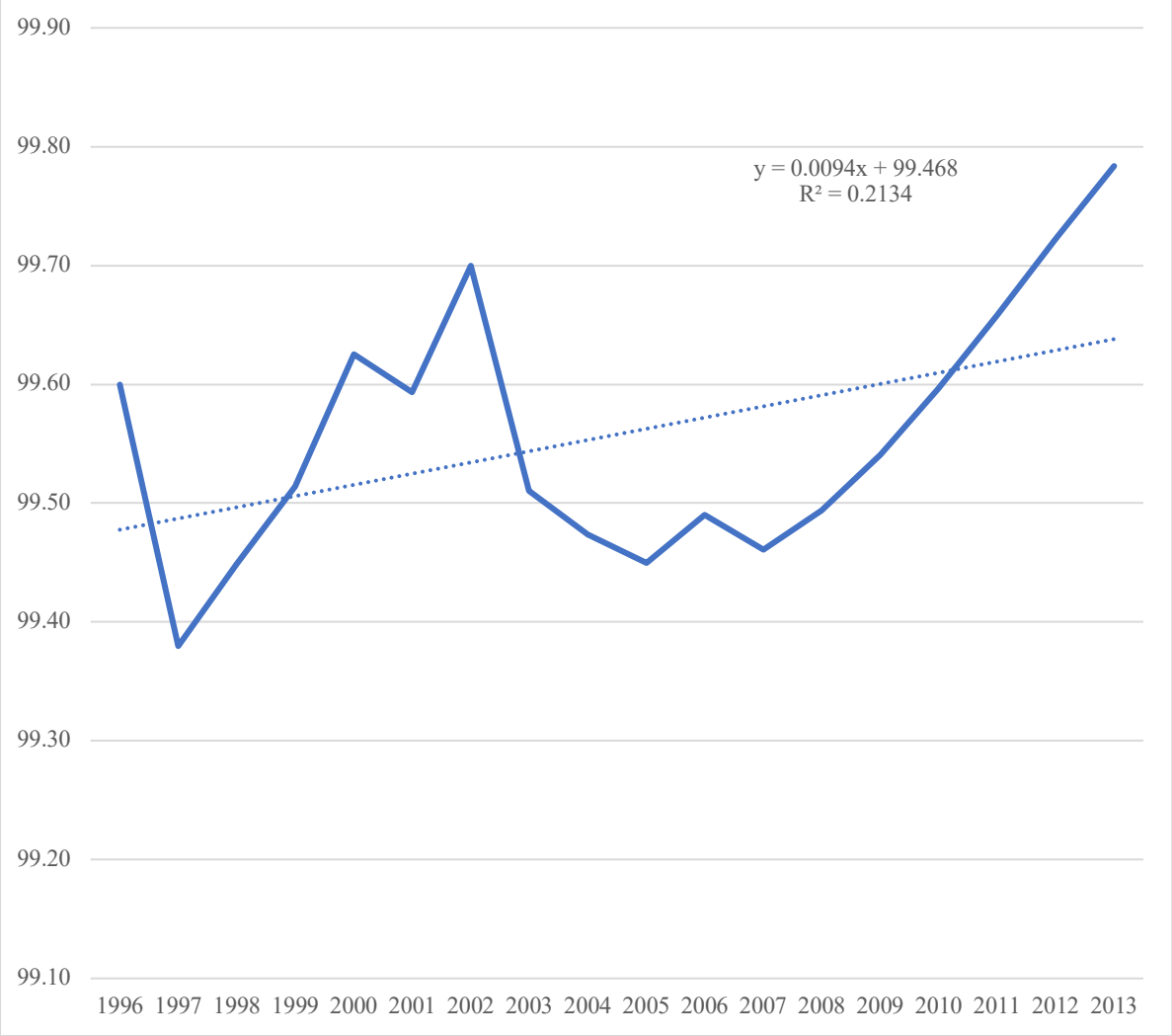


Source: own processing based on The World Bank, 2023

On the other hand, after noticing a downward-sloping trend for fossil fuel energy consumption, it was quite sensible to anticipate an opposite trend for alternative and nuclear energy consumption since both phenomena are usually substitutes for each other. Effectively, the country has recently made a lot of effort in the domain of alternative and nuclear energy, but the share is still extremely low, with just 1-2% of the total energy

consumption of the country. On the one hand, this is explained by the abundance of natural resources, but it is still vital to understand that Uzbekistan offers a very good platform for renewable energy sources, especially solar energy, given the country's average temperatures that are extremely high during both winter and summer months. Overall, the situation is not quite good, but it is rapidly improving, so it is wise to anticipate a further improvement in the status of renewables in the Central Asian country. The final variable is access to electricity, where the information is available starting from the year 1996 and , the time series plot is presented in Figure 14.

Figure 14, access to electricity



Source: own processing based on The World Bank, 2023

After looking at the time series plot of Uzbekistan's access to electricity of the population, it is possible to say that the country is a typical example of a country in transition,

where the communist heritage left a huge industrial trail over the country. As of 1996, the overwhelming majority of the country had access to electricity, and the tendency of improvement continued even further until almost reaching the level of 99.8% in 2013. It is wise to expect that the country managed to achieve the level of 100% over the course of the second decade of the 21st century.

After finishing the empirical part of the analysis, it is finally possible to continue to the deeper elaboration of the results that will involve the comparison of the results achieved in the diploma thesis with other relevant publications of prominent authors and scholars. As it stands now, according to the results of the thesis, the current situation in the energy market is more than clear.

5 Results and Discussion

In order to summarize the findings of the linear regression analysis and better elaborate on the results of the study, it is wise to create a table containing quantitative effects on the price of electricity per kilowatt for households and businesses respectively to the selected categories – the history within the Soviet Union, European location and developed classification. The table with the summary is presented in Table 8.

Table 8, the summary of linear regression analysis

Type of Electricity	Former Soviet Union	Developed Countries	European Countries
Households	-0.02	0.13	0.16
Businesses	-0.045	0.08	0.14

Source: own research

When it comes to the former Soviet Union republics, it is possible to indicate that this category of countries does have cheaper electricity for both households and businesses – 0.02 USD and 0.045 USD lower than the average, according to the results of the empirical analysis. This is an important finding that fully coincides with what has been achieved by other authors – notably by Brunnschweiler (2010) and Zhang (2013), who justify cheaper electricity prices for the majority of former Soviet Republics by the fact that those countries inherited both viable energy systems from the Soviet Union and also strong ties with Russia that tends to supply cheap electricity and other energy resources to the countries of the former Soviet Union, notably to the Central Asian region, Belarus and Armenia.

The cases of Belarus and Armenia are quite similar since both countries form part of the Eurasian Union, so they directly enjoy gains from their participation in the union in the form of various discounts on energy and fossil fuels. On the other hand, there are obvious outliers that led to the fact that the category was categorized as a non-significant one – the Baltic countries that took a very different approach to economic and political development by joining the EU in 2004, which was not done by any other country. Georgia did attempt to follow in their footsteps, but the attempt was fruitless partially due to the difference in the

geographic position of the countries, where Georgia shares the longest border with Russia and despite its reluctance to cooperate with the country that causes a lot of controversy in the Georgian society, there seems to be no other choice for the country, as Chomakhidze (2016) suggests.

The Central Asian region is the one where the dependency on Russia is the highest, which is especially visible based on the example of the country whose energy sector was briefly discussed – Uzbekistan. It is suggested that the country strongly relies on cheap energy generated mainly from power stations and fossil fuels exported from Russia to Uzbekistan, which is also suggested by Gomez et al. (2015).

Developed countries, on the other hand, have more expensive electricity. The price of electricity for households is 0.13 USD higher on average, while it is 0.08 higher for businesses on average. This is an interesting finding, but something similar was already concluded by Seliom et al. (2017), who blamed the higher cost of producing electricity for such a high price. On the other hand, it is important to understand that developed countries all over the world are more and more interested in using alternative sources of energy, such as renewables and nuclear ones, where the cost of producing electricity is even higher, but the energy is significantly cleaner. Examples of such countries are France, which heavily relies on nuclear energy and Scandinavian countries that are especially advanced in the renewable sector, where for some of those countries, notably Sweden, the share exceeded 50% of the total output during some periods of time (Seliom et al., 2017).

The final category of countries – the ones located in Europe, is somewhat similar to the category of developed countries with the exception of the magnitude of higher prices – 0.16 USD higher on average and 0.14 USD higher on average for households and businesses, respectively. This is mainly explained by the fact that the majority of European countries are not just classified as developed ones, but there are few of them that can easily claim the status of the world's wealthiest nations, such as Luxembourg, Switzerland, Netherlands, Austria and others. In addition to that, none of those welfare states with high price levels and huge purchasing power of inhabitants is abundant in natural resources. Thus, the need for importing energy and using alternative sources leads to higher prices, which is also highlighted by Mahedevan & Asafu-Adiaye (2007). The case of the Netherlands is a unique

one because the country sacrificed their abundance of natural gas in favour of approaching the goal of reaching clean energy with the least possible negative effect on the environment of the country and the whole planet, which is also mentioned by Bretschger (2015).

6 Conclusion

The diploma thesis was dedicated to the analysis of the electricity market after the pandemic of COVID-19. The analysis aimed at quantifying the disparities that exist between different groups (according to their economic classification) of countries, where the largest emphasis is put on the post-Soviet environment and republics that were once parts of the USSR. The other two categories were developed countries (according to the UN classification) and countries situated in Europe. Furthermore, the thesis had an additional objective of describing the situation with the energy development in one selected country from the post-Soviet environment – Uzbekistan, a state from the Central Asian region that has the largest population in the region with approximately 35 million inhabitants.

It is identified that the countries once forming part of the Soviet Union enjoy lower prices of electricity for both businesses and households, where the households in those countries pay 0.02 USD less on average, and businesses pay 0.045 USD less per kilowatt per hour. This is mainly influenced by close ties with Russia, which is one of the world's biggest suppliers of crude oil and other energy-related commodities. On the other hand, there are obvious outliers from the category – the Baltic states, which have inadequately high prices for electricity within the category of former Soviet republics, which is influenced by the preference of those countries to join the EU rather than the CIS and other trading blocks such as the EAEU created between the former Soviet countries.

Developed countries and countries situated in Europe have more expensive electricity, which is influenced by both their preference for the clean energy that comes at a given cost and also the fact that those countries are not abundant in natural resources, which might, in fact, serve them quite well by establishing a different way for economic growth and development.

At last, it was identified that the situation with the energy sector in Uzbekistan is not quite favourable due to the fact that the energy use per capita rapidly decreases under the constantly expanding population of the country. In addition to that, the country is extremely dependent on fossil fuels that constantly deteriorate not just the environment of the country but also endanger the planet's sustainability potential. Overall, if the country continues to

expand its share of renewables, it is likely to yield quite good results in the long-term perspective.

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