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RENEWABLE ENERGY AND FINANCIAL DEVELOPMENT IN CENTRAL ASIA

MASTER THESIS

2023

NEAR EAST UNIVERSITY

INSTITUTE OF GRADUATE STUDIES

DEPARTMENT OF BANKING AND ACCOUNTING

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M.Sc. THESIS

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M.S.c THESIS

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Declaration

I hereby declare that all information, documents, analysis and results in this thesis have been collected and presented according to the academic rules and ethical guidelines of Institute of Graduate Studies, Near East University. I also declare that as required by these rules and conduct, I have fully cited and referenced information and data that are not original to this study.

Talent Daisy Chamboko

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Acknowledgments

I would like to express my deepest gratitude to God almighty for the guidance, strength, divine health, divine life, and wisdom to ensure I complete my goals. I would also like to thank my parents for being a great source of strength, inspiration, and encouragement. My father, Mr. Jerry Chamboko for seeing the best in me and always pushing me to achieve the best results, as he used to say “Duty first”. For funding my studies and for being a great motivation in all aspects, thanks a million you are indeed the best. My mother, Mrs. Zvinaiye Lucia Muzarabani for always being my source of encouragement. For always doing anything that was in your power to support my studies, I am so grateful. My whole family for the words of love and encouragement you are greatly appreciated. My Christ Embassy Cyprus family for the love and encouragement you are indeed all amazing. My Supervisor Prof. Dr. Aliya Işiksal for the massive support in the topic, and analysis, and for always being there to assist in any way possible. For always pushing me to achieve yet the best and for investing your time to build me up with knowledge, I can never thank you enough you are the best I have had. Assist. Prof. Dr. Ala Fathi Assi for your support and guidance in the project. Thank you for taking your time to assist in the best way possible.

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Soyut

Orta Asya'da Yenilenebilir Enerji ve Finansal Gelişme

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……., Şubat 2023 (97) sayfa

Bu çalışma, 1998'den 2019'a kadar Kırgızistan, Türkmenistan, Özbekistan, Kazakistan ve Tacikistan dahil olmak üzere Orta Asya'da yenilenebilir enerji ve finansal gelişmeyi araştırıyor. Bu çalışma, yenilenebilir enerjinin finansal gelişme, doğal kaynaklar, doğrudan yabancı yatırım, GSYİH ve kişi başına düşen, finansal özgürlük, yatırım özgürlüğü ve ticaret özgürlüğü ile ilişkisini bulmayı amaçlamaktadır. Orta Asya'daki en büyük endişe, yenilenebilir enerji için büyük bir potansiyel olmasına rağmen, yenilenebilir enerjinin henüz tam olarak geçiş yapmamasının nedeni olmuştur. Sabit etki ve rastgele etki sonuçları, finansal gelişmenin yenilenebilir enerji ile negatif bir ilişkisi olduğunu, yenilenebilir enerji projelerinin yüksek fonlamaya ihtiyaç duyduğunu, bu nedenle finansal kurumların yenilenebilir enerjiye yatırım yaptığında projelerin daha hızlı ve verimli bir şekilde çalışacağını göstermektedir. Finansal özgürlük ile yenilenebilir enerji arasında pozitif bir ilişki vardır. Sonuçlar ayrıca, doğal kaynaklar ile yenilenebilir enerji arasında negatif bir ilişki olduğunu göstermektedir, çünkü Orta Asya devletlerinin bol doğal kaynakları vardır, yenilenebilir enerjiyi devreye sokmak, doğal kaynak çıkarımını ve tüketimini azaltacaktır. Dumitrescu Hurlin nedensellik testinde yenilenebilir enerji tüketiminden doğal kaynaklara, finansal gelişmeden yenilenebilir enerji tüketimine ve yatırım özgürlüğünden yenilenebilir enerji tüketimine doğru bir nedensellik vardır. Bu nedenle, Orta Asya otoritelerinin yenilenebilir enerji tüketimini artırmaya yönelik uygulayacağı politikalar şeffaflık, finansal eğitim, erişilebilirlik, etkin borsa, teknolojik ilerleme, bankacılık sektörünün bağımsızlığı ve yatırımdır.

Anahtar Kelimeler: Yenilenebilir enerji, Doğal kaynaklar, Finansal gelişme, Orta Asya, Finansal özgürlük

Abstract

Renewable Energy and Financial Development in Central Asia

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……., February 2023 (97) pages

This study investigates renewable energy and financial development in Central Asia, including Kyrgyzstan, Turkmenistan, Uzbekistan, Kazakhstan, and Tajikistan, from 1998 to 2019. This study aims to find the relationship of renewable energy with financial development, natural resources, foreign direct investment, GDP and per capita, financial freedom, investment freedom, and trade freedom. The biggest concerns in Central Asia have been the reason why renewable energy has not yet fully transitioned even though there is great potential for renewable energy. Fixed effect and random effect results show that financial development has a negative relationship with renewable energy, the projects of renewable energy need high funding so when financial institutions invest in renewable energy the projects will run efficiently at a faster rate. There is a positive relationship between financial freedom and renewable energy. This means that a transition to renewable energy is possible when financial institutions have fewer restrictions they can invest in renewable energy. The results also show there is a negative relationship between natural resources and renewable energy, since the Central Asian states have abundant natural resources introducing renewable energy will reduce natural resource extraction and consumption. Dumitrescu Hurlin causality test, there is causality extending from renewable energy consumption to natural resources, financial development to renewable energy consumption, and investment freedom to renewable energy consumption. Therefore, the policies to increase renewable energy consumption to be implemented by the Central Asian authorities are transparency, financial education, accessibility, efficient stock market, technological advancement, independence of the banking sector, and investment.

***Key Words**:* Renewable energy, Natural resources, Financial development, Central Asia, Financial freedo

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List of Abbreviations

FDI:	Foreign direct investment
NR:	Natural resources
TF:	Trade freedom
IF:	Investment freedom
FF:	Financial freedom
GDP:	Gross domestic product
GDPPC:	Gross domestic product per capita
REC:	Renewable energy consumption
FD:	Financial development index
WTO:	World trade organization
EBRD:	European Bank for Reconstruction and Development
CTF:	Clean Technology Fund
ADB:	Asian Development Bank
AIFC:	Astana International Financial Centre
TCCB:	Turkmenistan Coca-Cola Bottlers
FMFB:	First Microfinance Bank
CLIMADAPT:	Climate Resilience Financing Facility
GCF:	Green Climate Fund
NBU:	National Bank for foreign economic activity of Uzbekistan
WB:	World Bank

UNFC:	United Nations Framework Classification for resources
GNI:	Gross National Income
HDI:	Human Development Index
IMF:	International Monetary Fund
FI:	Financial Institutions index
FM:	Financial Markets index
FID:	Financial Institutions Depth index
FIA:	Financial Institutions Access index
FIE:	Financial Institutions Efficiency index
FMD:	Financial Institutions Depth index
FMA:	Financial Markets Access index
FME:	Financial Markets Efficiency index
ATM:	Automated Teller Machine
EF:	Economic Freedom
ADF:	Augmented Dickey Fuller
PP:	Phillips Perron
FE:	Fixed effects
RE:	Random effects
OLS:	Ordinary least square
PSCE:	Panel Correlated Standard Errors
FGLS:	Feasible Generalized Least Square
NTB:	Non-trade barriers

CHAPTER I

Introduction

1.1 Background of the study

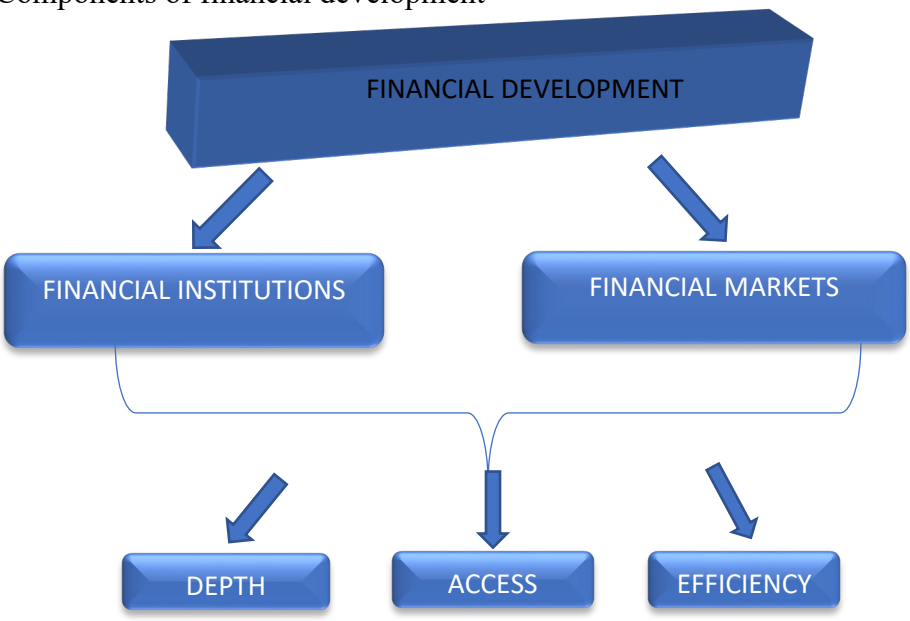
Renewable energy is a resource that occurs naturally that can be regenerated consistently. Therefore, the advantage is that they cannot be depleted so they can be used repeatedly, they affect financial development if they are effectively used to benefit the economy hence it is important that the Central Asian states transition to the usage of renewable energy since the renewable energy usage are relatively low. Renewable energy consumption are resources that can be used without being exhausted. According to the (Working & Series, 2021) Central Asian countries have been working towards the usage of renewable energy sources. The challenges in these countries have been the lack of adequate knowledge to fix the organization of the systems in the country, that is the roads, buildings, and the power supply that is needed in the operation of the country at large. The finances directed to the building of the proper infrastructure are insufficient, making it more difficult to run renewable energy projects. However, the Central Asian states need to find ways to make the population to make it of importance to use sustainable sources of energy and technology. It is important to raise an awareness of the sources of energy that are sustainable to the environment to reduce the effect of diminishing of the abundant natural resources that are present Central Asia. Because of the Covid19 the energy demand was low globally due to the lockdown measures that were put into place whereby the government put measures to restrict the movement of people to many locations' movement was done for necessities. Workplaces were closed thereby providing the option of working online. For the businesses that cannot operate online there were highly affected they had to close after the lockdowns or try to recover the lost revenues during the lockdowns, many lost their jobs because their services became irrelevant. This turn out of events affected the demand of energy from the companies local and international thereby slowing down the transition to renewable energy. Even though the demand for energy for consumption in homes also increased since the people were now staying at home, most of them without anything to do. Energy was used mainly for lighting and heating purposes in the homes; hence the profits of energy consumption were also affected. The government offers the subsidy and lower tax in the electrical energy sector thereby giving an upper hand in terms of the revenues gained. This is because when the government

provides subsidies it makes the supplier increase their profits and thereby reduces the prices offered for the goods and services making it even more affordable for the consumers leading to excessive consumption. This kind of action really affects the renewable energy market because it is not fully established in these countries which means that it still has a lot of costs to be incurred thereby making it look more expensive than fossil fuel energy. Also, as a result of the subsidies it hinders the institutions to generate a lot of incentive to use to ensure they build an effective connection of the infrastructure thereby can explain some of the problems that are faced during winter-time of terrible network breakdowns and inefficient electricity supply to provide with heating. Therefore, the countries to move towards the usage of renewable energy to create job opportunities and to also add to the human capital of the population. This means that the government can ensure they educate the population on the energy sector and employ them to increase their work experience. The population should be trained to raise awareness of sustainable sources of energy, the production and to dispose of the waste to remove the adverse effects on the environment. To avoid the adverse effects on the environment there is need to use renewable energy sources since when non-renewable energy is in production it uses a lot of water which is at the end of the production chain disposed to the environment thereby, polluting the water and causing harm to the ecosystem. Although hydro energy has been a common source of energy gradually been considered for usage as one of the renewable energy sources it has also posed dangers on the environment like the destroying of the varieties of the species in the ecosystem, it also alters to construction of the land and cause the carbon emissions. The effects caused by climate change have made the government be cautions of the energy sources they use and before usage of a particular energy it is highly accessed to analyze the threats posed by usage of that energy. Increasing the trading activities between the different countries increases the potential revenue that will add on the needed investment in the energy sector which will be beneficial to both renewable and non-renewable sources of energy. Central Asia can also venture into financing new projects of renewable energy since it is not utilized and there is a great capacity for these energy sources in the country.

The variables affecting renewable energy consumption (REC) are financial development (FD), foreign direct investment inflows (FDI), natural resources (NR), trade freedom (TF), investment freedom (IF), financial freedom (FF), and GDP per capita (GDPPC). According to (Svirydzenka,

2016) financial development involves the flexibility of the market, the size, accessibility of the services provided, and also the ability to provide the services with minimal costs thereby increasing the revenues. Figure 1 is explanatory financial development according to the definition of financial development (Paper, 2012).

Figure 1: Components of financial development



Source: IMF

The depth is the size of the market, that is the value of the shares, the number of transactions on the stock market and the quantity of the debt securities. Access refers to the accessibility of the financial services without discrimination meaning that the financial services are available to everyone despite the class in society. This is whereby the institution looks at the quality of the project the returns to provide the financial services. Financial efficiency is how well the money yields the revenue after being used for production. Foreign direct investment inflows the investment into a country with the aim of benefiting the interest. Whereby the investor can create a productive asset, or they can purchase the assets that is the voting power in a company (European Union, n.d.). These are lasting investments that are made to the company for expansion giving the foreign investor control over the company (Adam Hayes, 2022a). Since Central Asia the economies have been strategically positioned to attract investment in the natural resource sector to make it more competitive in the world. The foreign direct investment is beneficial to the economy by expansion of the natural resource sector it also affects the

competitive level of the local competitors (Kaditi, E., Swinnen, J., & Swinnen, 2006). Over the years Central Asia has managed to attract a lot of investment due to the abundant natural resources in the countries (Metaxas & Kechagia, 2016). The agricultural sector has attracted a lot of investors to invest in Central Asia due to the high interest that will be retained (Doytch et al., 2014). The instability of the financial and political discouraged the investors to invest in central Asia due to the high prices ("Toujours Sous La Férule," 2008). In Uzbekistan the foreign direct investment has been attracted to enhance renewable energy technologies to reduce the diminishing of the natural resources and possible increase of the standards of living (Russell et al., 2014). Also should ensure that the FDI should be attracted to increase the tourism sector it is important that there is diversity in the economy to increase the chances of revenue in the economy (Kantarci, 2007). This foreign direct investment aids in the development of efficient structures to produce the goods and the services. GDP per capita to check on the economic growth in terms of everyone is concerned this allow the government to analyze the growth of the population. This means that if the GDP per capita grows with no change in the population it shows that the economy is expanding in some sort (Team, 2022). Natural resources are a form of resource that occurs without the involvement of humans (*Natural Resource*, 2022). Natural resources increase the overall GDP of the country thereby also increasing the standards of living and their consumption by individuals has a positive impact at the expense of their depletion (Buckner et al., 2016). According to the (The Heritage Foundation, 2022) trade freedom shows the impact of the absence of the restrictions on the goods and services exports and imports. The restrictions which can be in form of quantity restrictions which is when the government gives a certain number of exports, the government can also choose to place a ban in some exports due to various reasons but mainly in the interest of conserving the natural resources. It can also be in the price restrictions of paying antidumping tax that is the tax that is charged on the imported goods and services to balance with the export price that is charged on the goods exported. Countervailing duty is the tax that is charged on the goods that are imported in the country with the consideration that the government has supported the producer of the good hence the producer will offer a lower price of the good since government would have given them an incentive. It is important that the government will charge the tax on the goods and services because it ensures that there is fairness in the price that is charged on the goods produced in order to avoid exploitation on the other producers of the same goods who are not provided subsidies this means

their prices will not be lower but to try to be competitive if this tax is not charged they will reduce their prices charged (Ortiz, n.d.). Border tax is the tax that is paid in the when the goods are consumed (Bird, 2022). The regulatory restrictions are also important, that is the government regulations that are put in place to govern the production process of the goods, the marketing strategy used, and the authorization of the company to operate. Investment restrictions are the regulation made by the government on the financial aspect and exchange rate. Government based regulations that is the assistance of the government on the technology policies, the state regulations, and any other strategies to enable the effective regulation of the trading sector. In Central Asia they have been trying to implement policies to reduce the taxes imposed on the goods imported and exported to encourage the trade of producers and suppliers. Kazakhstan, Kyrgyz republic, and Tajikistan are currently members of the World Trade Organization whereby the agreement is to remove any restrictions when trading and removing the discriminating between small and large countries. While Turkmenistan and Uzbekistan are still working towards becoming a member of WTO since there is still needed to ease some restrictions in the country (Asian Development Bank Institute, 2014). Investment freedom is whereby they are no restrictions that forbid the transfer of capital in and out of the country. The restrictions can also come in the form of the types of investments expected in the country, the restriction in the transfer of payments or the restrictions on the foreign exchange rate due to the reasons usually beneficial to the country, protection of the resources or corruption (The Heritage Foundation, 2022). The efforts to increase the investment should be made by ensuring the index is higher and attractive to the investors. The Central Asian countries can try to break the mindset of the population to accept the corruption activities in the country and to increase the efficiency of the calculation of the index. (Roberts & Cohen, 2012). Financial freedom measures the effective regulation of the bank and the absence of the government controlling the financial sector which means that the ownership of some financial institutions by the government reduces the competition level with the other institutions and reduces advancement of customer services offered. Ideally financial systems are more efficient if they are independent from the government the decisions made in the company are not affected by the government, the central bank will supervise the institutions to check for their level of efficiency. The absence of control over the institutions increases their productivity because it means that the bank is responsible to accept the deposits, give out loans to make profit from interest rates and carry any other transactions

without any restriction both the local and international institutions. The state should also show openness for international competition and development of the capital market (The Heritage Foundation, 2022). However the government can choose to put restrictions to protect the financial institutions from any risks that can have adverse effects on the economy ("Bank Concentration and Stability in Central Asia: The Effect of Capital Regulation and Financial Freedom," 2022).

1.2 Problem Statement

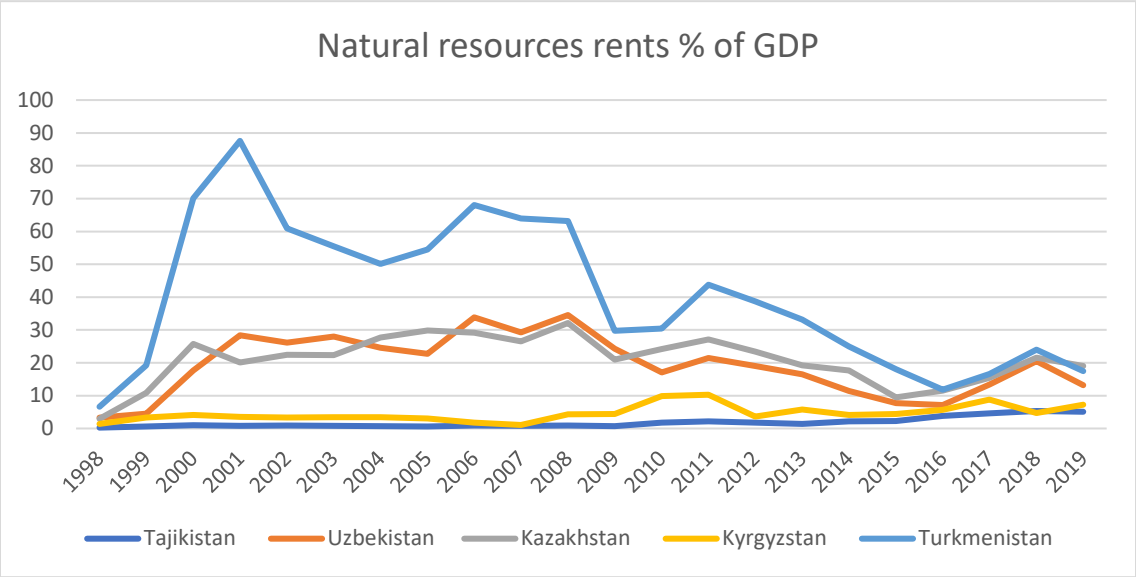
With the way the Central Asian countries have abundant natural resources and great potential for renewable energy is it logical and achievable to move to usage of renewable energies with the aid of financial development?

The central Asian countries have been working towards the goal of sustainability to reduce the forecasted depletion of natural resources. Natural resources are a natural phenomenon on any continent and their existence is overall assumed to have a positive impact on the economy at large. The existence of natural resources is important to ensure that the economy is functioning efficiently and that they are increasing GDP and the overall welfare of the whole country. Hence, it's important that they balance natural resources to avoid depletion, increase the usage of renewable energy, financial development, and political development. In countries with high natural resources, the financial sector is expected to benefit particularly the banking sector by tax, and it's also expected to have a high lending objective which is not always the case (Bhattacharyya & Hodler, 2014). The economy is highly affected by the structure of the political institutions because the choices made will affect the economy, in some economies the higher the resources the higher the corruption (Bhattacharyya & Hodler, 2010) To avoid the incompetent judgment of the organization of resources they have to be an organization of leaders with the knowledge of the natural resources, renewable energies and their effects on the economy, to ensure they make the right policies (Bhattacharyya & Hodler, 2014). When a country does not have competent leaders the rich natural resources will slow down the growth of the economy. (Beck, 2012) In countries with high resources, the banking sector is liquid, yet they do not give out as many loans due to the less demand since most firms do not really use external finance. Given the evidence of central Asian states, there is no doubt that it has abundant natural resources at their disposal.

1.2.1 Developing infrastructure in Central Asia

Central Asia is amongst the resource rich countries according to the World bank data which is provided in percentages the natural resource abundance is impressive (Yoshino et al., 2021). Figure 2 shows the trends of natural resources in Central Asia.

Figure 2: Natural resources in Central Asia



Source: Authors computations

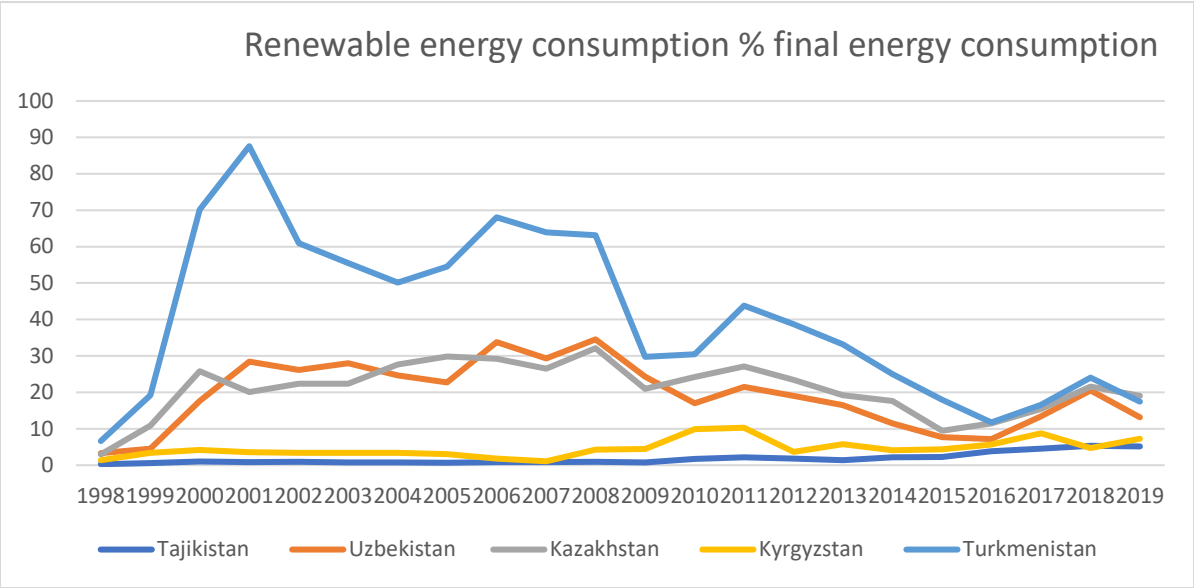
From the above figure 2 it shows the available natural resources in Central Asia with a high ranking of natural resources is Turkmenistan and according to the World bank (Bank, n.d.) it is rich in oil and gas. It also adds to the chemical and construction industry with the raw materials of production since it's rich in petroleum, sulfur, iodine, salt, bentonite clays, limestone, gypsum, and cement. The connection with other countries through trade has been accompanied by a lot of restrictions. Even though there is a booming private sector the state holds a say in economic activities especially if it is government owned. Over the years the natural resources have decreased in Turkmenistan due to land debasement when the land is irrigated the due to the inefficient drainage system the soil is saturated with water affecting the yield also waste of water as a resource. Poor waste management especially in the medical and the oil field thereby causing

threat to the environment. Despite having one of the largest natural gases in the world the threat caused by production of gas has not been properly handled, thereby affecting the environment. The government of Turkmenistan has also not put polices to use energy efficiently to conserve for the future causing the natural resources to diminish over time (Nations, 2010). Kazakhstan is one of the biggest uranium producers in the world and has abundant natural resources with exporting activities mostly to countries in the European Union (EU). Investors, being attracted to the abundant natural resources tried to invest in mining equipment but a lot of them pulled back due to the risks of massive restrictions especially on international investors, lack of clear transparency, and low returns. To attract the returns in the country the government has increased the transparency of records to the potential investors (International Trade Administration, n.d.). According to World Bank, Uzbekistan has been making notable efforts increase the trade and price flexibility. It has abundant natural resources and during the period of the Soviet Union it was recorded as one of the top cotton producers, making it in a position that it has threats to the environment due to the different chemicals used in the cotton production. Even though over time the living conditions have increased from the point that some families in the village could not afford the basic needs there is still threats of the health and education which are the sole issues of a well-being of a person (Bank, n.d.) Tajikistan has been under economic recovery since after the period it faced the pandemic to increase its economic growth after the challenges. The Kyrgyz Republic is a resource abundant country with the capacity for agriculture, hydro energy production and tourism even though it is solely dependent on the money that is sent from other countries by people from abroad and gold production. It has been the target of investors to invest in coal and oil since approximately 27 mines have been open since the 1900s. The products of the mining sector exported are forecasted to earn revenue, 40% is used to cater for the needs of the population and 30% is imported into the country. They also developed a system to mine the construction materials thereby making the country competent to supply these materials to other countries and increase the inflow of revenue (Rogalsky, 2019).

Figure 3 shows the renewable energy consumption in Central Asia, Turkmenistan, Kazakhstan, and Uzbekistan show a low usage of the renewable energy. The highest renewable energy consumption is in Tajikistan then Kyrgyzstan, these two countries have a higher potential in hydro because they tend to have higher water supplies and Tajikistan being the leader in supplying electricity from hydro in central Asia. According to the World Bank during the periods

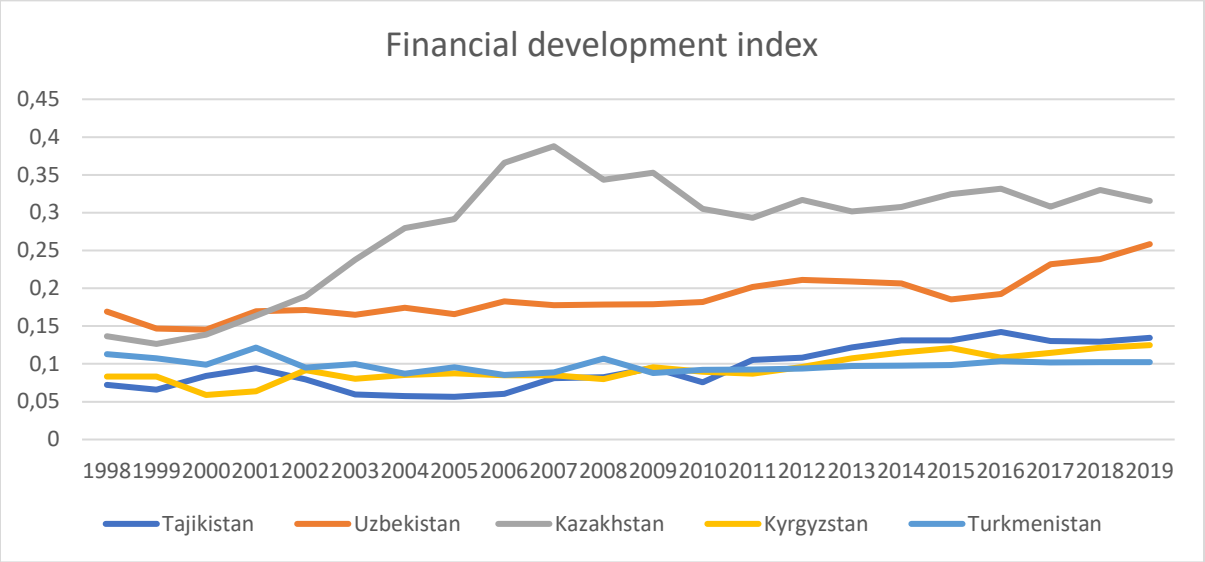
of Covid 19 the region had decreases in revenue because of decrease in prices of the goods and services traded which was natural resources and the was a decrease in the money sent from abroad since a lot of people lost their jobs and they could hardly feed hence it was difficult to send money home. Hence, there is need to move to usage of natural resources since there is a higher possibility of renewable energy consumption. Since Central Asia has a great capacity for renewable energy it can also work on mixing the non-renewable energy and renewable this is forecasted to increase the renewable energy. The slow-down of the energy transmission between the countries in Central Asia has led to reduced electricity supply in the region. The Central Asian states have been making reforms to move towards the sustainable ways of the environment. Which is Tajikistan, Kyrgyzstan and Uzbekistan has been making efforts to ensure that they become stronger to resist any threats to climate changes. The reforms have also been made for Uzbekistan to move towards the renewable energies, diversity, and climate resilient methods. World bank is vitally involved in the projects, Kazakhstan to improve the renewable energies, climate resilience and exported beef. Tajikistan has also been improving in the rebuilding of the "Nurek Hydro power plant" through the World bank (Bank, n.d.). These countries formed into "Central Asia Power Supply" (CAPS) to ensure that there was efficiency in the energy. Since Tajikistan has abundant water supply and supplies to Uzbekistan the division of interests comes into play because the production of renewable energy in Tajikistan is not much Uzbekistan also needs the water for the agricultural production. This triggered Uzbekistan to not be a member of the CAPS causing constrains in the efficiency after some years it joined again (Ardelean, 2021).

Figure 3: Renewable energy in Central Asia



Source: Authors computations

Figure 4: Financial development in Central Asia



Source: Authors computation

Kazakhstan and Uzbekistan show high trends of financial development while Tajikistan, Kyrgyzstan and Turkmenistan are ranging a bit lower. One of the reasons why the financial development is lower in these Central Asian countries is because some of the institutions are controlled by the government this means that the transactions to be done are also controlled therefore the profitability will be lower (*Banking in the Eastern Neighbours and Central Asia*, n.d.) (Ben Naceur et al., 2019).

1.2.2 Democracy in Central Asia

According to (Olcott, 2001)'s testimony, they have been a poor response to the movement toward democracy due to the leaders who have viewed the Central Asia population as not ready for democracy. The leaders pass on the theory to the population that their existence is the only way the country can be stable. Each year that goes by the possibility of democracy declines due to the decrease in the political leaders that fight for democracy. This influences the economic structure as the economy is also controlled by the political structure. In Uzbekistan, the development of the country has a huge impact on the surrounding country to shape its structure. It was also the headquarters of Islam in the region with only 2 parties in the political institutions. It also has the best structure in the region in that the political leader is trying to achieve a situation whereby they are a strong leader at the top. Due to this leadership, the GDP has maintained a certain level because of a strict conversion of the national currency and maintaining prices of certain commodities. For Kyrgyzstan, democracy worked for around 1991 which increased the effectiveness of the economy and foreign direct investment. This allowed some businesses to enter new ventures and allow citizens to have better living conditions. This was, however, not the outcome because living conditions deteriorated, and the rich were responsible for the resources while the poor were left out. The political leaders have also restricted the press on any information whether formal or informal, also the opposition party has the fear of being arrested. In Kazakhstan, it is like Kyrgyzstan to increase the effectiveness of the economy they must be more stable to govern the oil and gas available. Also, the instability of the neighboring countries is hindering foreign investment in the country. In Turkmenistan there is no structure of democracy as other opposition left the country, the political leader uses the availability of oil and gas as personal wealth, while agriculture sector some wealthier individuals are also in charge. Tajikistan, as political leaders incorporated Islamic leaders, at the country, is known for its high

level of criminals due to the level of lawlessness. The USA has been making efforts to ensure that Central Asia becomes democratic by ensuring they provide knowledge and qualified lawyers that are aware of how things should operate to work towards democracy. Democracy is whereby the decisions that affect the state are decided by mostly the public whether directly or indirectly. It's a state of a rule that makes the public feel more involved in the decisions done by the government and it is augmented that it makes the public sort of be in apposition to work together since they are a feeling of self-belonging to the rules and regulations that can be put in place (Dahl, 2022) . It is mostly the rule of the majority which means that the most consideration is mainly on what the majority suggests the minority suggestions are usually ignored (He et al., 1982). Usually, in a democracy, the way it happens is that they choose certain representatives to represent their thoughts and feelings on how the nation should be governed and this happens through voting, and the person with the highest votes wins. So, the people feel like the decisions being made by the government are theirs other than they are not included. This gives them freedom of thought and expression. This implies that democracy affects financial development because it makes the people work in one accord.

1.3 Purpose of the study

This study contributes to the effects of financial development on renewable energy. The effects of trade freedom, financial freedom, and investment freedom on renewable energy in Central Asia. In this study we determine that: What role does financial development have on renewable energy? Will financial freedom increase renewable energy consumption? Can the increase in the usage of renewable sources of energy foster overall economic growth? Do the restrictions on economic activities limit economic growth? Why is there a low investment on the renewable energy technologies? Are the natural resources of these countries overrated to be the richest in comparison to the world? Is there an efficient financial system in these countries?

1.4 Limitations

The limitations to the study were the unavailability of the data especially in the current year so that we can have accuracy in the results. The choice of the variables on economic freedom is new and have few studies to compare the results. The unavailability of the information on Central Asia to get a deeper understanding on the financial institutions and renewable and non-renewable

energy. The study is focusing on Central Asia hence further studies can also be made on Asia as a whole on renewable energy and financial development.

CHAPTER II

Literature Review

Various studies have not yet given the conclusion of the effect of renewable energy with other variables involved. Central Asia is described by a sense of richness in the renewable energy sources considering the abundant sunshine and winds even though most of these countries have put renewable energy technologies as long-term goals (Shadrina, 2022). The renewable energy is a suggested substitute to reduce the increase of the carbon emissions and also assist to ensure that there are various jobs that are created to boost the economy (Mentel et al., 2022). Despite the high potentials in Central Asia for the renewable energy there are a lot of isolated villages that have little communication and have inaccessibility of the energy therefore transition to the usage of renewable energy might be a bit of challenge because there are still using coal (Mehta et al., 2021). Renewable energy usage is a way to use cheaper sources of energy to substitute the natural resources usage even though the restrictions that are put in the country reduce the usage of the natural resources. Some researchers view the renewable energy sources as the way to reduce the high trends of pollution on the environment (Olabi & Abdelkareem, 2022).

2.1 Financial development and renewable energy consumption

When there is advancement in financial development the preferences of energy will change to renewable energy after there is support on the projects and also the possible research on the energy thereby having a positive relationship with renewable energy (Assi et al., 2020) (Assi et al., 2021). When there is more investment in renewable energy the consumption will increase this also reducing the demand for non-renewable energy (Zhakanova Isiksal, 2021) (Jalil & Feridun, 2011) (Tamazian & Bhaskara Rao, 2010). (El Khoury et al., 2022) suggested that the functionality of the financial institutions determines the whole functionality of the economy, meaning the more the financial institution's sector is organized the more the whole economy is organized. (Kassouri et al., 2020) on their study of resource curse in an oil exporting countries and effect of democracy from 21 oil exporting countries from 1984- 2016 found out that they are a resource curse, and the issue of democracy was not put into consideration, yet it influenced the economy. To support that the country is not only supposed to be based on the oil sector it should be diversified because once it is based on resources it puts pressure on the supply side that might

not be able to meet all its demands. (Ng et al., 2020) suggested that the financial sector should be more open and transparent about the position of the economy to attract more investors to invest, thereby adding the inflows that will be in a particular country. Also, the government can also assist financial institutions by ensuring that their interest rates are low, and the loans are accessible and available to finance investments and offer tax rebates just to add to the finances for investment. It will also be effective if the banking sector can also develop more online services to ensure they are efficient and maximum there is customer satisfaction. According to (Terry Miller, Anthony B Kim, 2022) in Central Asian countries there are a lot of restrictions when it comes to the economy. For instance, the banking sector overshadows the financial sector in that due to a lack of effective competition the banking sector lacks proper structure. This explains the high credit costs that the customers face, the development of the banking sector is mostly dependent on the lack of competition, so the banking sector is reluctant on improving the structure. ("Bank Concentration and Stability in Central Asia: The Effect of Capital Regulation and Financial Freedom," 2022) in the study of "bank concentration and stability in Central Asia and the Effect of capital regulation and financial freedom from 1993- 2017", the results suggest that bank concentration and stability have a positive correlation meaning that when the banking sector has a well-capitalized and there is more competition the banking sector will improve and overall improve the financial development. (Nagac & Rizvanoghlu, 2018) suggested that to keep the financial development strong the central banks must become independent to ensure that they gain the trust of the customers for them to carry out their transactions. According to the financial development in Kazakhstan, the GDP is quite stable, yet they are limited lending due to the instability of the exchange rate (International Monetary Fund, 2015). In Uzbekistan, there is a great potential for the deposits of minerals and the government has been organizing the financial sector to be effective in relation to that (Curry, 2018). Turkmenistan focuses on agriculture, and they are strict policies to restrict private acts promoting direct investment to enhance the growth of the economy. Tajikistan has low resources except for water due to previous civil wars and currently sustaining from money sent to the countries to families who have their loved ones abroad, the government has been making efforts to restore the country (Beeson et al., 2016). Kyrgyzstan has been striving to regain financial stability despite the structure of providing microfinance with the aid of some international organizations the banking sector is still poor and only limited to some restricted areas Kyrgyzstan: Country overview, (Rezvani, 2013). They

have been high evidence of Dutch disease in central Asian countries (Goderis, 2007), whereby the evidence of resources has led to instability and violence (Auty, 2002). According to (Eromenko, 2016) Dutch disease is when a country is rich in natural resources and tends to do exports to other countries to earn income, in return the country's currency will start to appreciate leading to a decrease in the effectiveness of other sectors of the economy at large. (W . M . Corden 1984) suggested that there are three sectors in the economy, that is the first sector is extraction, the second sector is manufacturing, and the third sector is services. They also suggested that the Dutch disease is caused by the inflow of foreign currency from the exports of other countries and other sources causing an increase in the exchange rate. A country that has abundant natural resources is supposed to be economically stable and ranging as a rich country but in antithetical most of the resource abundant countries are the poorest. The background of how it starts is when the first sector discovers that there is a high demand it will increase its production thereby increasing the number of workers maybe a higher wage will be fixed to attract more workers. Due to this the services sector will increase in demand because the workers demand more services to spend their income so they will increase their wages. Therefore, the evidence of Dutch disease can be the increase in the inflation rate, wages, and exchange rate. To maintain a high GDP they have good governance and low levels of corruption (Henri, 2019). Countries that have high mineral resources attract revenue inflow into the country and the banking sector activities are deposits and loans. For banks to give out loans is funded by deposits and the capital inflow will be used by the banks to fund loans and their revenue will be from the interest charged on the loans. Proper management of the natural resources will foster a high growth in GDP because the continual inflow of funds will ease the banking sector (Dwumfour & Ntow-Gyamfi, 2018). Looking at Central Asia has an abundant supply of resources yet there is not so much benefit to the economic growth over time. There is a need to adjust a lot of systematic processes for the natural resources to be beneficial and also increase in the knowledge acquired to enable growth (Tabash et al., 2022). Central Asian countries are solely dependent on natural resources therefore there should be promotion of diversification in Central Asian countries. (Tiba & Frikha, 2020) suggested that the resource curse existing is a result of systems that are not transparent it is giving much room for fiditory activities. Also, there is need to work on the investment of the population to increase the chances of a positive impact of the resources in terms of education, health, and standards of living.

Hypothesis 1: Financial development and renewable energy consumption have a positive relationship.

2.2 Natural resources and renewable energy consumption

The natural resources have a positive relationship because the growth of renewable energy will increase the availability of excess energy (Ahmadov & van der Borg, 2019). Renewable energy is associated with high costs that might not be recovered which makes it appear unpreferable to natural resources due to the risks involved (Lilliestam et al., 2017) (Fathi et al., 2021) on the study: "Do, Natural Resources and Human Capital Contribute to Environmental Degradation?" Evidence from the Central Asian States suggested that the central Asian countries are highly dependent on natural resources which then leaves it questionable if they are evidence of Dutch disease in the countries. Natural resources are an important aspect to ensure that the economy will grow, they need to be measured to continually sustain them to stop depletion. (Dell'Anno, 2020) suggested that the theory of the resource curse and the effect of the political part depends on the time it rather fluctuates. (D. Adams et al., 2019) stated that a country with rich natural resources over a country with poor natural resources does not mean it will do well in its economy but rather how the revenue is handled once it is received from the natural resources. This means that a country with natural resources should strive towards ensuring that it can manage natural resources and try to reduce the level of corruption. The study also suggests that they are policies implemented to protect natural resources and to ensure they are transparent, and these policies should be free from political watch to avoid any manipulation. The legal and judicial structure of the country should also be strengthened to ensure that they are more accountable and honest to increase the country's overall GDP. (Saeed, 2022) stated that accountability and more people being involved in the decision-making is what improves and strengthens the structure. (Han et al., 2022) found a negative relationship between financial development and natural resources, which means that natural resources increase or reduce financial development, though natural resources are a blessing to a country and should benefit financial development if the right policies are put in place. It was suggested that the development of the financial sector will conserve natural resources and will reduce the depletion process of natural resources. (Opoku et al., 2022) on the study "Does democracy really improve environmental quality? Empirical

contribution to the environmental politics debate" on 46 Sub Saharan African countries found out that conserving the natural resources can be done by democracy because people will naturally conserve natural resources upgrading the technologies used and ensuring they are regulations that protect the natural resources. (Shahbaz et al., 2018) suggested that natural resources should have a substitute that will reduce the pressure on the natural resources and once they are earnings from the natural resources it should be put in such a way that it will benefit the public that way it reduces the chances of a resource curse in a particular country. There is a negative relationship between natural resources and financial development, therefore, the economy should be diversified to increase income economy all the industries should be functional not depending on only one (Tang et al., 2022). (Yıldırım et al., 2020) suggested that natural resources should be a relevant aspect of the economy which means that the government must ensure that there is awareness raised of the importance of natural resources to the economy. That is, there must be efforts towards ensuring that the system is functioning well to increase economic growth. There is also a need to strengthen the sectors so that the economy will not be dependent on one sector, for instance in exporting they should be other exports not solely dependent on natural resources this reduces the pressure on natural resources and causes depletion. There should be more investment in the manufacturing sector since the economy will be solely dependent on natural resources which mean that the manufacturing sector should be more developed to increase financial development (Sun et al., 2020). (Isiksal et al., 2022) on the study of natural resources, human capital and CO2 emissions in Central Asia found that the GDP of Central Asia is solely dependent on natural resources, and they are high evidence of exporting of oil and gas. There is also evidence of a resource curse whereby they are a lot of resources, but they are not being efficiently used and they are of low institutional quality. To increase financial development, they should be an active and effective stock market in central Asia to increase the financial instruments and aid in the economic growth of a country. (Ali et al., 2022) The resource curse should be normalized meaning that the central Asian countries should expect that the resources are not beneficial to the economy such that they will start to be more strategic when it comes to policies to reduce the resource curse. The banking sector will also need to adjust the revenues from the natural resources in a way that the domestic investment should increase the economic growth of the country by creating jobs and opening the window for domestic investors. Natural resources occur out of a natural phenomenon and the ecology is solely dependent on

natural resources to function. The natural resources quantity vary from time to time depending on how they are managed if the action is to conserve or deplete (Salter et al., 2019). Resources also have different natures of their occurrence that is the existence of the renewable and nonrenewable resources. whereby renewable resources can be regenerated once they are used for instance solar, wind, and water. While non- renewable resources are resources that cannot be regenerated once they are used for instance coal, oil, and nuclear power (Kevin Stark, 2019). Countries with a lot of natural resources benefit more in financial development if they can use them effectively with the aid of technology to limit any leakages of natural resources to benefit the economy (Tang et al., 2022) (Khan et al., 2020).

2.2.1 Central Asia natural resources strategies

According to (UNECE, n.d.) this project was mainly done to enhance the Central Asian states to live in a more environmentally friendly environment after the activities of the natural resources whereby the Russian Federation is involved in ensuring that the government has put in place the policies to assist the people at large regarding the abundant natural resources. According to the "United Nations Framework Classification for Resources" (UNFC) the classification of natural resources into how they are extracted and their effect on the environment or the nation at wide. This makes it logical to put in place a system to govern the natural resources by usage of renewable energy technologies. The Central Asian states are resource abundant, and there have been working towards implementing the policies to encourage investment into the country. Since these Central Asian countries are solely dependent on the export natural resources it puts them in a situation that they can easily be affected by the fluctuations of other economies, by the changes in the product prices thereby having an adverse impact of the economy. Also aiming to ensure that there is a balance of the revenues from natural resources on how the companies, state and the people at large will benefit from the natural resource activities. With the abundant resources in Central Asian states the government should put in detail the plan on the natural resources value to the economy, its people, and the trade partners. Also, with the adverse effects of the production and the possible measures to live in an environmentally friendly environment. Despite the presence of the deserts in Central Asia it is impressive that it still ranks as one of the top countries in natural resource production. Efficient production processes have been put in

place to ensure they is greater production of the natural resources for instance Kazakhstan, Turkmenistan, and Uzbekistan turn the oil into liquid to form some form of natural gas then export it through the pipeline. The Kyrgyz Republic and Tajikistan have a major role in providing electricity through their hydro energy to countries like Iran, Pakistan, Afghanistan, the People's Republic of China, and Russia. Kazakhstan is one of the top countries in the production of coal while Kazakhstan and Uzbekistan ranging one of the top countries in the world when it comes to uranium. To work towards the conservation of the natural resources or the possible adverse effects one of the ways is to ensure to reduce the chances of possible climate change, to stop the liquidation of oil to natural gas to export it through the pipeline, usage of renewable energy and eliminating possible threats to pollute the environment. However, the usage of hydro power has been quite a tricky issue because they are needs of the agricultural production of the products in Kazakhstan and Uzbekistan, also Kyrgyz republic and Tajikistan are supplies of hydro energy thereby the need to balance to effectively use the natural resources. Looking at the water sources in the Central Asian states there are not evenly spread hence they is needed to enhance the irrigation schemes. Wind energy production is also a possible measure by the availability of the possible wind waves. Central Asia has also been categorized as one of the places with a rapid climate change which can cause the countries to experience droughts, floods, snow, shifts in the frequency and amount of rainfall. Due to the various threats to the environment the UNFC aims to provide the government with efficient policy implications, usage of the natural resources and efficient business processes to implement. With the considerations of the social, economic and the technological impacts of the economy. Kyrgyzstan implementations of the UNFC policies will have a direct impact on the peoples living conditions even though there is need for more investment in the renewable energy. They also have developed their brands of the goods they produce from natural resources to ensure that the public in the country consumes them. The different production of natural resources and keeping it as a base in the economy has positive impact in attracting foreign investors to invest in the economy. They have also adjusted their policies to suit the competitive environment to attract more investors. Looking at the value and the outlook of the Central Asian the natural resources are worth a lot of billion dollars hence the creation of production processes to produce should create job opportunities for the people in the country. Through the creation of job opportunities this will have a positive impact on the creation of efficient transportation to transport the goods that will

be exported. The UNFC will also assist in ensuring that there is advancement in digital technology thereby making fossil fuels and other minerals accessible on the internet that is on the stock market thereby increasing the investments coming into the country. The UNFC will also enable that the data for the non-renewable energy is accessible making it easier for the policy makers to make the accurate estimations and put in place the accurate policies. In Kazakhstan the presence of fresh ground water is very minimal therefore the conservation is very vital since it's an important natural resource used in everyday life. With the UNFC it can assist in ensuring it the analysis to be done on the country is aligning with international standards and strategically position the natural resources in the stock markets to attract investment. Unifying the exchange rates that are shown at a global level to match the local conditions. In Tajikistan the prices of the raw materials that are available to export to the other countries are always adjusting they is no fixed price at a time hence the UNFC put into consideration to fix the issue at hand. It will also ensure that there is long term analysis to ensure that there is conservation of the natural resources. To ensure that the restrictions between countries for trade are lifted to allow the country to benefit from the trading relationship. To aid in the growth of the natural resources sector thereby giving an insurance of advancement not extinction. On the other hand, Uzbekistan has been working towards getting as many investors attracted to investing and perform other transactions to increase the overall GDP of the country. The project of installing solar panels has been in action to conserve natural resources. The UNFC also ensured that there are trained personnel to handle the production of natural resources who are more knowledgeable in the natural resources. Turkmenistan is quite impressive because it has one of the economies that grow quickly, and it well known from basing their economy on the production of petroleum and natural gas. However, through the aid of the UNFC it will maximize the production of natural resources in an environmentally friendly way. The country is affected by the desert climate making it possible to install solar energy. The Central Asian states provide a potential to ensure they is renewable energy production. Because of the great winds experienced in central Asia that give a chance to venture in wind energy, the great sunshine experience also gives the potential for solar energy giving a chance for Central Asia to move to use sustainable sources of energy.

Hypothesis 2: Natural resources and renewable energy consumption have a positive relationship.

2.3 GDP per capita and renewable energy consumption

It is the measure of the production levels in the economy enabling us to be able to track the growth between different periods. It is important to sum up the productivity of the economy so it can be analyzed and check for areas to work on. Hence when the renewable energies are implemented, they increase the GDPPC because more revenue will be generated, and competition increases the quality of the goods and services thereby the increase of renewable energy will increase the availability of energy in the country thereby having an impact on GDPPC.

Hypothesis 3: GDP per capita and renewable energy consumption have a positive relationship.

2.4 Foreign direct investment and renewable energy consumption

Owning property in another country might either be rewarding or a total loss depending on the fluctuations of the economy of that country. Investments have a lasting impact when they are profitable. When the government sees a profitable open economy, it usually invests for instance with capital, a skilled workforce, or technology (Adam Hayes, 2022b). Therefore, the fluctuations of the FDI inflows increase the renewable energy it means that there is more funding to the renewable energy projects.

2.4.1 European Bank for Reconstruction and Development (EBRD) in Central Asia

According to the European Bank for Reconstruction and Development (EBRD) brochure (EBRD, 2017) the Central Asian states have been putting in place strategies to attract investors since there is a high risk of investment. EBRD has been one of the top investors in Central Asia since the higher the risk the higher the return. The EBRD has been aiding the strategy implementation to ensure that there is increased economic growth. Central Asia has been a route for trade in many west and east countries with very few small businesses, hence the ERBD has been ensuring that there is an increased number of small businesses by offering flexible loans to business owners thereby fostering the growth of small businesses. They also offer business advice for a period of 3 years with the best business tycoons that are based internationally based on operating a business, costs involved, marketing and investment. There has been working towards the employment creation of women and youth thereby increasing the human capital.

Particularly it arranged a syndicated loan to JSC Shalkiya Zinc Ltd, a Kazakh mining company to foster the production of zinc and the establishment of a new mine in Kyzylorda region with the aim of increasing the education and job opportunities in the rural areas. Aiding the women to be business owners by the women's business program aimed at giving out loans to support the women in business. The support of going green to ensure the Central Asian states fight against global warming but rather maintain the climate and efficiently use the resources. Promoting the use of renewable energy sources such as solar energy whereby they are organizing a syndicated loan with Clean Technology Fund (CTF) and the Asian Development Bank (ADB) to install a solar panel in Baikonur in central Kazakhstan and another one in Kyzylorda region of south Kazakhstan. With this solar energy installed it is estimated to reduce the CO_2 emissions by 75 000 tonnes thereby reducing the risks associated with the emissions. Promoting green finance through the formation of Astana International Financial Centre (AIFC) to aid Kazakhstan become the headquarters of green finance thereby supporting the issue of use of renewable energy technologies to reduce the risks of emissions. They also aim to ensure that businesses are energy efficient by providing funds that ensure the expansion of the business such as giving a ten million loan to Turkmenistan's Coca-Cola Bottlers (TCCB) to ensure that they expand by getting new equipment and migrating to other energy sources of using renewable energy sources. Small and medium businesses are also being trained to ensure they match up to the standard of Coca-Cola, so they also become their competitors. Promoting the efficient use of natural resources whereby Tajikistan's First Microfinance Bank (FMFB) joined forces with ERBD to form Climate Resilience Financing Facility (CLIMADAPT) to ensure that there is stability in terms of climate change and to aid in the technologies put in place to support the project. Also ensuring the energy efficiency in the Kyrgyz Republic through the "Kyrgyz Sustainable Energy Financing Facility" by providing flexible credit lines. This aided a lot of institutions, for instance Jala-Abad kindergarten who managed to install windows, boiler and heatproof walls thereby regulating warmth among the children and reduced usage of energy by 50%. Boosting the electricity supply as one of the ways to promote the usage of renewable energy the EBRD and Green Climate Fund (GCF) will aid Tajikistan to restore the Qairokkum hydro plan to ensure that electricity is provided to more than 500 000 people thereby creating the capacity of new ideas to ensure they is climate stability. Improvement of the airport infrastructure to assist in better connection to the world by granting a loan to Kyrgyz Republic to aid in improving the terminal at Manas airport,

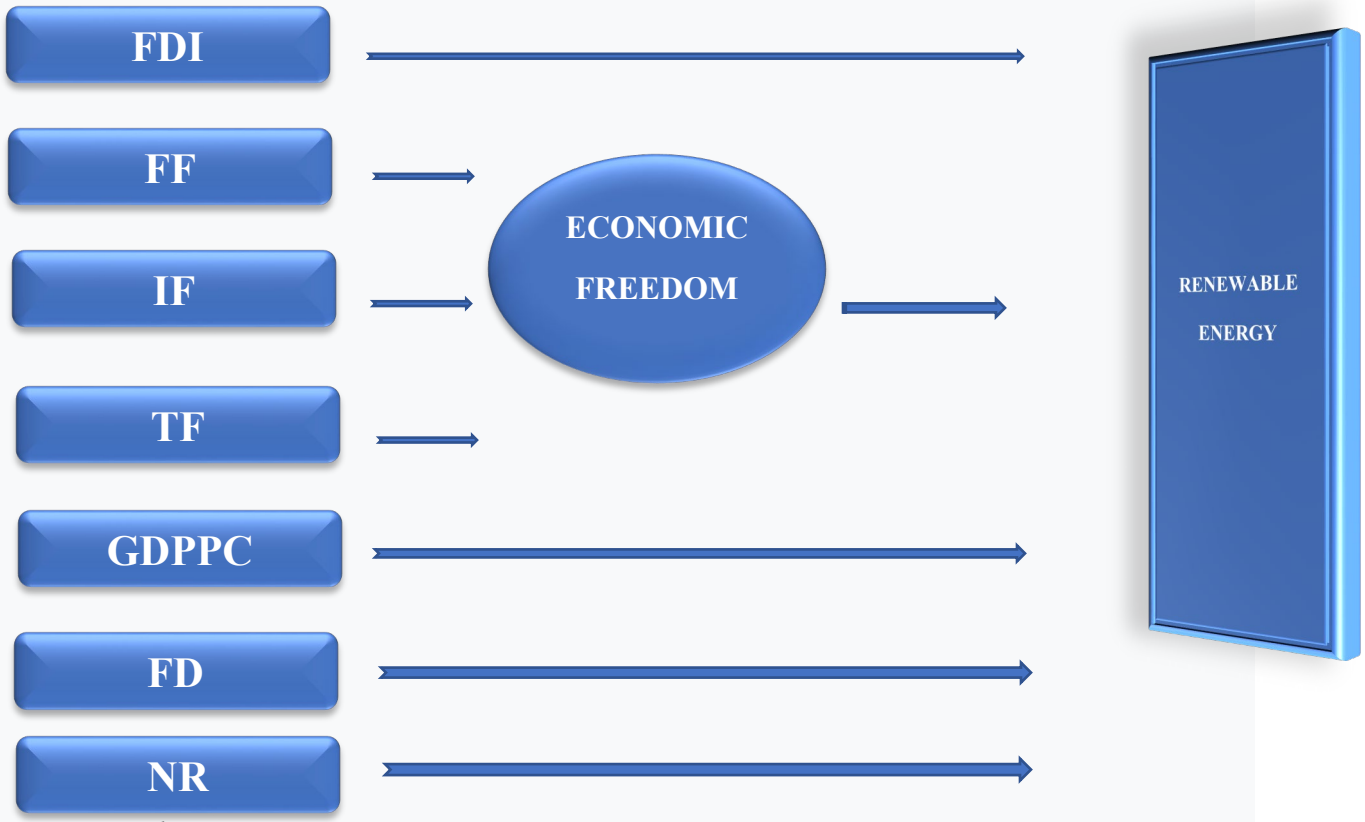
installing efficient heating systems and ventilation systems. Development of an efficient system to connect the nation and the world for instance in Tajik capital Dushanbe the development of 3 level road will reduce the congestion in the city since there is a large population in the country of 800 000 thereby reducing the emissions. A similar instance like ,Tajikistan also, Uzbekistan border was a syndicated loan by the EBRD and the Asian Infrastructure Investment Bank thereby increasing the accessibility of the Central Asian states. Supporting small businesses so that they encourage the trade the "National Bank for Foreign Economic Activity of Uzbekistan" (NBU) by the aid of EBRD is offering loans that assist the small businesses and support the economy at large. To support the risk of exchange rate in 2013 EBRD lend Bear Beer a dominant supplier of soft drinks and beer in Kyrgyz Republic with the aim to expand the business internationally but as time passed the business started to face the risk of exchange rate and it started to affect their profits. Since it also exported to countries like Kazakhstan the currency was losing value making their exports encounter deficits which made it a challenge to pay off the loan by EBRD. With the turnout of things, the EBRD decided to convert the loan to the local currency to ensure that Kyrgyz Republic could pay it off.

Hypothesis 4: Foreign direct investment and renewable energy consumption have a positive relationship.

2.5 Conceptual view and hypotheses

Renewable energy consumption (REC) is the dependent variable its growth is affected by natural resources (NR), foreign direct investment inflows of GDP (FDI), financial development (FD), GDP per capita (GDPPC), financial freedom (FF), investment freedom (IF), and trade freedom (TF). In this study analysis of the behavioral changes of financial development is affected by the independent variables. Figure 5 below shows the relationship between renewable energy consumption and independent variables.

Figure 5: Hypothesis



Source: Authors computations

CHAPTER III

Methodology

This chapter is a discussion of renewable energy in Central Asia with the model estimation and the choice of the data that is used. The data used in this study is secondary data for all the variables.

3.1 Data and model specification

3.1.1 Variables description

The variables used to analyze the renewable energy in Central Asia from 1998 to 2019 in Kazakhstan, Kyrgyz Republic, Turkmenistan, Tajikistan, and Uzbekistan were extracted from the World Bank that is renewable energy consumption (REC), GDP per capita (GDPPC) , natural resources (NR) and FDI inflows (FDI) while trade freedom (TF), investment freedom (IF), and financial freedom (FF) are extracted from the Heritage Foundation 2011 Economic Freedom index and financial development index was extracted from the International Monetary Fund (IMF).

3.1.2 Data description

Table 1: Variables Description

Variables	Indicators	Measurement	Source
REC	"Renewable energy consumption % total of final energy consumption"	Percentage	"World Bank, Sustainable Energy for All (SE4ALL) Global Tracking Framework by the World Bank, International Energy Agency, and the Energy Sector Management Assistance Program."
FD	"Financial development index"	Index	IMF
FDI	"Foreign direct investment net inflows % of GDP"	Percentage	"International Monetary Fund, International Financial Statistics and Balance of Payments databases, World Bank, International Debt Statistics, and World Bank and OECD GDP estimates."
GDPPC	"GDP per capita growth annual %"	Percentage	"World Bank national accounts data, and OECD National Accounts data"
NR	"Total natural resources rents % of GDP"	Percentage	"World Bank based on sources and methods in the World Bank's The

			Changing Wealth of Nations"
FF	"Financial freedom index"	Index	"World Bank, *World Development Indicators 2012*; World Trade Organization, *Trade Policy Review*, 1995–2012; Office of the U.S. Trade Representative, *2012 National Trade Estimate Report on Foreign Trade Barriers*; World Bank, *Doing Business 2011* and *2012*; U.S. Department of Commerce, *Country Commercial Guide*, 2008–2012; Economist Intelligence Unit, *Country Commerce*, 2009–2012; World Bank, *Data on Trade and Import Barriers: Trends in Average Applied Tariff Rates in Developing and Industrial Countries, 1981–2010*; and official government

			publications of each country."
IF	"Investment freedom index"	Index	"Economist Intelligence Unit, *Country Commerce*, 2009–2012; Office of the U.S. Trade Representative, *2012 National Trade Estimate Report on Foreign Trade Barriers*; and U.S. Department of Commerce, *Country Commercial Guide*, 2009–2012."
TF	"Trade freedom index"	Index	"Economist Intelligence Unit, *Country Commerce* and *Country Finance*, 2009–2012; International Monetary Fund, *Staff Country Report*, "Selected Issues," and *Staff Country Report*, "Article IV Consultation," 2009–2012; Organization for Economic Co-operation and Development, *Economic Survey*; official government

			publications of each country; U.S. Department of Commerce, *Country Commercial Guide*, 2009–2012; Office of the U.S. Trade Representative, *2011 National Trade Estimate Report on Foreign Trade Barriers*; U.S. Department of State, *Investment Climate Statements*, 2009–2012; World Bank, *World Development Indicators 2012*; and various news and magazine articles on banking and finance."

Source: Authors computations

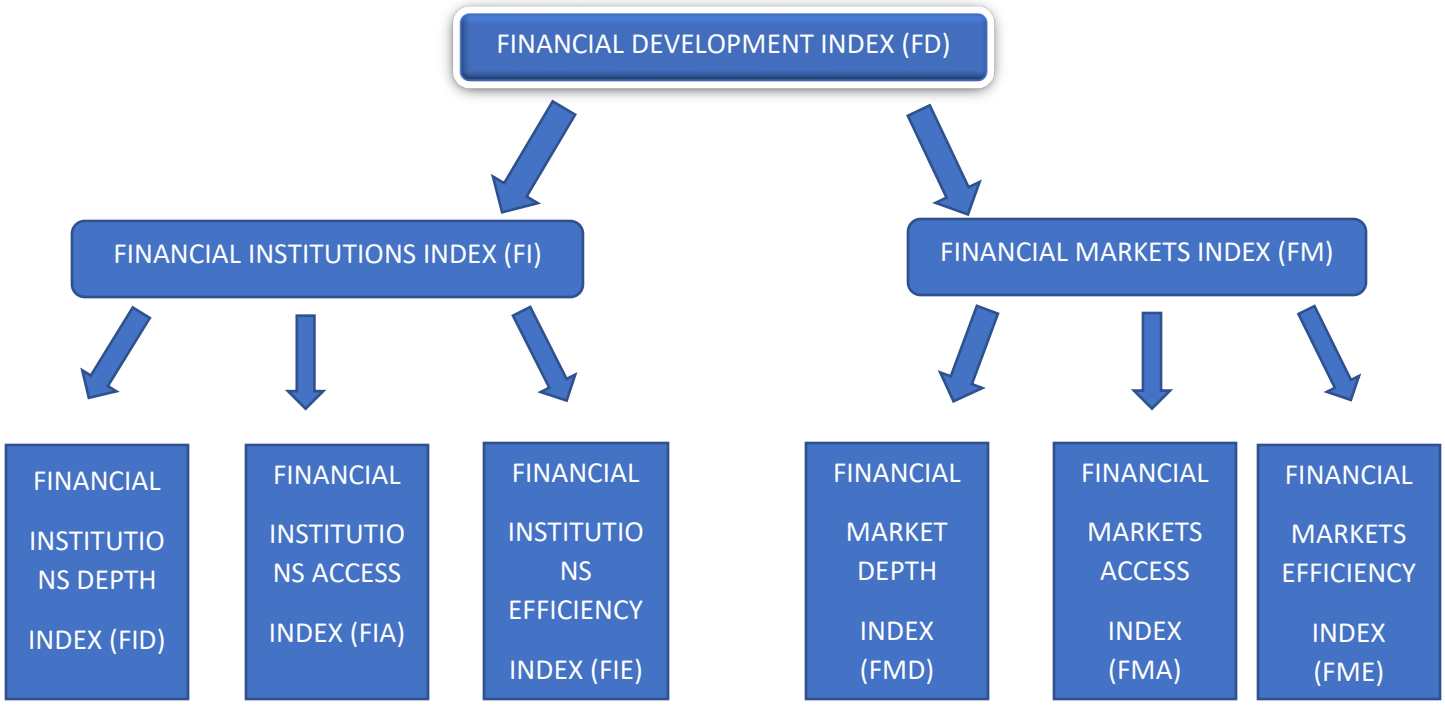
3.2 The dependent variable

The dependent variable is renewable energy consumption according to the World Bank, renewable energy consumption is the portion of total final energy consumption. Whereby the total final energy consumption which is in the formula is calculated by primary energy + Imports – Bunkers +/ -stock changes (*SHARE OF RENEWABLE ENERGY SOURCES IN TOTAL ENERGY USE Consumption and Production Patterns*, n.d.).

3.2.1 Financial development Indicator

According to the IMF the indicator aims to achieve to merger the financial markets and institutions in terms of how developed in the 3 components which the depth is this describes the size of the market and the way the market is liquid that is the ease of the assets in buying and selling on the market. The next component is the accessibility that is to analyze if the financial services are reachable to the customers which is the individuals and the companies. Also, to analyze the capability of the companies to offer services at a minimal cost and be able to get good revenue. Figure 5 shows the components in the financial development index.

Figure 5: Components in the financial development index



Source: IMF

According to the above figure 4 (IMF), n.d.)the financial development index is broken down into two that is the financial institutions index (FI) and the financial markets index (FM). The two components of FD are further simplified, the FI is also simplified in the financial depth index (FID), financial institutions access index (FIA), and the financial institutions efficiency index (FIE). While the FM is also simplified into financial market depth index (FMD), financial

markets access index (FMA), and financial markets efficiency index (FME). The FID is described as the when the bank gives out the credit to the private sector given as a percentage of the GDP, with the pension funds' assets, mutual fund assets, and insurance premiums all these individually a ratio to the GDP. FIA this index mainly focuses on the data that is collected in the banks on adults and the ATMs. FIE is the data compiled on the return on equity, net interest margin, lending deposits spread, return on assets, non-interest income to total income, and costs to total assets. Moving on to the other element of the FD, which is the FM, the FMD is inclusive of data on the stocks traded, stock market capitalization, debt securities of government, debt securities financial and non-financial all as a ratio of the GDP. FMA is the data on the market capitalization besides the 10 best and big size companies and the issuers of the debt securities financial and non-financial. FME is the data on the stock market turnover ratio that is the shares divided by the market capitalization. Hence all these components make up for the value that we have as the financial development index, and it ranges from 0 to 1.

3.3 Independent variables

3.3.1 Natural resources

According to the (Bank, n.d.) it is the summation of the oil, coal, mineral, forest, natural gas rents using the weighted average method which leads us to the natural resources as a percentage of the GDP. The major reason for the value of the natural resources and the GDP to ensure that the countries fully benefit from the existence of the natural resources from the fossil fuels and the minerals to also ensure that the costs for the production process are lower as comparison with the revenue. Natural resources enable that there is the income derived from them, and the production of the goods and the services the supply must be driven to zero to ensure that there is maximization of the profits. When the country is earning the revenue from fossil fuels, minerals, and forests it shows that the country is turning the resources to cash at the expense of depletion. Hence the usage of the revenue earned from these natural resources is of paramount importance because the country should invest the returns earned to secure the future of the country other than just spend it all and deplete the future resources. When it comes to the methods of calculation of the natural resource value the price and the average cost is put into consideration of the natural resource. The estimated figure of the price of the products deducted

from the costs incurred during the production phase of the natural resource. The figure is further multiplied amount a country extract for the natural resource to compute the rents figure for the natural resources as a percentage of the GDP of the country.

3.3.2 GDP per capita

According to the (Bank, n.d.) the GDP per capita is the percentage basing on the currency in the country. Which is computed by the (GDP / population of half of the year). When accounting for the GDP at the prices of the people involved in the production process the value of the goods at cost price with the addition of tax deduct the subsidies this is without accounting for the depreciation.

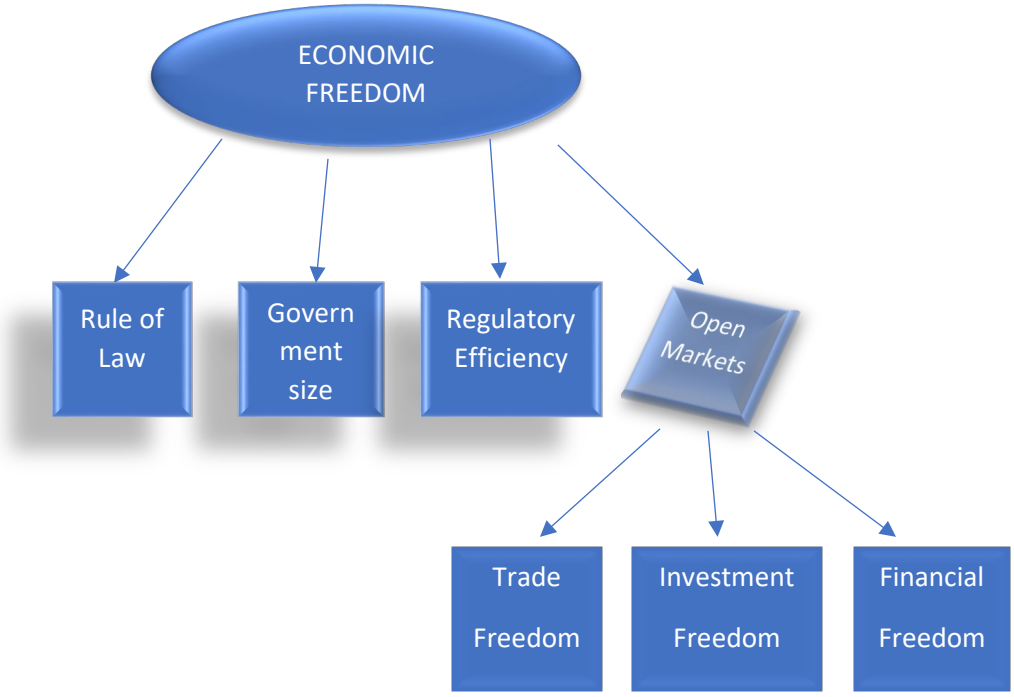
3.3.3 Foreign direct investment net inflows of GDP

This is to secure the investment in stock in another country different from the country of the investor. It is the computation of the equity capital, reinvestment of earnings, short- and long-term capital also included in the balance of payments value. It comprises of the new investment inflow deducted from the reduction of the investment and then dividing it with the GDP. The FDI, however, fails to give the complete picture of the investments made in the country since the data on the balance of the payments does not include the capital that was contributed from the country itself. FDI also does not include the non-equity transactions, that is the goods and services interchanged between the countries. Also, the FDI in comparison to other sources differs with the method of computation. In the computation the equity flow is based on the source of the IMF, while the FDI is sourced from the United Nations Conference on Trade (UNCTAD) and other sources from the countries. The FDI components include the equity, investment indirectly to the companies, and directly by other companies. FDI influences the management of the enterprise, investment in the buildings to ensure the more efficient production of goods and services. The investor might start up a new company and build it up in the facilities for production and then partner with another existing company in another country in a merger or acquisition.

3.3.4 Economic freedom

According to the ("No Title," n.d.) the economic freedom is the ability of the individuals to freely operate in the consumption, production, labor and invest without the control of the various restrictions that may be put in place by the government to alter the way of life and follow the prescribed guidelines. Economic freedom promotes increased standards of living. Economic freedom is measured in the components of rule of law that is the property rights, judicial efficiency and the government integrity, government size the spending and the tax imposed, regulatory efficiency the business, labor and monetary freedom, and the open markets that is the trade, investment and the financial freedom with the scare of 0 to 100. The lowest represents the absence of economic freedom while the highest represents economic freedom which is highly preferred for the efficiency of the economy in general. This is shown in figure 6.

Figure 6: Components of Economic Freedom



Source: Authors computation

In this study we will be using the variables under the open markets which is the trade freedom, investment freedom and the financial freedom. (The Heritage Foundation, 2022)Whereby the trade freedom is the removal of the barriers that restrict the trade of imports and exports in the

form of tax or other restrictions. The score for trade freedom is based on the trade weighted average tariff and non-tariff barriers. The average tariff is based on every good and services that is imported from another country. Which is computed by:

$TF= ((tariff_{max} – tariff_{i})/ (tariff_{max}-tariff_{min}) *100 –NTB))$

The "($tariff_{max}$ and $tariff_{min}$)" shows the higher and lower for tariff rates respectively which is usually 0% when its lower bound and 50% when its higher bound, $tariff_{i\ is}$ the weighted average tariff and the NTB is the non-tariff barrier. The scale is defined from 5, 10, 15 and 20 and it represents: 20 means NTB are widely used on the goods and services traded with a high amount, 15 means NTB are imposed on the goods and services on most of the goods, 10 means NTB are imposed on some of the goods and services, 5 means that NTB are imposed on few of the goods and services and 0 means NTB is not imposed on any of the goods and services. The NTB are in form of price, quantity, regulatory, investment, customs, and direct government intervention. Investment freedom is whereby the people are allowed to make investments in any country without any restrictions. Using the index, it evaluates the categories of the investments whereby the points are deducted from the maximum ideal score of 100. The restrictions can be all real estate purchases restricted, inefficiency of policies, lack of transparency and restrictions on land ownership just to mention a few. Depending on the type of government many restrictions are placed on the investments then the total score for investment freedom is calculated. (The Heritage Foundation, 2022). Financial freedom is a measure of the function ability of the banking sector without any intervention from the government or financial sector. When the banks are owned by the state it reduces their efficiency in their services. The financial freedom index will measure the availability of foreign companies' competition, government influence on credit, financial and capital market development, state intervention in the financial institutions and the level of government intervention on the financial institutions. With the scale of 0 to 100 after being deducted from the score of 100. 100 means insignificant level of government intervention, 90 means the government intervention is very low therefore they might be involved in contracts to prevent money swindling, 80 the average normal intervention of government whereby they own some shares in few companies the restrictions are not felt, 70 the government restrictions are very limited because the government is the one responsible for the credits given out not inclusive the private sector and the foreign investors have minimal

restrictions, 60 the government has a noticeable control even though the central bank is independent the government has ownership and control in institutions, the services offered are restricted to a certain extent, 50 foreign investors, credit allocation and service provided are subject to restrictions, 40 significant barriers the government has a large portion of the shares and enforces contracts, and a greater level of supervision on the institutions, 30 government controls most of the financial institutions, the institutions are highly restricted and foreign investors, 20 the central bank is fully controlled by the government foreign institutions are restricted or not popular, 10 credit allowances, foreign institutions, and bank formations are fully restricted by the government, 0 means that the government is in full control and the private financial institutions are not encouraged.

CHAPTER IV

MODEL SPECIFICATION

The model specified as:

$$REC = \beta_0 + \beta_1 GDPPC + \beta_2 NR + \beta_3 FDI + \beta_4 TF + \beta_5 IF + \beta_6 FF + \beta_7 FD + \varepsilon$$

Whereby:

REC is Renewable Energy Consumption the dependent variable to measure the effect on it with the independent variables, GPPC is the Gross Domestic Product per capita, NR is the Natural Resources, FDI is the Foreign Direct Investment, TF is the Trade freedom index, IF is the Investment Freedom index, FF is the Financial Freedom index, FD is the Financial Development index, β_0, β_1, β_2, β_3, β_4, β_5, β_6, and β_7 are the intercept and the parameters of the variables, and the ε is the error term to check for the margin of error.

4.1 Descriptive statistics

Descriptive statistics is important because it analyses the data given in this study the behavior and the characteristics of the data. The data is measured to show the mean, median, mode, standard deviation, variance, minimum and the maximum, kurtosis, and the skewness. Table 1 shows the descriptive statistics of the data in this study. With the sample size of 110 observations from the 5 Central Asian countries. The mean shows the center of the data that is the average, which shows we have values of 17.028, 69.466, 17.398, 28.277, 4.922, 29.455, 5.171, and 0.151 in REC, TF, NR, IF, GDPPC, FF, FDI, and FD respectively. The median also shows the center of the data and the advantage is that it is less affected by the outliers in the data which is also 1.809.70.7, 12.472, 30, 3.994, 0.118 for variables REC, TF, NR, IF, GDPPC, FF, FDI, and FD respectively. The data ranges in REC are from 0.050 to 64.580, which is quite low in these countries. In the TF data ranges from 22 to 87.6 which is relatively good because it shows the level at which these countries have less restrictions on their trading activities. NR data ranges from 0.263 to 87.577 which is relatively high showing that there is evidence of natural resource abundance in these countries. IF data is from 0- 60 this shows that there is evidence of

investment restrictions in the countries. For the GDPPC data ranges from (1.738) to 15.127 this already shows that the people living in those countries in terms of the benefits from the natural resources that are abundant the benefits are minimal because the GDPPC is low. FF ranges from 10 to 70 showing that the wide gap between being purely controlled by the government with a lot of restrictions on the credit allocation, the banking facilities are prohibited to form and the foreign financial institutions that are not allowed to operate to having the financial institutions operational but still face some restrictions, government having few shares in companies, the credit allocation is controlled by the government while the private credit is not controlled. FDI ranges from (1.391) to 22.524 it shows that the net inflows are relatively low that are being received in the countries this shows the need to increase it to boost the various projects to increase the economic growth. FD ranges from 0.057 to 0.388, which is relatively low in these countries. This shows that there are maybe fewer financial institutions that are fully efficiently operational. The standard deviation checks on the data if it is spread out from the mean. REC with a mean of 17.028 and a standard deviation of 22.057 which shows the data is close to the mean and the skewness which shows if they is a positive or negative distribution is 0.994 which is positive , TF with a mean of 69.466 and a standard deviation of 13.638 this means that the data is dispersed from the mean, the distribution is skewed to the left with (1.824). NR mean is 17.398 and the standard deviation is 17.821. This shows that the data points are so close to the mean, with the distribution skewed to the right with 1.558. IF mean is 28.227 and the standard deviation is 17.075 this shows the data is a little bit far from the mean and it has a negative skewness of (0.101). GDPPC with a mean of 4.9215 and a standard deviation of 3.306 with a skewness of 0.519. FF with a mean of 29.455 and a standard deviation of 18.115 this shows the data is dispersed from the mean and the skewness is positive 0.175. FDI with a mean of 5.171 and standard deviation of 4.234 which shows that the data points are close to the mean the skewness is 1.237. The FD mean is 0.151 and the standard deviation is 0.084 and data points are close to the mean with the skewness of 1.184. The kurtosis measures the tails in the data on the effect of the outliers that is observed in the dataset that means a higher kurtosis shows that the data is more spread out on the tails there is evidence of tail data. A lower kurtosis means that the data is close to the mean and there is not so much tail data. The higher kurtosis of 6.6926 is from TF which shows that the data variability is also based on the relationship between the standard deviation and the mean shows the data is spread out on the tails. The lowest kurtosis is 2.416

which means that there is not so much tail data and usually a lower kurtosis is preferred by the investors because it is less risky it shows that the price variability is not so much. The Jarque-Bera test shows the difference between the skewness and the kurtosis of the data, and the null hypothesis is that there is a normal distribution. Looking at the probability we cannot reject the null in IF and GDPPC. We reject the null hypothesis in REC, TF, NR, FF, FDI and FD which means that they are not normally distributed which means we have extreme values either flatter or steeper.

Table 2: Descriptive Statistics.

	REC	TF	NR	IF	GPPC	FF	FDI	FD
Mean	17.028	69.466	17.398	28.227	4.922	29.455	5.171	0.151
Median	1.809	70.700	12.472	30.000	4.604	30.000	3.994	0.118
Max	64.580	87.600	87.577	60.000	15.127	70.000	22.524	0.388
Min	0.050	22.000	0.263	0.000	(1.738)	10.000	(1.391)	0.057
Std. Dev.	22.057	13.638	17.821	17.075	3.306	18.115	4.234	0.084
Skewness	0.994	(1.824)	1.558	(0.101)	0.519	0.175	1.237	1.184
Kurtosis	2.512	6.693	5.486	2.416	3.502	1.5	4.800	3.300
Jarque-Bera	19.185	123.50	72.843	1.751	6.091	10.875	42.899	26.128
Prob	0.000	0.000	0.000	0.417	0.048	0.004	0.000	0.000
Sum	1873.0	7641.3	1913.8	3105.0	541.365	3240.0	568.850	16.619
Sum Sq Dev	53030	20275	34618	31779	1192	35767	1954	0.766
Obs	110	110	110	110	110	110	110	110

Source: Authors computations

4.2 Panel unit root test

The unit root test should be carried out to check if there is stationarity in the data or not because of a time series. By conducting the unit root test using Augmented Dickey-Fuller (ADF) which might have the problem of serial correlation even though the ADF can handle more complex model and Phillips Perron (PP) this handles the problem in autocorrelation and heteroskedacity. The unit root test shows if the characteristics of the data if it is trending it must be differenced to keep the data at stationary mode (Herranz, 2017). The data is stationary when the data is constant over time this means that the mean, variance, and covariance. By differencing we can remove the trend in the data. It is important to remove unit root so that the model is easily computed. The unit root formula is computed as:

$$Y_t = D_t + z_t + \varepsilon_t$$

Whereby D_t is the component that gives constant results which is deterministic, z_t is the component that gives different results which is stochastic and ε_t is the process of stationary. Table 3 shows the unit root tests of the ADF and the PP at intercept and trend.

Table 3: Panel Unit Root Test.

Intercept and Level				
	Augmented Dickey-Fuller (ADF)		Phillips Perron (PP)	
Variables	Coefficient	P value	Coefficient	P value
REC	19.483	0.035	18.449	0.048
FD	28.117	0.002	22.058	0.015
FDI	29.277	0.001	29.669	0.001
GDPPC	31.846	0.000	31.846	0.000
IF	23.999	0.008	40.038	0.000
TF	31.839	0.000	21.689	0.017
FF	19.672	0.033	20.417	0.026
NR	18.402	0.049	18.451	0.048

Source: Authors computations

The results show that using the ADF and PP the results for REC, FD, FDI, GDPPC, IF, TF, FF, and NR we reject the null hypothesis that there is unit root in the data therefore there is no unit root found in the data. This means that the data is non-stationary.

4.3 Model estimation and justification

To make the analysis of the variables the various analysis will be made that is the Pooled Ordinary Least Square, Fixed Effects and Random Effects model. With the pooled OLS it's a simple analysis to check on the relationship between the variables, this model is usually unbiased if the residuals are independent of the independent variables. Pooled OLS is important because it gives you variables that are unbiased. The FE and RE model are more specific on the relationship between the variables therefore there are better models than the pooled OLS the Hausman test will also be used to check the best model between the FE and RE models. Table 4 shows the pooled OLS model. The pooled OLS model is derived as:

$$REC_{it} = \beta_0 + \beta_1 FD_{it} + \beta_2 FDI_{it} + \beta_3 GDPPC_{it} + B_4 NR_{it} + B_5 TF_{it} + \varepsilon_{it}$$

$REC_{it} = \beta_0 + \beta_1 FD_{it} + \beta_2 FDI_{it} + \beta_3 GDPPC_{it} + B_4 NR_{it} + B_5 IF_{it} + \varepsilon_{it}$

$REC_{it} = \beta_0 + \beta_1 FD_{it} + \beta_2 FDI_{it} + \beta_3 GDPPC_{it} + B_4 NR_{it} + B_5 FF_{it} + \varepsilon_{it}$

Table 4: Pooled OLS Mode.l

	Model 1		Model 2		Model 3	
REC	Coefficient	P value	Coefficient	P value	Coefficient	P value
FD	-111.26	0.000	-105.557	0.000	-133.655	0.000
NR	-0.66	0.000	-0.669	0.000	-0.529	0.000
FDI	-0.333	0.358	-0.184	0.543	-0.563	0.076
GDPPC	0.288	0.535	0.623	0.181	0.818	0.046
FF					0.388	0.000
IF			0.171	0.009		
TF	0.192	0.092				
C	32.288	0.000		37.683		33.88
R squared		0.57		0.573		0.622
Prob		0.000		0.000		0.000

Source: Authors computations

The results of the pooled OLS model show the relationship between the dependent variable which is the REC with the independent variables. FD shows that when there is an increase in FD decreases REC which is means that in the first phases of the introduction of the REC the FD will decrease because there will be an investment in the renewable energy then provide sustainability in the long run for instance the investment in the green financing will cause sustainability through the stock market thereby showing a negative relationship and that it is significant. FDI has a negative relationship with the REC, this means that when FDI increases the REC decreases and it is significant. This means that when the consumption of renewable energy increases which means that the population will tend to also move to sustainable ways of energy this means that the demand for non-renewable energy will decrease thereby also decreasing the foreign investments on the non-renewable energy. FF has a positive relationship with the REC, this means that an increase in the FF will increase the REC and it is significant.

This means that when the financial institutions are free to make their own decisions in the transactions, they can engage in giving of credit, foreign institutions can form, and they are less restrictions this allows the public to increase in the renewable energy consumption and even if they need credit to consume, they can get it at ease. GDPPC has a positive relationship with the REC this means that when GDPPC increases the REC will increase. This means that the more renewable energy consumption is consumed the more the growth of every individual because renewable energy is more accessible, and it can be used without being rationed since it can be regenerated. The effect of the GDPPC is insignificant on the REC. IF has a negative relationship with REC and this means that an increase in IF will lead to a decrease in REC and it is insignificant. This means that when the renewable energy in implemented the IF increases to ensure that the population will transition from natural resources to renewable energy sources therefore the government will put restrictions on the invest capital of the non-renewable sources. NR has a negative relationship with REC this means that an increase in NR causes a decrease in the REC and it is statistically significant. This means when the transition from the non-renewable energy to renewable energy this causes the decrease in demand of the natural resources if it is fully implemented which is good for the growth of the economy to more sustainable energy sources that can be replenished. TF has a negative relationship with the REC meaning that an increase in TF causes the REC to decrease and it is statistically significant. This means that when the REC is implemented by the government some restrictions will be put in place to ensure that the renewable energy sources are fully promoted, and this act will influence the trading sector this will overall cause a decrease in their transactions. The adjusted R squared shows how the independent variables explain the dependent variable, so it shows the strength of the relationship therefore the adjusted R squared is approximately 61% which is good. The F statistic shows if the model is fitted based on the p value, the null hypothesis is rejected, the F statistic will analyze the effect of all the 110 observations and the individual variables. In the next section the FE and the RE will be used to check the relationship between the variables giving more advanced results.

4.4 Fixed effects and random effects model

With the panel data of 5 Central Asian countries and a period from 1998 to 2019 the fixed and the random effects model was used. Whereby in the fixed effect model it is assumed that the

results are the same in all studies and the summation of the results is inclusive of the common effect. While the random effects assume that the results vary from one study to the other, which means that the results will be different. Then the summary is the average of those effects. Fixed effects model the assumption that the results are the same in all the studies and any difference is because of the sampling error. When computing the weights under the fixed effects model overall there is of less use to results in the studies with a small sample the studies with large sample size will be used since they have vast amounts of information. When using the random effects model the analysis tends to be computed by using the overall effects of all the studies. Therefore when allocating the weights the sole purpose is to find the overall effect on the all the studies using the random effects model (Borenstein et al., 2009). Also looking at the random effects model allows the assumption of uniqueness in the results, and it gives the allowance to check the effect on the variables individually effects. The assumption that the individual effects are not correlated with the regressors is an issue of concern. Whereby the fixed effects model dismisses the assumption of individual effects thereby dismissing the issue of variability of the data (Huang, 2020). (Empirical & From, n.d.)The fixed effect model assumes that the intercept never changes while the random effects assumes that the effects are random, and the intercept will have a mean value. Hence when using the random effects, the contrast between the variables will show in the error term. The Hausman test will also be performed to test the best model suitable with the data in this study. When using the fixed effect model, it is of ultimate importance to put into consideration the two factors which is assuming that the results are the same in the studies and to also to calculate the common effect size on a specific population other than not being specific. While the random effect models the assumption is that the analysis is done by different researchers therefore the results are different this means that the assumption of common effect size is not considered. Hence most researchers justify the random effects because it is more logical to assume the different scenarios in the population (Borenstein et al., 2009). The fixed effects model assumes that the population is specified while the random effects model assumes that the population is on a general level (Reading, 2011). (Rasul, 2018) The FE and the RE model are more dependable compared to the pooled OLS. The FE and the RE model were carried out and to check the best model Hausman test was also done. In the FE and RE model the model is divided into 3 because the individual effect of the TF, FF and IF are tested to avoid correlation of the variables. Table 5 shows the FE and the RE model.

Table 5: Fixed Effect and Random Effect Model.

Variables	**Fixed Effect**			**Random Effect**		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
TF	0.231			0.192		
P value	0.117			0.098		
IF		0.092			0.171	
P value		0.383			0.074	
FF			0.295			0.388
P value			0.008			0.000
NR	-0.776	-0.794	-0.659	-0.660	-0.669	-0.53
P value	0.000	0.000	0.000	0.000	0.000	0.000
FD	-102.48	-104.59	-125.0	-111.26	-105.56	-133.66
P value	0.000	0.000	0.000	0.000	0.000	0.000
FDI	-0.364	-0.262	-0.557	-0.333	-0.184	-0.563
P value	0.379	0.522	0.177	0.368	0.607	0.118
GPPC	-0.249	0.044	0.397	0.288	0.623	0.818
P value	0.633	0.939	0.467	0.543	0.214	0.086
C	33.08	45.183	39.633	32.288	37.684	33.88
P value	0.003	0.000	0.000	0.000	0.000	0.000
Hausman				0.0046	0.0132	0.0801
Adjusted R squared	0.533	0.523	0.558	0.55	0.552	0.604
F statistic	5.783	5.6	6.284	27.62	27.88	34.221
Prob	0.000	0,000	0.000	0.000	0.000	0.000
Obs	110	110	110	110	110	110

Source: Authors computations

Fixed effects model is derived as:

$$REC_{it} = \beta_0 + \beta_1 FD_{it} + \beta_2 FDI_{it} + \beta_3 NR_{it} + \beta_4 GDPPC_{it} + \beta_5 TF_{it} + \varepsilon_{it}$$

$$REC_{it} = \beta_0 + \beta_1 FD_{it} + \beta_2 FDI_{it} + \beta_3 NR_{it} + \beta_4 GDPPC_{it} + \beta_5 IF_{it} + \varepsilon_{it}$$

Random effects model is derived as:

$$REC_{it} = \beta_0 + \beta_1 FD_{it} + \beta_2 FDI_{it} + \beta_3 NR_{it} + \beta_4 GDPPC_{it} + \beta_5 FF_{it} + \alpha_1 + \varepsilon_{it}$$

When analyzing the results, to check the appropriate model to use between the FE and RE, the Hausman test was used. On the model 1 whereby TF is included the p value is 0.0046 therefore the null hypothesis is rejected that RE is the appropriate model hence the FE is the appropriate model. On model 2 where the IF is included p value is 0.0132 therefore, the null hypothesis is rejected hence FE is the appropriate model. On the model 3 where the FF is included the p value is 0.0801 therefore, the null hypothesis is rejected that the RE is the appropriate model hence the RE model will be used.

In model 1 using FE model where by one of the independent variables is TF, there is a positive relationship between the REC and TF meaning that an increase in the TF will increase the REC and the impact of the trade freedom is not significant NR. This means that the implementation of the utilization of renewable energy consumption will also boost the freedom of trading activities. This means more profits at a sustainable status. This can be further explained by the ease of restrictions since the goods and services traded are renewable so the trading activities can go on unrestricted. NR has a negative relationship with the REC meaning when the NR increases the REC decreases and is statistically. FD has a negative relationship with the REC meaning increase in the FD will decrease the REC and the variable is statistically significant because. Meaning that the renewable energy needs a lot of investment which might also need to implement a longer time to payback because it requires huge financing from the financial market to ensure that it is efficiently working (Polat, 2021). Due to the high installation costs of the renewable energy the government needs to be vitally involved in the financing of the facilities of production to ensure that the renewable energy consumption will also increase (X. Wang et al., 2022). Thereby the development of the financial sector can ensure that borrowing costs, increased levels of investment, ensuring that the renewable energy is accessible to the population by also advancing the technology, the threats of risks on financial sector should be removed and, there should increase capital production. The proper development of the financial

sector can also ensure that the capital and the long payback periods are also adjusted to ensure that there is growth in renewable energy consumption. Hence low-cost loans can be provided to encourage renewable energy consumption. The financial market can do projects to encourage the investment in renewable energy. The population needs to be informed on the importance of the usage of the renewable energies and further investment continually in REC is necessary through the financial tools and institutions (S. Liu et al., 2018) (Eren et al., 2019)(Danish et al., 2019)(Inglesi-Lotz & Dogan, 2018)(Zafar et al., 2019)(Zhu et al., 2018)(Munir & Riaz, 2019)(Munir & Riaz, 2019)(L. Liu et al., 2020)(Z. Wang et al., 2022). FDI has a negative relationship with the REC and this means that when the FDI increases the REC will decrease the effects of FDI on REC are not really felt because it is not statistically significant. This means that the local providers of energy will face competition from the foreign producers therefore they will look for ways to reduce the production of renewable energy therefore making the foreign firms try to keep up with the competition and adapt (Polat, 2018). Therefore the foreign investors should promote the usage of the renewable energy technologies on the productivity this will ensure that they is more investment in the renewable energy (Khandker et al., 2018). GDPPC has a negative relationship with the REC and this means that increase in GDPPC causes the REC to decrease even though the effect is insignificant. This means that in countries that lack democracy the pursuit of renewable energy is less because the power governance of the country will have the impact on their reaction to the renewable resources. Specifically in the Central Asian the democracy level is low therefore the GDPPC will decrease when the renewable energy increases therefore the stability of the countries politically will increase the level of renewable energy transition (S. Adams et al., 2018). The reduction of corruption in these countries will enhance the transition to renewable energy.

Model 2 whereby the IF is included in the equation and according to the Hausman test the FE model is the appropriate one to use. IF has a positive relationship with the REC meaning that an increase in the IF will cause the REC to increase its effect is not statistically significant. This means that in these Central Asian countries if the financial sector, foreign investment is less restricted, and the government has less shares in the companies this will allow the companies to freely give the company's credit to finance the development of renewable energy and credit for consumption. The stability of the economy that is it is free from the restrictions it means that the

renewable energy production will increase this also including the usage (Amoah et al., 2020). The freedom of the financial institutions will also increase the ability to increase in technological advancement and reduce the negative effects on the environment (Fayad, 2022). NR has a negative impact on the REC, and this means that the increase in NR will decrease the REC and the effect is statistically significant. This means that renewable energy is more of a long-term project that will take some time to be effective and the slow transition to sustainable uses of energy will mean that it will incur at the expense of some natural resources. For instance, if the land is purchased to use for renewable energy this means the productivity of the land in terms of crops and wildlife is stopped so this will decrease the natural resources. UNFC has been mainly interested in the abundant natural resources in Central Asia to boost their efficiency for instance they convert oil into liquid to form natural gas for easy exportation through the pipeline, they have made natural resources as a base of the economy to attract more foreign investment, putting the fossil fuels and other minerals on the internet to be more accessible to the investors, and installing solar panels to conserve natural resources. FD has a negative relationship with the REC, an increase in the FD will decrease REC and it is statistically significant. This is because the banking sector in Central Asia is not supporting enough the renewable energy construction of the facilities since it needs a big funding of the capital to be operational. This is because the banking sector is not independent, so it has some restrictions from the government on the transactions performed. Even though the Central Asian countries are receiving revenue from the natural resources it tends not to channel it to the safer energy sources which is the renewable energy. It is crucial that the banking sector can independently make investment decisions and in future support renewable energy projects. To boost the financial development EBRD has been ensuring growth of small businesses, flexible loans to build a strong system of renewable energy by offering syndicated loans with ADB, promoting green finance, and ensuring that provision for exchange rate risk. FDI has a negative relationship with the REC and increase in FDI decreases the REC even though it is statistically not significant. This means that the Central Asian countries are not attracting enough investment in the renewable energy rather the natural resources have been attracting a lot of foreign investment since the 1990s. Even though they have been a huge investment risk still the central Asian countries have been able to attract the investments to the agriculture and manufacturing processes. They have not reached a certain conclusion on the fact that Central

Asian states have attracted the most FDI inflows by the reduction of the risk in the institutions. The investors are also attracted to the countries that have democracy and also invest in manufacturing and agriculture, hence the investors are usually interested in investing somewhere that has potential and the natural resources sector has showed a lot of potential (Metaxas & Kechagia, 2016) (Doytch & Eren, 2012) (Doytch & Uctum, 2011) (Omri et al., 2014) (Doytch et al., 2014). For instance, in Uzbekistan the government is not working towards the development of infrastructure and the taxing so that the system so that the countries will attract more FDI. The fact that in this region it is described with autocracy and a lot of restrictions and sometimes the government does not accept the capital from investors. GDPPC has a positive relationship with REC, and this means that increase in GDPPC will increase the REC though the impact of the it is not statistically. This means that if the renewable energy sector is functioning well this will increase the employment opportunities for the population thereby increasing their standards of living which will in turn increase the GDPPC. Also, the usage of sustainable energy will increase the availability of energy thereby causing competition among the suppliers. This might end up reducing the prices thereby increasing consumption.

Model 3 whereby the FF was in the equation according to the Hausman test the RE model is the appropriate model to use. With the FF having a positive relationship with the REC which means that increase in FF will increase the REC and it is also statistically significant. This means that when the banking sector in the country is not facing financial restrictions, they can make investment in renewable energy. Therefore, when they invest in the projects for renewable energy the renewable energy will increase therefore it is important to channel resources for the transition to renewable energy (Abbas, 2021)(Sarpong-Kumankoma et al., 2020) (“Bank Concentration and Stability in Central Asia: The Effect of Capital Regulation and Financial Freedom,” 2022) (Santoso et al., 2021)(EKİNCİ, 2020). The NR has a negative relationship with the REC it means that when NR increases the REC will decrease, and it is statistically significant. When the economy moves from usage of natural resources it means that the demand for the natural resources will decrease and the renewable energy consumption will increase because people will be moving to sustainable ways of energy. FD has a negative relationship with REC meaning an increase in the FD decreases the REC and it is also statistically significant. Renewable energy projects are a risky investment because of high investment costs

and the returns are not yet clearly forecasted so it might take a while to get profits. Therefore, the government is skeptical in investing in these projects because the returns are not certain thereby increasing the chances of low investment in renewable energy. FDI has a negative relationship even and is not statistically significant. The governments should aim to attract the capital in renewable energy since it requires huge capital to be fully operational maybe they should be attractive investment returns attached to the renewable energy to move the capital that initially would have been invested in the natural resources by the investors. GDPPC has a positive relationship with the REC even though the impact is insignificant this means that the development of renewable energy technologies will create job opportunities this will increase the human capital because the workers gain experience to work in a developing sector thereby having a positive impact on the economy. Table 6 shows the summarized relationship of model 1, 2 and 3, and the significance.

Table 6: Relationship of the Variables.

Variables	Model 1 (FE)		Model 2 (FE)		Model 3 (RE)	
	Relationship	Significance	Relationship	Significance	Relationship	Significance
IF			Positive	Insignificant		
TF	Positive	Insignificant				
FF					Positive	Significant
NR	Negative	Significant	Negative	Significant	Negative	Significant
GDPPC	Negative	Insignificant	Positive	Insignificant	Positive	Insignificant
FD	Negative	Significant	Negative	Significant	Negative	Significant
FDI	Negative	Insignificant	Negative	Insignificant	Negative	Insignificant

Source: Authors computations

4.5 Analyzing the proposed hypothesis.

Table 7 shows the results that are found from the analysis of the variables using the FE and RE model to analyze the proposed hypothesis.

Table 7: Analysis.

Hypothesis	Model 1	Model 2	Model 3
NR and REC have a positive relationship	✗	✗	✗
GDPPC and REC have a positive relationship	✗	✓	✓
FDI and REC have a positive relationship	✗	✗	✗
FD and REC have a positive relationship	✗	✗	✗

Source: Authors computations

4.6 Dumitrescu Hurlin test

For the policymakers it is important the causality test is done to have a clear view if the relationship between the variables. Testing for causality test to analyze if a change in a variable will affect another variable holding all other variables constant. That is the correlation between the past values of a variable and the present values of another. The causality test is used to predict the future values of a variable, this means that it will contribute to the future information of variables trends. The panel granger causality test using the Dumitrescu Hurlin was done on

model 1: regressing with TF, model 2: regressing with IF and model 3: regressing with FF. Table 8 shows the Dumitrescu Hurlin results for model 1.

Table 8: Dumitrescu Hurlin Model 1.

Null hypothesis	**W-Stat**	**Zbar-Stat**	**Prob**
TF ⟶ REC	1.385	0.331	0.740
REC⟶ TF	0.714	-0.524	0.6001
Bidirectional causality			
NR ⟶ REC	1**.940**	1**.039**	0**.299**
REC ⟶ NR	2**.735**	2.053	0.040
Unidirectional causality			
GDPPC ⟶ REC	0.517	-0.776	0.438
REC⟶GDPPC	1.126	0.001	1.000
Bidirectional causality			
FDI ⟶ REC	0.848	-0.354	0.724
REC ⟶ FDI	0.804	-0.409	0.6826
Bidirectional causality			
FD ⟶ REC	4.900	4.815	0.000
REC⟶FD	1.283	0.202	0.840
Unidirectional causality			
NR⟶ TF	1.009	-0.148	0.883
TF ⟶ NR	2.745	2.066	0.039
Unidirectional causality			
GDPPC ⟶ TF	3**.217**	2**.668**	0.008

TF ⟶ GDPPC	1.542	0.532	0.595
Unidirectional causality			
FDI ⟶ TF	0.775	-0.447	0.655
TF ⟶ FDI	1.568	0.565	0.572
Bidirectional causality			
FD ⟶ TF	2.963	2.344	0.019
TF ⟶ FD	1.92	1.103	0.311
Unidirectional causality			
FDI ⟶ GDPPC	1.44	0.402	0.688
GDPPC ⟶ FDI	1.824	0.892	0.373
Bidirectional causality			
FD ⟶ GDPPC	3.178	2.618	0.009
GDPPC ⟶ FD	2.406	1.634	0.102
Unidirectional causality			
FD ⟶ FDI	1.565	0.562	0.574
FDI ⟶ FD	0.792	-0.425	0.671
Bidirectional causality			

Source: Authors computations

From the Dumitrescu Hurlin causality test for the relationship between the variables, the null hypothesis is rejected therefore there is causality extending from REC to NR showing a unidirectional causality. Therefore, we can use the REC to predict the NR this means that if these Central Asian countries make the transition to NR the demand for REC will increase thereby reducing the demand for NR therefore the extraction and production of the natural resources will decrease. The null hypothesis is rejected therefore there is causality extending from TF to NR

showing a unidirectional causality. The reduction of the restrictions made by the government on the goods and services traded will increase the trading activities therefore we can predict the total number of the NR that will be used to export to other countries. The null hypothesis is rejected therefore there is causality extending from GDPPC to TF showing a unidirectional causality. The economic output of the population will predict the TF because when there are less restrictions in trading the revenue will increase from the exports and the people will have access to better goods and services through the imports. The null hypothesis is rejected therefore there is causality extending from FD to TF showing a unidirectional causality. If the financial institutions can make their own decisions on loans, investment, and expansion it can predict the TF since they will have freedom to invest in the sector. The null hypothesis is rejected therefore there is causality extending from FD to GDPPC showing a unidirectional causality. Therefore, if the financial sector is efficient can be able to provide for the financial needs of the people in the form of loans, stocks, and deposits thereby it can predict the GDPPC. The null hypothesis is rejected therefore there is causality extending from FD to REC showing a unidirectional causality. This means that as the financial institutions invest in renewable energy consumption, they will increase the transition of renewable energies because the funding is necessary.

Model 2: regressing the IF to find the causality using Dumitrescu Hurlin causality test. Table 9 shows the causality of the variables.

Table 9: Dumitrescu Hurlin Model 2.

Null hypothesis	**W-Stat**	**Zbar- Stat**	**Prob**
NR⟶REC	1**.939**	1**.039**	0**.299**
REC⟶ NR	2**.735**	2**.053**	0**.040**
Unidirectional causality			
IF⟶ REC	3**.912**	3**.555**	0**.000**
REC ⟶ IF	0**.588**	**-0.685**	0**.494**
Unidirectional causality			
GDPPC⟶ REC	0**.517**	**-0.776**	0**.438**

REC⟶GDPPC	1**.126**	0**.001**	1.000
Bidirectional causality			
FDI⟶REC	0.848	-0.354	0.724
REC⟶FDI	0.804	-0.409	0.683
Bidirectional causality			
FD⟶REC	4.900	4.815	0.000
REC⟶ FD	1.283	0.202	0.840
Unidirectional causality			
IF⟶NR	3.713	3.301	0.001
NR⟶IF	0.570	-0.708	0.479
Unidirectional causality			
GDPPC⟶ NR	2.702	2.011	0.044
NR⟶GDPPC	2.304	1.504	0.133
Unidirectional causality			
FDI⟶NR	0.75	-0.478	0.632
NR⟶FDI	0.565	-0.715	0.475
Bidirectional causality			
FD⟶NR	2.64	1.932	0.053
NR⟶FD	1.486	0.460	0.646
Unidirectional causality			
GDPPC⟶IF	1.339	0.273	0.785
IF⟶ GDPPC	0.564	-0.715	0.474
Bidirectional causality			

FDI ⟶IF	2.6	1.879	0.06
IF ⟶ FDI	0.273	-1.086	0.277
Bidirectional causality			
FD ⟶ IF	1.716	0.754	0.451
IF ⟶ FD	2.582	1.858	0.063
Bidirectional causality			
FDI ⟶ GDPPC	1.44	0.402	0.688
GDPPC⟶ FDI	1.824	0.892	0.373
Bidirectional causality			
FD⟶GDPPC	3.178	2.618	0.009
GDPPC⟶ FD	2.406	1.634	0.102
Unidirectional causality			
FD ⟶ FDI	1.565	0.562	0.574
FDI ⟶ FD	0.792	-0.425	0.671
Bidirectional causality			

Source: Authors computations

From the Dumitrescu Hurlin causality test, the null hypothesis is rejected therefore there is causality extending from REC to NR showing a unidirectional causality. The usage of renewable energy will mean a decrease in the usage of NR. The null hypothesis is rejected therefore there is causality extending from IF to REC showing a unidirectional causality. Therefore, if the government reduces the restrictions on the investments the foreign investors are free to invest in the renewable energy facility therefore, we can predict the value of REC if the IF increases. The null hypothesis is rejected therefore there is causality extending from IF to NR showing a unidirectional causality. Therefore, the removal of restrictions will boost the investment in

natural resources, so the investors are free to carry out investment since they are already attracted to the abundance of natural resources in the country. The null hypothesis is rejected therefore there is causality extending from GDPPC to NR showing a unidirectional causality. This means the economic output can be predicted by the increase in the NR extraction and production. The null hypothesis is rejected therefore there is causality extending from FD to NR showing a unidirectional causality. This means that continual investment from financial institutions will increase the extraction and the production of NR. The null hypothesis is rejected therefore there is causality extending from FD to GDPPC showing a unidirectional causality. This means that financial institutions are better off when they are free from restrictions. This will increase the GDPPC.

Model 3: regressing the FF to find the causality using Dumitrescu Hurlin causality test. Table 10 shows the causality of the variables.

Table 10: Dumitrescu Hurlin Model 3.

Null hypothesis	W-Stat	Zbar-Stat	Prob
NR ⟶**REC**	1.939	1.039	0.299
REC⟶**NR**	2.735	2.053	0.040
Unidirectional causality			
GDPPC ⟶**REC**	0.517	-0.776	0.438
REC ⟶**GDPPC**	1.126	0.001	1.000
Bidirectional causality			
FF ⟶**REC**	1.922	1.017	0.309
REC ⟶**FF**	0.713	-0.526	0.599
Bidirectional causality			
FDI ⟶ **REC**	0.848	-0.354	0.724
REC⟶**FDI**	0.804	-0.409	0.683

Bidirectional causality			
FD ⟶ **REC**	4.900	4.815	0.000
REC ⟶ **FD**	1.283	0.202	0.840
Unidirectional causality			
GDPPC ⟶ **NR**	2.702	2.011	0.044
NR ⟶ **GDPPC**	2.304	1.504	0.137
Unidirectional causality			
FF ⟶ **NR**	0.408	-0.915	0.360
NR ⟶ **FF**	2.022	1.144	0.253
Bidirectional causality			
FDI ⟶ **NR**	0.750	-0.478	0.632
NR ⟶ **FDI**	0.565	-0.715	0.475
Bidirectional causality			
FD ⟶ **NR**	2.64	1.932	0.053
NR ⟶ **FD**	1.486	0.460	0.646
Unidirectional causality			
FF ⟶ **GDPPC**	2.832	2.177	0.029
GDPPC ⟶ **FF**	2.206	1.379	0.168
Unidirectional causality			
FDI ⟶ **GDPPC**	1.44	0.402	0.688
GDPPC ⟶ **FDI**	2.406	1.634	0.373
Bidirectional causality			

FD ⟶**GDPPC**	3.178	2.618	0.009
GDPPC ⟶**FD**	2.406	1.634	0.102
Unidirectional causality			
FDI ⟶**FF**	1.894	0.980	0.327
FF ⟶**FDI**	1.055	-0.09	0.929
Bidirectional causality			
FD⟶ **FF**	1.885	0.969	0.333
FF ⟶**FD**	1.101	-0.031	0.9756
Bidirectional causality			
FD ⟶**FDI**	1.565	0.562	0.574
FDI ⟶**FD**	0.792	-0.425	0.671
Bidirectional causality			

Source: Authors computations

Using the Dumitrescu Hurlin test the null hypothesis is rejected therefore there is causality extending from REC to NR showing a unidirectional causality. The Central Asian states have abundant resources and a great potential for the renewable energies therefore directing the focus to the renewable energies will increase the output and reduce the demand for natural resources. The null hypothesis is rejected therefore there is causality extending from FD to REC showing a unidirectional causality. The more the banking sector is independent the more it can make decisions of its own to invest in renewable energy. The null hypothesis is rejected therefore there is causality extending from GDPPC to NR showing a unidirectional causality. The revenues got from the natural resources should be beneficial to the population, this means that the GDPPC will increase. The null hypothesis is rejected therefore there is causality extending from FD to NR showing a unidirectional causality. The null hypothesis is rejected therefore there is causality extending from FF to GDPPC showing a unidirectional causality. When the Central Asian countries are less restricted it increases the GDPPC this means that the

government has minimal ownership of the institutions, the banks can carry out any transactions between the savers and the borrowers and take on any investment this will increase the standards of living of the people living in the countries. The null hypothesis is rejected therefore there is causality extending from FD to GDPPC showing a unidirectional causality. This means that accessibility, efficiency and the frequency of the transactions will increase the GDPPC. The null hypothesis is rejected therefore there is causality extending from REC to GDPPC showing a bidirectional causality. This could be because of the way renewable energy has not been really boosted in these countries so the demand is still low on renewable energy and it is being well established so the returns from renewable energy have not been properly assimilated.

4.7 Robustness checks

These tests are carried out to ensure that the main results are supported thereby giving a greater confidence level in the results. For this analysis a PSCE model and FGLS model were used. The results support the results from the main model used and the coefficients are similar. The PSCE model for the 3 models to check for the relationship between REC and other independent variables. Table 11 shows the PSCE results.

Table 11: PSCE Model.

	Model 1		Model 2		Model 3	
REC	Coefficient	P value	Coefficient	P value	Coefficient	P value
FD	-111.26	0.000	-105.557	0.000	-133.655	0.000
NR	-.66	0.000	-.669	0.000	-.529	0.000
FDI	-.333	0.332	-.184	0.543	-.562	0.076
GDPPC	.288	0.542	.623	0.181	.817	0.046
FF					.388	0.000
IF			.171	0.009		
TF	.192	0.100				
C	32.288	0.000	37.683	0.000	33.879	0.000
R squared	0.57	0.622		0.573		0.622
Wald chi2	155.38	378.58		184.60		378.58
Prob	0.000	0.000		0.000		0.000

Source: Authors computations

The results for model 1 show that FD has a negative relationship with REC, and it is significant. One of the reasons is that the stock market has been so effective in Central Asia that the shares should be open to be traded to boost the investment in renewable energy. With the EBRD as a key player to provide syndicated loans at flexible terms it will also increase the renewable energies. A syndicated loan was made with Clean Technology Fund and the Asian Development Bank to facilitate the installment of a solar panel in Kazakhstan. NR has a negative relationship with REC, and it is significant. UNFC has been aiding in ensuring natural resources shares can be put on the stock market. This makes the natural resources easily accessible thereby reducing the usage of natural resources. For model 2, IF has a positive relationship with REC and it is significant. The more the institutions are free to make their investments in REC it will increase because renewable energies require large amount of cash outlays and longer time spans therefore the investors should not face restrictions to boost REC. In model 3, FF has a positive relationship with REC. This means that when the banks and institutions are not restricted, they

can fully invest in renewable energy. EBRD has also been assisting in promoting green finance through the formation of Astana International Financial Centre to support renewable energies and reduce the effects on the environment.

The FGLS model supports the results in the PCSE model.

Table 12: FGLS Model.

	Model 1		Model 2		Model 3	
REC	Coefficient	P value	Coefficient	P value	Coefficient	P value
FD	-99.412	0.000	-94.533	0.000	-121.336	0.000
NR	-0.457	0.000	-0.483	0.000	-0.377	0.000
FDI	-0.176	0.166	-0.138	0.298	-0.328	0.047
GDPPC	0.064	0.732	0.026	0.902	0.136	0.548
FF					0.365	0.000
IF			0.112	0.001		
TF	0.0374	0.452				
C	40.449	0.000	39.359	0.000	33.493	0.000
Wald chi2		186.43		208.69		459.63
Prob		0.000		0.000		0.000

Source: Authors computations

The results show that FD has a negative relationship with REC, NR has a negative relationship with REC, IF has positive relationship with REC, FF has a positive relationship with REC and these findings are all significant thereby supporting the PCSE results.

CHAPTER V

Conclusions

This chapter summarizes the results regarding the subject topic of renewable energy in Central Asia. Through analysis of the results conclusions were drawn of the relationship of renewable energy and other variables that affect it.

5.1 Summary and discussion of results

This study is mainly focused on studying the relationship between renewable energy and financial development in Central Asia and how far it can be improved. According to the results it confirms that renewable energy does not have much attention in terms of the funding of the projects since these projects require high capital costs to establish. This is the reason financial development has a negative relationship with renewable energy. Even when these countries are mainly based on the abundant natural resources in the region this means that they also get revenue from the natural resources locally and internationally therefore the government should also try to channel some of these resources for the transition to renewable energy to avoid the greatest fear of complete depletion of these valuable natural resources (Awosusi et al., 2022) (Dong & Akhtar, 2022) (Burakov & Freidin, 2017). Natural resources have a negative relationship with renewable energy and, this shows that the transition to usage of renewable energy will cause the natural resources to decrease in usage. Therefore, the change in preference of the population will cause an increase in renewable energy. To keep being competitive the producers will start to invest more in renewable energy to match up the demand (Burakov & Freidin, 2017) (Ahmadov & van der Borg, 2019). Financial freedom has a positive relationship with the renewable energy this means that the financial institutions should have less restrictions on the credit, and transactions for the financing of the renewable energy projects thus, when the financial institutions are functioning by themselves the financial institutions can raise capital to finance these projects for a return in the future. Therefore, the increase in financial freedom will cause the institutions to freely make investments. Overall, investment freedom, trade freedom, GDP per capita and foreign direct investment, the effect on renewable energy is insignificant.

Hence the policy makers should focus more on the financial freedom, financial development, and natural resources (Alola, Alola, et al., 2022)(Alola, Doganalp, et al., 2022)(Amoah et al., 2020).

This study also explains the research questions posed at the beginning of the study which are: What role does financial development have on renewable energy? Will financial freedom increase renewable energy consumption? Can the increase in the usage of renewable sources of energy foster overall economic growth? Do the restrictions on economic activities limit economic growth? Why is there a low investment in renewable energy technologies? Are the natural resources of these countries overrated to be the richest in comparison to the world? Is there an efficient financial system in these countries? The results showed that the evidence is that the Central Asian countries are one of the top countries with abundant natural resources, they are supplies of energy and many other commodities to meet the needs of the market. The renewable energy will increase the economic growth in that the commodity will incur reduced fluctuations of the prices on the market, increase in the productivity with minimal harm caused on the economy. The restrictions reduce the economic growth in these countries because when there is need to invest in the renewable energy in reference to the current study the financial institutions are posed with many restrictions thereby reducing the growth in the economy. The renewable energies have a low investment because they require huge cash outlays and looking at the risk of the investment it's quite high and it is estimated that it is a long-term project that will yield returns in the future after a while. The banking sector of central Asia has improved in so many sectors (Djalilov & Piesse, 2014).

5.2 Contributions and implementation

This study has contributed to the factors that affect the implementation of renewable energy in Central Asia has also shown that there is a great chance that if renewable energy receives investment, it will increase economic growth. Since one of the findings of this study showed that the financial freedom has a huge part in the transition to renewable energy. The governments should reduce the restrictions in the investment by these the renewable energy facilities and they can be fully operational since they would have received funding. The foreign institutions that want to operate should face less restrictions which will contribute to the renewable energy transition. The government should fully support the renewable energy projects by giving the

capital and enforcing the population to move to use the renewable energies. The government can also ensure there are educational programs on renewable energy to make sure the population understand the importance of transitioning to renewable energy. The government should also make a review on the policies that have already been made and implement them because there have been so many policy makers that have suggested certain policies to no avail. The people handling natural resources and renewable energy should be more educated in that aspect to ensure efficiency. The transparency in the financial institutions should increase to attract investors because before the investors invest, they want the assurance that the investment will bring returns. The government should also ensure that when renewable energy is fully operational it should properly dispose avoiding any threats to the environment. The government can also endorse a law that will ensure that the population will transit from the usage of the natural resources. This will carry along the entire population to be enforced to use renewable energies. The data availability should also be available so that the investors can ensure they invest in renewable energy, and this gives them an opportunity to access the risk of the investment and probably invest. The government should also work on the education of the population to fix the infrastructure, energy supply and the production systems and this will increase the pace at which an effective system can be made. The government can also ensure there are educational programs on renewable energy to make sure the population understand the importance of transitioning to renewable energy. The transparency in the financial institutions should increase to attract investors because before the investors invest, they want the assurance that the investment will bring returns. The government should also ensure that when renewable energy is fully operational it should properly dispose of it to avoid any threats to the environment. The government can also endorse a law that will ensure that the population will transfer from usage of the natural resources this will carry along the entire population to be enforced to use renewable energies. To improve the efficiency of the financial sector, the institutions should provide financial knowledge to the savers and the lenders. In Kazakhstan and Uzbekistan, the rates of loans have been increasing mostly on home improvements while the income earned by the households is lower than the loans they acquire. Hence with more knowledge they can ensure that the households save and earn interest over time. To improve the financial customs of the people in Central Asia, in Kazakhstan and Tajikistan the mindset is mainly about consumption of earnings in the short run than to save for the long run. Therefore, it

is of importance that the mindset towards financial tools is changed to increase the profits earned by the banks or institutions. Accessibility of the financial tools will ensure an increase in investment in the financial sector. That is the availability of banks and ATMs especially in remote areas will ensure that the people are aware of the financial tools and the risks involved. Effective information sources in the financial sector will ensure that the banks or financial institutions do not exploit their customers by overcharging them. This also reduces the number of people being defrauded by investing in financial tools that are framed. In Tajikistan the banks faced a lot of defaults when they failed to provide vital information to customers on the foreign exchange rate risks on the financial tools, so the Tajiks invested unaware of the risks involved. The Central Asian states needs consumer protection that is the effective information between the suppliers and consumers so there is reduced exploitation. There should be a strong establishment in the stock market this gives the variability of financial instruments thereby increasing the drive for investment in stocks. The banking sector should be independent so that it makes its decisions without any influence from the government. The banking sector should also ensure that they are reduced borrowing costs this will increase the number of loans acquired which increases the profits earned by the bank. There should be more technological advancement in the financial sector to conduct the necessary transactions and this adds a variety of instruments that are attractive for investment.

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PLAGIARISM REPORT

RENEWABLE ENERGY AND FINANCIAL DEVELOPMENT IN CENTRAL ASIA

by Talent Daisy Chamboko

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Submission ID: 2036009657
File name: renewable_energy_thesis_1.docx (378.01K)
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ETHICS COMMITTEE APPROVAL

NEAR EAST UNIVERSITY

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24.03.2023

Dear Talent Daisy Chamboko

Your project **"Renewable energy and financial development in Central Asia"** has been evaluated. Since only secondary data will be used the project does not need to go through the ethics committee. You can start your research on the condition that you will use only secondary data.

Prof. Dr. Aşkın KİRAZ