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An Empirical Analysis of the Impact of Industry, Service Sectors, Urbanization, Exports, and Inflation on Energy Consumption: The Static and Dynamic Panel Model Approaches

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ABSTRACT

Investigating energy use is critical because it addresses the decreasing energy supply. The majority of global energy use is nonrenewable, with much of it coming from fossil fuels emitting greenhouse gases. As a result, energy consumption research is vital for understanding energy usage trends and developing methods to reduce energy use or employ renewable energy sources. This study investigates the impact of industry, service sectors, urbanization, exports, and inflation on energy consumption in a panel of 38 nations from 2019 to 2023. Based on the static panel approach, the key findings of the Pool model reveal that the industrial and service sectors have a positive and significant impact on energy consumption, emphasizing the vitality of these sectors as major energy users. The Fixed Effects model (FEM) suggests that the industrial and service sectors have a significant and negative impact on energy usage. Furthermore, the FE model reveals that urbanization and export significantly and negatively impact energy consumption. In the Pool model, inflation is associated positively with energy consumption. The dynamic panel approach additionally suggests that the industrial and service sectors significantly impact energy consumption in the investigated countries. Exports have a significant and negative impact on energy consumption. The CPI, a measure of inflation, significantly and positively impacts energy consumption. The findings of this study provide helpful policy recommendations for identifying the significant variables influencing world energy consumption. Policymakers in the examined countries must promote energy consumption efficiency initiatives and shift to renewable energy sources.

1. INTRODUCTION

Energy plays a substantial part in a country's economic development, particularly considering energy is regarded as one of the primary sources of power that supports production and manufacturing sector [1, 2]. Energy significantly contributes to machine growth, which is essential for stimulating economic activity [3]. Insufficient energy hinders optimal economic activity across all sectors, impeding economic progress. In this setting, energy-related laws and regulations become critical for ensuring the availability and efficiency of its use, particularly in understanding the relationship between energy consumption and GDP [4, 5].

According to Sijabat [6] and Ahmed and Shimada [7], a suitable policy associated with energy consumption can influence direct economic growth, with energy consumption serving as a critical measure in evaluating a country's economic success. As a result, energy consumption plays a critical role in determining a country's growth patterns, particularly in growing globalization and urbanization [8, 9]. In today's economy, energy plays a significant role in production. It catalyzes the development of diverse manufacturing, services, and infrastructure sectors. Energy consumption and increased global demand for products and services are also improving significantly. Several studies have shown a substantial association between energy consumption and economic growth, particularly in emerging countries. According to Piccirilli et al. [10], energy consumption is not only a result of economic expansion but also serves as a primary driver of growth. The relationship demonstrates that existence bait has a beneficial effect, as increased energy consumption stimulates economic activity, which increases the need for energy [2, 11, 12].

Many developing and developed countries experience rapid economic growth. According to Solow's classical theory [13], economic growth is determined by capital accumulation, increased power work, and technological improvement. As a power source for the production and consumption of many activities, energy has become essential to achieving growth [14, 15]. As a result, the availability of energy and how efficiently it is used can directly impact a country's economic performance. Xu et al. [15] and Zhang et al. [16] have shown that rising urbanization and industrialization, particularly in countries like China, are producing a surge in demand for significant energy in crowded energy sectors such as transportation and housing. Therefore, this study emphasizes how energy consumption dynamics impact a country's economic growth.

According to Kuznets [17], energy demand rises with economic growth and urbanization. As a result, energy consumption rises dramatically with industrial sector expansion and urban economic activity. According to Shazed et al. [18], large cities in China are experiencing a more substantial spike in energy consumption than small cities, owing to the intensity of energy use in large cities being significantly higher due to more sophisticated infrastructure and economic activity. Thus, urbanization changes energy consumption patterns and introduces new issues to energy resource management.

Furthermore, globalization and international trade enhance the nature of energy consumption. Sadorsky [19] and Fatima et al. [20] contend that trade liberalization and increasing exports directly impact energy consumption, particularly in export-oriented manufacturing sectors. Abboud and Betz's [21] research in BRICS countries discovered that increased economic openness through exports and FDI led to increased energy consumption in energy-intensive industries. This surge happened due to increasing manufacturing activity to meet export demand, which required significant additional energy. At the same time, these countries face the task of improving energy efficiency to remain competitive in the global market [22].

Energy demand is additionally affected by other economic factors, including energy pricing and inflation. Dahl [23] proposed the notion of energy price elasticity, asserting that energy cost variations might influence energy demand. Increased energy prices typically diminish energy usage, particularly in sectors very susceptible to price fluctuations, such as transportation and residential heating. Bekun et al. [24] stated that elevated inflation could diminish consumer purchasing power, thereby reducing energy usage, particularly in OECD nations. In this context, inflation significantly influences energy consumption levels, particularly when price escalations diminish household purchasing power.

In the past few years, a global paradigm shift has increasingly underscored the significance of transitioning to renewable energy sources. Numerous nations, particularly emerging ones, need help in regulating rising energy consumption while striving to mitigate the environmental repercussions of fossil fuel utilization. Kongkuah et al. [22] and Yang et al. [25] emphasize the significance of investing in renewable energy within a sustainable development framework. By diminishing reliance on fossil fuels, nations can alleviate the risks associated with global energy price volatility and adverse environmental effects. This study concluded that shifting to renewable energy in emerging nations could stabilize long-term economic growth, enhance energy security, and diminish carbon emissions.

Elevated energy consumption in a nation frequently indicates heightened industrial and economic activity. Nonetheless, efficient energy utilization is equally significant as elevated levels of consumption. Energy efficiency contributes to lowering manufacturing costs and mitigating adverse environmental effects from excessive energy consumption. Esen and Bayrak [26] assert that efficient energy usage is a crucial metric of sustainable economic development, particularly in nations encountering difficulties regarding energy supplies. Consequently, nations should attain an equilibrium between augmenting energy consumption and optimizing efficiency to guarantee sustainable economic expansion.

Moreover, energy is a fundamental and essential infrastructure for industrial and economic operations in every nation. Critical economic sectors, including transportation, manufacturing, and public services, rely significantly on energy for optimal functioning. Mahmoodi [27] asserted that the absence of robust energy infrastructure would disrupt industrial and economic operations, thereby impacting economic stability and growth. Consequently, investment in energy infrastructure and implementing technologies that enhance energy efficiency are crucial for fostering sustainable economic growth.

Sustainable development has emerged as a crucial framework for ensuring the long-term preservation and utilization of natural resources. Development that neglects sustainability may lead to the overexploitation of resources, ultimately constraining future economic progress. Moreover, environmental contamination constitutes a significant challenge encountered throughout industrialization, modernization, and urbanization. Azam et al. [28] assert that environmental contamination from industrial operations poses a challenge for developed and developing nations. The fast industrialization in numerous developing nations frequently results in heightened carbon emissions and environmental degradation, which can ultimately degrade community quality of life and impede long-term economic growth.

The shift to clean and renewable energy is increasingly vital to a sustainable development strategy. The excessive reliance on fossil fuels has demonstrated detrimental effects on the environment, prompting numerous governments to transition to more sustainable energy sources. This transformation is anticipated to mitigate environmental harm while enhancing energy efficiency and bolstering long-term energy security. Numerous studies indicate that using renewable energy mitigates carbon emissions and fosters economic growth [25]. Consequently, the sustainable utilization of energy resources is a crucial element in fostering future inclusive and enduring economic growth.

Concurrently with substantial progress, global energy consumption has escalated significantly. Without considerable attention from policymakers, global energy availability will emerge as a substantial concern in the future. Furthermore, with sustainable development objectives, a substantial focus must be directed towards minimizing energy consumption. Consequently, examining the determinants of energy consumption is essential for a comprehensive empirical understanding of its driving variables. Studying energy consumption is important because the pattern and amount of energy consumed impact many elements of human existence and the environment. As a result, energy consumption research is essential; by analyzing factors that influence energy consumption, areas for reducing excessive energy use can be identified and addressed. As a result, the findings of this study can provide insight into energy usage, which can then be used to ensure a stable and reliable energy supply.

Empirical study on energy use in various countries has primarily concentrated on technological and policy concerns, with less attention paid to which economic sectors contribute the most to increased energy use. Furthermore, most energy consumption research has been undertaken in industrialized countries, leaving a gap in knowledge about the specific conditions and issues that developing countries face. As such, there is a vacuum in our understanding of energy consumption trends. Thus, findings from this study contribute significantly to overcoming energy consumption difficulties and achieving sustainable development.

This study seeks to empirically examine the determinants of energy consumption, including sectoral economic development, exports, and inflation, which are crucial for developing a successful energy policy. The results of this study are anticipated to offer more thorough insights for policymakers in formulating more sustainable and efficient energy plans.

This paper consists of five sections. The first section is an introduction that summarizes the key results from the literature on energy consumption and the relevance of focusing on the energy sector. The second section discusses theoretical background and hypothesis development. The third section explains the econometric approach, analyzed data, and the development of the current analysis and model. The fourth section summarizes the study's primary findings based on the panel data model results for the factors influencing energy consumption. This section also explores the findings and compares them to other relevant studies. This paper concludes with the fifth section, which contains conclusions and recommendations.

2. LITERATURE REVIEW AND HYPOTHESES

Economic growth is the priority of a country's development. Solow's classical theory holds that capital accumulation, increased labor productivity, and technical innovation drive economic growth. From this perspective, primary energy is critical in supporting manufacturing since its availability and efficiency can substantially impact a country's economic growth. Economic studies have extensively investigated the relationship between energy consumption and industrialization. Numerous studies, including those by Piccirilli et al. [10], Abboud and Betz [21], Yang et al. [25], Luo et al. [29], and Jilte et al. [30], show that rising energy consumption frequently correlates with increased manufacturing activity, which drives economic growth, particularly in developing countries.

Economic and demographic factors such as industrial activity, urbanization, and energy prices all impact energy demand. Kuznets' [17] basic demand theory predicts that energy demand would rise with economic expansion and urbanization, as both drive increased energy consumption at household and industrial levels. Furthermore, Dahl's [23] price elasticity theory demonstrates that changes in energy prices can considerably impact energy demand, with higher energy prices typically resulting in reduced consumption.

Urbanization is characterized by an increase in the proportion of the population living in urban areas. According to Haughton and Hunter [31], urbanization hypothesis, population growth in cities leads to increasing demand for infrastructure, transportation, and energy services. This growth is due to the concentration of economic activity in urban regions, which require more energy than rural ones. As a result, high levels of urbanization tend to drive up a country's primary energy consumption.

In the context of globalization, international trade significantly impacts energy usage. According to Sadorsky [19], international economic theory, countries with high export levels have a more vital requirement for energy to support the production of exported goods and services. This is especially true for nations whose export businesses rely on energy-intensive sectors. As a result, one of the study's objectives is to investigate the relationship between energy consumption and exports.

Inflation, as measured by the Consumer Price Index (CPI), has the potential to influence energy consumption by affecting consumer purchasing power. Mohammed's economic theory implies that excessive inflation can diminish purchasing power, reducing energy consumption, particularly in the family sector. Conversely, constant or low inflation can boost energy consumption by increasing consumer expenditure on energy-intensive goods and services.

2.1 Industrialization and energy consumption

Industrialisation is a key sign of modernisation and economic progress [29, 32-34]. Industrialization, characterized by manufacturing growth, is positively associated with the significant contribution of manufacturing to GDP and economic growth [35, 36]. In addition to other economic benefits, industrialization raises energy consumption because energy is a necessary input in both production and consumption [12, 37, 38]. Energy consumption is also linked to industrialization because energy is used in the manufacturing industry for production, lighting, and other commercial purposes. The production industry contributes more than half of world energy consumption and is expected to expand by 1.5% annually until 2035 [39]. Luo et al. [29] present an essential perspective in the context of OECD countries, finding that economic growth is significantly connected with higher energy consumption, particularly in highly industrialized countries. This study implies that the rapidly increasing industrial sectors in OECD countries demand much energy to power their expanding economic activity.

Li and Yuan [40] discovered a positive relationship between industrial expansion and energy consumption, particularly electricity in China, from 1995 to 2017. However, the correlation's strength is heavily influenced by the degree of industrial electricity usage and development. Their findings reveal that industrial expansion and energy consumption have a substantial link during the middle era of industrialization. Then, it steadily weakens, coinciding with consistent industrial growth and high electricity use. Meanwhile, Yang et al. [25] and Wang et al. [34] emphasize the relevance of investing in renewable energy in emerging countries to sustain long-term economic growth. They contend that by lowering reliance on traditional energy sources, developing nations can achieve more sustainable and ecologically friendly economic growth while avoiding the risks associated with global energy price volatility and fossil fuels' negative environmental repercussions.

2.2 Service sector and energy consumption

Like the manufacturing sector, the service industry has a favorable impact. It is a growth engine in many developed countries [36]. The service sector is considered a potential energy saver, particularly when compared with the manufacturing sector.

However, the service sector significantly impacts energy usage [41]. The service industry, a tertiary sector in private and public sectors, is the fastest-growing sector in consumption energy [42]. The service sector can boost energy consumption by growing service demand, using technology in manufacturing process sector services, developing infrastructure, and meeting varied transportation demands [3, 43].

Huseynli [41] investigated the relationship between the service industry and energy usage in Italy using data and panel analysis from 1997 to 2021. The study discovered that service exports were crucial in explaining the growth in energy consumption in a positive manner. The interaction between the factors that drive the service industry in Italy substantially impacts both the service sector and energy consumption.

Meanwhile, Yi [3] investigated the varied effects of economic sectors, including the service sector, on the demand for renewable energy in four major regions, Asia, America, Africa, and Europe, from 1998 to 2021. Yi discovered that the growth of the service sector increased long-term renewable energy usage in all regions but Africa. The study also discovered that the development of the service sector considerably influences short-term renewable energy usage in one or two locations.

2.3 Urbanization and energy consumption

Urbanization can increase the consumption of energy [11, 43-45]. His high population and quick industrial development in metropolitan regions drive improvements in energy demand such as electricity, material burning, and source energy [46].

Zhang et al. [16] investigated the relationship between urbanization, economic growth, energy consumption, and the effects on carbon emissions in China. The study found that urbanization significantly impacts increasing energy consumption, particularly in areas such as transportation and housing. The findings show that as urban areas grow, so does energy demand, which directly correlates to increased carbon emissions, highlighting urbanization as an essential aspect of China's environmental dynamics.

Another study by Shazed et al. [18] provides further insight into the impact of urbanization on energy consumption in China, concluding that urbanization has a strong push to improve energy consumption. Interestingly, the influence of urbanization on energy consumption is more significant in large cities than in small cities. These findings demonstrate that more fabulous cities, with more complicated infrastructure and a denser population, have higher energy demands, exacerbating the country's energy challenges.

Klemeš et al. [47] and Sharma et al. [48] added another dimension by demonstrating that urbanization improves energy consumption in general and influences the structure of energy consumption. They discovered a shift in energy consumption patterns caused by urbanization, which encourages electricity use while decreasing the use of solid fuels. Such a shift reflects a shift in demands and preferences for energy in metropolitan areas, with a greater reliance on clean and efficient energy sources [48].

2.4 Exports and consumption energy

The export of goods and services can considerably impact energy usage [20, 41]. Exports need more output, which causes a rise in energy consumption. Furthermore, transport services consume significant energy after production operations [49, 50].

Abboud and Betz [21] conducted a study examining globalization's impact on energy consumption in the BRICS countries. They discovered that greater trade openness and foreign direct investment (FDI) dramatically increased energy consumption, particularly in export-oriented industries. This conclusion emphasizes the critical role of globalization in increasing economic growth through international trade, which raises energy demand to sustain production and exports.

In the context of European countries, Jilte et al. [30] discovered that economic globalization has a considerable impact on energy consumption, particularly in countries with high trade openness. This study emphasizes the need for energy policies that not only improve energy efficiency but also consider the effects of global economic integration. In a more open trading environment, energy consumption tends to rise with economic activity, highlighting the importance of a comprehensive approach to energy policy formulation.

Another study by La Monaca et al. [51] provides a broader viewpoint by demonstrating that international commerce and FDI lead to rising energy consumption in Sub-Saharan Africa. This study supports the idea that economic openness might boost energy demand, particularly in emerging countries attempting to integrate into the global economy. This conclusion emphasises that, while globalisation can spur economic progress, developing countries must address the environmental consequences and higher energy demands that come with economic openness.

2.5 Inflation and energy consumption

Various empirical research has discovered a complex relationship between inflation and energy consumption, with the overall finding that inflation tends to force people to utilize energy more carefully and efficiently [52]. Instead, increased energy consumption and global population induce inflation, increasing energy prices [52, 53]. In this study, the CPI is employed to measure inflation. The CPI estimates the average change in price paid by consumers for goods and services over time as an indicator of significant inflation [54].

Bekun et al. [24] investigated the relationship between economic conditions, including inflation, and their effects on energy consumption and health in OECD countries. The study discovered that inflation had a considerable impact on consumer purchasing power, reducing energy consumption. When inflation rises, so do the prices of products and services, including energy, making it more difficult for customers to purchase the same quantity of energy as previously. This effect is most noticeable in industries that use a lot of energy, such as transportation and home heating.

In his research in Asian countries, Liu [55] discovered that inflation had a detrimental influence on energy consumption, particularly in price-sensitive sectors such as transportation and housing. When energy prices rise due to inflation, customers in these sectors reduce consumption to make do with a tighter budget. This study emphasizes the need to control inflation to stabilize energy consumption, which is critical for long-term economic growth.

Shioji [56] provides another insight into a study conducted in developing nations, revealing that price stability is critical in sustaining consistent energy consumption. Sharp price swings, frequently caused by unchecked inflation, can substantially impact energy demand. In this context, Shioji's study emphasizes the importance of developing countries maintaining price stability to avoid a sharp drop in energy consumption, which could impact on total economic activity.

Based on the above discussion, the hypotheses statement below expresses the link between independent and dependent variables. The industrial sector's high activity in achieving economic expansion is expected to favor rising energy consumption (H1). The service sector increases energy consumption because numerous facilities and activities require a lot of energy (H2). Urbanization increases energy consumption in tandem with the number of urban residents (H3). Companies will increase production and energy consumption to increase the volume of goods and services exported. After production, goods and services are exported to other nations, increasing energy consumption during the distribution phase (H4). Unlike the preceding hypotheses, inflation is supposed to be negatively associated with energy consumption. If inflation causes energy prices to rise, consumers and businesses will restrict their energy use to manage expenditure. Inflation can also boost production costs when energy prices rise, which drives less energy consumption (H5).

3. METHOD

3.1 Data and description of the variables

The current study employs an unbalanced panel data set spanning five years (2019–2023) and 38 countries. This research period was selected based on the availability of data for all variables evaluated in 38 countries. The dataset covers the consumption of primary energy as the dependent variable. The independent variables are (Table 1):

1. the contribution of the industrial sector to GDP (industry),
2. the contribution of the service sector to GDP (services),
3. urban population,
4. exports of goods and services, and
5. consumer price index as a measure of inflation.

The selection of dependent and independent variables is based on the review objective and theoretical and empirical prior research. Energy consumption is the total quantity of primary energy consumed by a country, measured in Terawatt-hours (TWh). Primary energy refers to energy sources extracted directly from nature, such as oil, gas, coal, and renewable energy, before being processed into final energy used in various economic sectors. Furthermore, the Industry and Services variables are used to assess the contribution of the industrial and service sectors to a country's GDP. The industry variable is reported as a proportion of total GDP and includes the construction industry, indicating how much value it contributes to the economy. Meanwhile, the Services variable is a percentage of total GDP, indicating the importance of service industries such as banking, education, health, and tourism to the broader economy. The urban population variable depicts the proportion of a country's population that lives in cities. This information is used to determine the extent of urbanization and the distribution of the population between urban and rural areas, which is frequently linked to changes in consumption habits and energy demand.

Furthermore, exports of goods and services calculate the entire value of a country's exports of goods and services as a proportion of GDP. This variable represents a country's reliance on foreign trade and its competitiveness in the global market. Finally, the Consumer Price Index (CPI) measures inflation and changes in consumer purchasing power over time. Energy consumption data is sourced from Our in Data (https://ourworldindata.org/), with all other independent source variables sourced from World Bank Indicators (https://data.worldbank.org). Given data availability, this analysis used a database including a panel data set of 38 countries (*n*) over 5 years (*t*). The dataset is an unbalanced panel with 190 observations ($n \times t = 38 \times 5$). However, due to missing country data at various time points, the total number of observations evaluated is 178.

Table 1. Data and variables

Variables	Definition	Unit
Energy consumption	The total primary energy consumed by a country is measured in Terawatt-hours (TWh). Primary energy includes source energy extracted directly from nature, such as oil, gas, and coal, as well as renewable energy, before being transformed into energy used in various sectors.	TWh
Industry	Industry, mainly building, contributes to a country's GDP. This metric is expressed as a percentage of total GDP, demonstrating how much the significant sectors of industry and construction contribute to the economy.	% of GDP
Services	The contribution of the service sector to a country's Gross Domestic Product (GDP), expressed as a percentage of total GDP, illustrates how much the extensive sector services contribute to the entire.	% of GDP
Urban population	A country's urban population is a percentage of its total population. This data is critical for assessing urbanization and the proportion of people living in cities versus rural areas.	% of total population
Exports of goods and services	A country's total exports of goods and services are expressed as a proportion of its GDP. This metric indicates how much a country's economy relies on international trade.	% of GDP
Consumer price index	A measure of the average price change in household goods and services, using 2010 as the base year (set to 100). The variable measures inflation and changes in consumer purchasing power over time.	Index

3.2 Model spesification and estimation strategy

The panel data model is used to analyze empirical data. Panel analysis considers both individual and temporal dimensions [57, 58]. Panel data is a collection of data gathered through observation of different units (cross-sectional) of time series [59, 60]. Panel data have several advantages, including more informative information, considerable variation, degrees of freedom, fewer collinearity between variables, and increased efficiency [61]. Furthermore, panel data analysis can control variables that do not change over time or between subjects because panel data has time dynamics with repeated cross-sectional data observations over time, allowing the effect of non-measurable variables to be controlled [62].

The panel regression employed corresponds to the work of Yessymkhanova et al. [63], Ogunsola and Tipoy [64], and Dokas et al. [65]. The following empirical model is specified:

$$ENERGY\ CONSUMPTION_{it} = \alpha + \beta_1 INDUSTRY_{it} + \beta_2 SERVICE_{it} + \beta_3 URBANPOP_{it} + \beta_4 EXPORT_{it} + \beta_5 CPI_{it} + \mu_{it} \quad (1)$$

where, $i = 1, 2, ..., N$ denotes the cross-sectional units, $t = 1, 2, 3, ..., t$ denotes the periods. Energy Consumption is the dependent variable indicating energy consumption, INDUSTRY refers to the contribution sector industry, including construction, against a country's Product Gross Domestic Product (GDP). SERVICE designates the contribution of the service sector to a country's GDP, URBANPOP represents the percentage of a country's population residing in urban areas, EXPORT indicates export, CPI symbolizes inflation, and μ is the stochastic error term. The independent variables forecast the response variable based on the explanatory variable available in relevant empirical studies. The panel approach begins with a static panel model approach and progresses to dynamic panels. The present study employs three static panel estimating methods: Pool, fixed effects (FE), and random effects (RE) [66, 67]. The analysis will subsequently proceed by employing dynamic panel data through the Generalized Method of Moments (GMM) estimator to enhance efficiency, minimizing the variants of the estimator [61, 68].

4. RESULTS AND DISCUSSION

4.1 Descriptive results

Energy consumption averages 1,707,990 Terawatt-hours (TWh) with a standard deviation of 4,205.733, demonstrating significant diversity in energy consumption among nations. The minimum energy consumption value is 37.54582 TWh, and the most significant recorded is 26,578.49 TWh. This dataset comprises 188 observations. The average contribution of the industry sector to GDP is 24.15527%, with a standard deviation of 6.108604%. The minimum value of the contribution sector industry is 10.39672%, whereas the most outstanding value is 49.15819%. There are 180 observations documented for the variable. The services sector, which assesses its contribution to GDP, has an average value of 63.76291% and a standard deviation of 6.464811%. The minimum value documented is 41.74495%, and the maximum is 80.59983%. A total of 180 observations were included in the study. The urban population indicates that, on average, 78.81610% of the population resides in urban areas. Urban, with a standard deviation of 11.02505%. The smallest value is 53.729%, while the most outstanding value is 98.189%.

Table 2. Descriptive statistics

Variable	Mean	Std. Dev	Min	Max
Energy Consumption	1707.990	4205.733	37.54582	26578.49
Industry	24.15527	6.108604	10.39672	49.15819
Services	63.76291	6.464811	41.74495	80.59983
Urban Pop	78.81610	11.02505	53.72900	98.18900
Export	55.57759	36.23229	10.08356	213.2227
CPI	133.9185	64.23336	98.82431	834.5931

The average value for the exports of goods and services variable is 55.57759% of GDP, with a standard deviation of 36.23229%. The least recorded export value is 10.08356%, while the most significant value attained is 213.2227%. A total of 187 observations were included in the study. The Consumer Price Index (CPI) variable averages 133.9185 and a standard deviation 64.23336. The minimum value of the CPI is 98.82431, whereas the most significant number is 834.5931. This dataset comprises 190 observations. Descriptive statistics (Table 2) provides a general description of the distribution and range of variables utilized in research, offering an initial knowledge of the behavior of each variable across observed samples.

4.2 Static panel regression

Empirical findings using Pool, FE, and RE models demonstrate substantial variance in the relationship between energy consumption and numerous economic variables such as industry, services, urbanization, exports, and consumer price indices. This discussion will not only review these results but also relate them to findings from previous research, as well as explore policy implications that can be drawn based on the results of this analysis.

Analysis of Pool Estimation

The estimates assume that variables across countries are homogeneous and do not account for effect still or randomness; the results demonstrate a robust association between energy consumption and significant economic sectors. Industry has a positive coefficient of 0.1863 ($p = 0.0000$), showing that increasing the industry sector's contribution to GDP is associated with increased energy consumption. The findings are consistent with the study of Luo et al. [29] which shows that the industry consumes a substantial amount of energy, particularly in rapidly industrializing countries. Industry requires significant energy for operations such as manufacturing, processing raw materials, and construction, all of which contribute to the country's overall energy consumption.

The Services variable likewise has a strong positive correlation with energy consumption, with a value of 0.1791 ($p = 0.0000$). It demonstrates that, while the service sector is generally seen as less energy-intensive than the industrial sector, significant growth in this sector significantly impacts energy consumption. Such a finding is also supported by Shazed et al. [18], who found that urbanization and the growth of the service sector might increase energy demand, particularly in supporting infrastructure such as transportation and hospitality.

Unexpectedly, the urban population has a positive coefficient but is insignificant at the 5% level (coefficient 0.0107, $p = 0.1763$). Although this shows a positive association between urbanization and energy consumption, the poor statistical significance suggests that the urbanization factor in the Pool model may need to be stronger. However, some studies, such as Zhang et al. [16], discovered that urbanization, particularly in developing nations, can significantly increase energy consumption in the housing and transportation industries. This difference could be attributed to the Pool model's homogenization methodology, which does not account for cross-country variances in urbanization rates and energy efficiency.

The exports of goods and services exhibit a negative coefficient of -0.0223 ($p = 0.0000$), showing that a rise in exports correlates with a reduction in energy usage. The results indicate that countries focused on exports are generally more efficient in energy utilization or employ more energy-efficient technologies in their industrial processes to maintain competitiveness in the global market. La Monaca et al. [51] previously discovered that international commerce and foreign direct investment (FDI) can elevate energy consumption; nevertheless, this negative outcome may indicate adopting more energy-efficient technology in these nations.

Finally, the CPI substantially correlates positively with energy consumption (coefficient 0.0035, p = 0.0043). These results highlight that inflation, as measured by the CPI, can impact energy consumption through higher energy prices that drive increased energy usage in the short term or as a response to economic uncertainty. In their study, Bekun et al. [24] stressed the impact of inflation on consumer purchasing power, which influences energy usage.

Fixed Effects Analysis

The FE estimations, which incorporate fixed effects for each country, yield more diverse results than the Pool model and, in certain instances, indicate an inverse relationship. The FE model's coefficients for Industry and Services are -0.0253 (p = 0.0002) and -0.0337 (p = 0.0000), respectively. The findings indicate that, after accounting for country-fixed effects, the rise in the contribution of these sectors to GDP may correlate with a reduction in energy consumption. This finding suggests that these sectors may have attained greater energy efficiency in certain countries or that other factors, such as a transition to greener technologies, are significant contributors. A study by Yang et al. [25] demonstrates that investment in renewable energy can alter energy consumption patterns, particularly in previously energy-intensive sectors.

The FE model indicates a significant negative correlation between urban population and energy consumption, with a coefficient of -0.0497 (p = 0.0001). This finding indicates that, when accounting for country-fixed effects, urbanization may contribute to a reduction in energy consumption. The observed decrease may result from enhanced energy efficiency in urban areas, which typically possess more modern and efficient infrastructure than rural regions. This finding challenges the prevailing notion that urbanization invariably leads to increased energy consumption. Zhang et al. [16] demonstrated that urbanization influences energy consumption in specific sectors, including transportation and housing.

The fixed effects model indicates a small yet statistically significant coefficient of 0.0023 for the Exports of Goods and Services variable (p = 0.0193). This finding suggests that, after controlling for country-fixed effects, the impact of exports on energy consumption is minimal. This result aligns with the perspective that while exports play a significant role in the economy, their effect on energy consumption may be less substantial than anticipated within the framework of the FE model, mainly if nations have implemented more energy-efficient production technologies.

In the FE model, the CPI exhibits a negligible and nearly insignificant coefficient (0.0001, p = 0.0709). This figure indicates that inflation minimally influences energy consumption within this context. This outcome diverges from the Pool model and may indicate the variability in the impact of inflation across different economies when fixed effects are considered.

Random Effects Analysis (RE)

The RE model posits that random effects are related to the independent variables, and the RE estimation results are comparable to the FE model, with a few notable exceptions. Industry and services have a negative connection with energy consumption, with coefficients of -0.022335 (p = 0.0007) and -0.030451 (p = 0.0000), respectively. These findings demonstrate that, in the context of a model that considers random variation among nations, the contribution of these sectors is associated with a decrease in energy consumption. These findings support the concept that energy efficiency improvements or technology breakthroughs in the industry and services sectors can help cut energy consumption despite economic growth.

In the RE model, the urban population has an insignificant negative coefficient of -0.0152 (p = 0.1142). The insignificant impact suggests that the influence of urbanization on energy consumption in the RE model needs to be more consistent and insignificant. This finding could imply that urbanization's impact on energy consumption dramatically depends on country-specific factors such as technical advancement and current energy policies.

Exports of goods and services have a very modest and insignificant coefficient of 0.0003 (p = 0.7212), confirming that in the RE model, exports have no meaningful impact on energy consumption. This study supports the concept that the impact of exports on energy consumption can be mitigated by efficiency improvements or a transition to more energy-efficient products.

CPI in the RE model has a relatively high but negligible coefficient (6.4134, p = 0.4741), which could indicate the inconsistent effect of inflation on energy consumption within this model framework. This fluctuation shows that the relationship between inflation and energy consumption may be more complex than a simple linear model, necessitating a more sophisticated analytical technique to comprehend it correctly.

Overall, the panel estimation study results reveal that different models provide varied perspectives on the link between energy consumption and the factors that influence it, as illustrated in Eq. (1). These differences highlight the necessity of selecting the appropriate model based on the features of the data and the study's aims. The Pool model results, which indicate a substantial positive association between most factors and energy consumption, support the hypothesis that rising economic activity, whether through industry, services, or urbanization, tends to increase energy consumption. However, the FE and RE results reveal that when country-specific or random effects are incorporated, this link can reverse direction or become negligible, indicating that other variables must be addressed in the analysis (Table 3). These findings add to the current literature by demonstrating the complexities of the relationship between economic conditions and energy usage and emphasizing the significance of a methodologically rigorous approach to panel data analysis. These findings further highlight the importance of a flexible energy policy that can account for the numerous factors that influence energy consumption across different economic contexts.

Table 3. Static regression: Pool, FE and RE estimation

Variable	Pool	FE	RE
Industry	0.1863 (0.0000)***	-0.0253 (0.0002)***	-0.0223 (0.0007)***
Services	0.1791 (0.0000)***	-0.0337 (0.0000)***	-0.0304 (0.0000)***
Urban population	0.0107 (0.1763)	-0.0497 (0.0001)***	-0.0152 (0.1142)
Exports of goods and services	-0.0223 (0.0000)***	0.0023 (0.0193)**	0.0003 (0.7212)
Consumer price index	0.0035 (0.0043)***	0.0001 (0.0709)*	6.4134 (0.4741)
R-squared	0.5184	0.9993	0.0931
Observations	178	178	178

*Significance at 10%, **Significance at 5%, ***Significance at 1%.

4.3 Dynamic panel regression

Within the framework of economic variables, the previous period is also a significant determinant of the value of a variable in the following period. The dynamic panel estimation accounted for this possibility in this work with the Arellano and bond estimators [61, 69, 70]. Arellano and Bond estimators are employed in dynamic panel analysis to address the issues of unobserved individual effects and endogeneity in panel data models [53, 71]. The Arellano-Bond estimator corrects endogeneity using the dependent variable's lag value [61, 69, 70]. Table 4 shows the estimation results using the Arellano-Bond Estimator.

According to the Arellano-Bond estimator, the coefficient of the industrial sector variable at lag 1 is 0.1807 in the dynamic OLS (Pool) model and 0.2024 in the FE model, with a significant p-value of 0.0000 in both models. This research demonstrates that the contribution of the industrial sector, which is delayed by one period, has a considerable positive impact on energy usage. In other words, an increase in industrial activity in the preceding period will immediately contribute to an increase in energy consumption in the subsequent era.

The estimation results suggest that the service sector has a considerable positive effect on energy consumption, with coefficients of 0.168264 in the Pool model and 0.2227 in the FE model and a p-value of less than 0.0001. This result demonstrates that, while the service industry usually is less energy-intensive than the industrial sector, it nonetheless significantly impacts energy consumption. The substantial regression coefficient at lag 1 suggests that energy consumption in the service sector is continuous, with an increase in service sector activity in the previous period contributing to energy consumption in the subsequent period. This conclusion could be attributed to the ongoing demand for energy to power information technology infrastructure, servers, data centers, and telecommunications networks, all critical components of the modern service industry.

It is crucial to highlight that while the service sector is expanding and pushing energy consumption, global efforts are underway to lower its carbon footprint through green infrastructure development and renewable energy consumption. Klemeš et al. [47] underlined that there is a shift in the pattern of energy consumption in the service sector, with urbanization and technological improvements driving higher usage of electricity from clean energy sources rather than fossil fuels. The urban population variable at lag one yields insignificant results, with coefficients of 0.0147 in the Pool model and 0.0097 in the FE model and high p-values of 0.2961 and 0.3304, respectively. It reveals that the rise in urban population during the preceding period has no meaningful effect on future energy usage.

As stated by Shazed et al. [18], urbanization and the growth of the modern service sector, particularly in large cities, are driving up energy demand, particularly for public transit systems and communication networks. Rapid digitization in the service sector necessitates significant energy consumption and the development of information and communication technology (ICT). Piccirilli et al. [10] emphasized that rising energy consumption in the service sector contributes to economic growth in developing countries, mainly through digitization and economic globalization.

The first lag in urban population may explain a contradiction with the general notion of urbanization, which is frequently connected with higher energy consumption. However, there are various plausible causes. First, countries with a high urbanization rate may have achieved higher energy efficiency, as significant cities use more energy-efficient technology and infrastructure, such as electric-powered transportation and green buildings. Zhang et al. [16] discovered that industrialized countries with more energy-efficient technologies did not substantially increase energy consumption despite increased urbanization. Furthermore, cross-national heterogeneity is significant. Urbanization may have varying effects based on the country's economic development and energy policies. In industrialized countries, urbanization relates to better energy efficiency; however, in developing countries, urbanization can increase energy consumption due to the demand for basic infrastructure.

The estimation results demonstrate that exports of products and services have a substantial negative connection with energy consumption, with coefficients of -0.0223 in the Pool model and -0.0254 in the FE model. Such an association suggests increased exports in the previous period can lower energy consumption in the subsequent quarter. The negative regression results in the first lag show that export-oriented countries are more energy efficient, probably because they are motivated to boost competitiveness by lowering energy costs in the manufacturing process. According to Abboud and Betz [21], enterprises in the export sector frequently use energy-saving technologies to save manufacturing costs, which explains the negative link between exports and energy consumption. It is feasible that countries with large export industries will reduce domestic energy intensity while shifting production to countries with higher energy intensity. Such circumstances are referred to as "externalization of energy consumption," in which rich countries import items from developing countries that use more energy for production. According to Sadorsky [19], economic globalization can lead to complex dynamics between exports, energy consumption, and energy efficiency, with nations with high export levels being more efficient in domestic energy consumption.

Table 4. Dynamic OLS and FE

	Pool	FE
Industry (lag 1)	0.1807	0.2024
	(0.0000) ***	(0.0000) ***
Services (lag 1)	0.1682	0.2227
	(0.0001) ***	(0.0000) ***
Urban population (lag 1)	0.0147	0.0097
	(0.2961)	(0.3304)
Exports of goods and services (lag 1)	-0.0223	-0.0254
	(0.0000) ***	(0.0000) ***
Consumer price indeks (lag 1)	0.0030	0.0054
	(0.1667)	(0.0023)
Constant	-9.4248	-12.9241
	(0.0060)	(0.0000) ***
R-squared	0.5262	0.5474
Observations	178	178

*Significance at 10%, **Significance at 5%, ***Significance at 1%.

The CPI coefficient at lag 1 of 0.0030 in the Pool model and 0.0054 in the FE model has a significant and positive influence on energy consumption, demonstrating that recent inflation can cause an increase in energy consumption in the following period. The first lag of CPI suggests that higher inflation in the prior period can raise energy consumption, particularly when consumers are obliged to spend more energy for fundamental needs. According to Bekun et al. [24], while high inflation might diminish purchasing power, it can also increase energy demand for primary requirements like electricity and heating.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

This study focuses on the complex relationship between energy consumption and various economic indicators in the countries studied, including the industrial sector's contribution to GDP, the contribution of the service sector to GDP, urbanization, exports, and inflation. The research using the Pool, Fixed Effects (FE), and Random Effects (RE) models demonstrates significant diversity in the influence of these variables on energy consumption. The Pool model shows a positive association between energy consumption and the industrial and service sectors. An increase always follows an increase in the industrial sector's contribution to GDP in energy consumption. These findings emphasize the importance of the industrial sector as a significant energy user, especially in countries experiencing rapid industrialization. Implication of a positive association between energy consumption with the industrial sectors. The association reveals how energy consumption directly affects industrial production. As a result, when industries produce additional goods, their energy demand rises, implying that industrial growth promotes economic expansion.

Similarly, while the services sector uses less energy than the industrial sector, it substantially impacts energy consumption, coinciding with the rise of supporting infrastructure such as transportation, telecommunications, and information technology. From these findings, then from the policy side, there needs to be anticipation in efforts to diversify energy sources towards renewable energy because, in the future, the rapid growth of the service sector can significantly increase energy demand. From the energy supply side, efforts must increase energy efficiency in the service sector through energy-saving technology and sustainable practices.

However, the results differ dramatically when fixed factors between countries are examined using the FE model. The industrial and service sectors had positive coefficients in the Pool model but now have negative coefficients in the FE model. One possible reason for this finding is that in several nations assessed, the industrial and service sectors have made significant breakthroughs in energy efficiency. For example, developed countries with green technologies and renewable energy policies tend to reduce energy consumption in energy-intensive sectors despite increased economic activity.

Urbanization also produces varying results. The Pool model reveals that the association between urbanization and energy consumption is positive but insignificant. This insignificant association could be attributed to the model's homogenization method, which needs to account for cross-country variances in urbanization and energy efficiency. In general, urbanization increases energy consumption rather than decreasing it. However, there are nuances in urbanization that can dampen energy consumption in some conditions. The study's findings reveal that, throughout the 38 nations examined, there are characteristics in metropolitan settings that contribute to energy consumption efficiency. These findings highlight the need for authorities to increase the efficiency of various city energy supplies.

In contrast, the FE model demonstrates that urbanization negatively impacts energy consumption. These findings imply that in highly urbanized countries, increased energy efficiency and contemporary city infrastructure may help to reduce energy usage.

Interestingly, exports of products and services have a negative association with energy use in all models. These data suggest that export-oriented countries are more efficient in energy consumption or incorporate energy-saving technologies into their manufacturing processes. Such efficiencies could be attributed to global competitive pressures driving enterprises to use more energy-efficient production systems.

Finally, inflation, as measured by the CPI, has a positive association with energy consumption in the Pool model but is insignificant in the FE and RE models. These findings imply that the influence of inflation on energy consumption may be more significant in the near term or in nations whose economies are sensitive to changes in energy prices. These findings also indicate that, in the long run, the impact of inflation on energy consumption may be mitigated by energy policy changes and consumer consumption reductions. The dynamic panel method indicates that the industrial and service sectors substantially influence energy consumption. Exports exert a significant and adverse effect on energy consumption. The Consumer Price Index (CPI), an indicator of inflation, substantially and positively impacts energy consumption.

5.2 Recommendations

The manufacturing and service sectors contribute significantly to increased energy demand. As a policy implication, the government of a country must increase the quality of energy infrastructure to support industrial operations. Furthermore, from a policy standpoint, attempts to diversify energy sources toward renewable energy must be anticipated since the rapid growth of the service sector in the future has the potential to increase energy consumption dramatically. On the energy supply side, efforts must be made to improve energy efficiency in the service sector by implementing energy-saving technologies and sustainable practices. The government must also implement a sustainable energy strategy to decrease energy usage in the industrial and service sectors. The two sectors rely highly on energy for production activities. Therefore, regulations promoting enhanced energy efficiency are essential. The government can promote green technology innovation by offering incentives and subsidies to companies that invest in energy-reducing devices. Investment in renewable energy sources, including solar power, wind energy, and bioenergy, must be augmented to supplant fossil fuels, which pose more significant environmental risks. Policies aimed at energy efficiency and the transition to renewable energy will assist the industrial and service sectors establish a more sustainable economy.

Urbanization frequently increases energy consumption in cities, although this rise can be mitigated by measures that promote energy efficiency. To lower urban carbon footprints, city governments must invest in energy-efficient infrastructure such as electric vehicles and green buildings. The development of renewable energy-based public transportation, such as electric buses, green-powered trains, and energy-efficient structures, will contribute to lower urban energy consumption. This policy is also vital in promoting long-term city development.

Export-oriented countries should also promote energy efficiency in the industrial sector by using energy-saving technologies. The government can offer incentives, such as tax breaks, to businesses that successfully cut energy consumption in their operations. Furthermore, legislation promoting the use of renewable energy in the export sector must be improved to ensure that the products produced are both environmentally benign and competitive in the global market. Further research into the influence of international commerce, foreign investment, and the renewable energy transition on energy consumption is critically required to support future successful and evidence-based energy policy.

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APPENDIX

Unbalanced panel regression analyses

Country	Period	Year	Industry	Services	Urban Population	Exports of Goods and Services	Consumer Price Index	Energy Consumption
Australia	2019-01-01	2019	25.27350693	66.02339847	86.124	24.11178836	119.7970864	1679.8438
Australia	2020-01-01	2020	25.38624951	66.26309207	86.241	23.96737274	120.8116545	1585.1263
Australia	2021-01-01	2021	25.41757604	65.71675728	86.362	21.97681939	124.2715921	1589.0751
Australia	2022-01-01	2022	27.48299454	63.30351904	86.488	25.42712413	132.4661811	1661.016
Australia	2023-01-01	2023	27.36265573	64.22493429	86.617	26.72198648	139.880333	1672.4558
Austria	2019-01-01	2019	25.20452933	63.10854422	58.515	55.76078481	118.0579801	427.9604

Austria	2020-01-01202025.4887323263.19179111	58.748	51.58494694	119.6894358	400.14407
Austria	2021-01-01202126.0704865862.15068292	58.995	55.9518373	123.0008436	406.03314
Austria	2022-01-01202226.1068838962.13923717	59.256	62.08317498	133.5135657	379.76904
Austria	2023-01-01202326.2612839762.29232556	59.53	59.47718589	143.9464948	384.8108
Belgium	2019-01-01201919.2593657369.34731662	98.041	82.39718206	117.1104572	738.434
Belgium	2020-01-01202019.3906567869.75468976	98.079	78.66790638	117.9780019	664.01184
Belgium	2021-01-01202119.3297972869.23520237	98.117	87.90139849	120.8569583	738.3453
Belgium	2022-01-01202220.0459678369.03784587	98.153	95.70223544	132.456219	694.4863
Belgium	2023-01-01202318.4421759670.70729909	98.189	86.68123029	137.8193856	642.0631
Canada	2019-01-01201924.0774078867.67116348	81.482	32.35269582	116.7572982	4067.8503
Canada	2020-01-01202022.4516173269.55977998	81.562	29.47364723	117.5944476	3821.6829
Canada	2021-01-012021	81.653	31.21635296	121.5870063	3866.976
Canada	2022-01-012022	81.752	33.84504756	129.8583286	3971.9736
Canada	2023-01-012023	81.862	33.53640807	134.8955352	3874.8867
Chile	2019-01-01201927.1184422458.88317546	87.643	27.87466776	131.913567	473.9787
Chile	2020-01-012020 29.8295676 56.34461458	87.727	31.33039024	135.9309826	442.47766
Chile	2021-01-01202130.88386558 54.9828043	87.817	31.9735835	142.0812728	476.857
Chile	2022-01-01202231.2573342954.94103922	87.912	35.51510707	158.6250269	503.5053
Chile	2023-01-01202329.66516641 56.9110073	88.012	31.13673653	170.6514728	504.06754
Colombia	2019-01-01201925.9934268458.13645917	81.104	15.86803865	140.9478497	563.1924
Colombia	2020-01-012020 23.4392386 60.12182627	81.425	13.52227556	144.5090874	512.58594
Colombia	2021-01-01202124.5565697458.19262238	81.74	16.19700595	149.5597632	574.74524
Colombia	2022-01-012022 26.1475271 54.87249548	82.05	20.23240039	164.7808063	610.0674
Colombia	2023-01-01202324.5483961656.85544993	82.354	17.76035462	184.1193244	626.48535
Costa Rica	2019-01-01201919.2336569369.20499402	80.076	34.32532156	128.8457433	66.162155
Costa Rica	2020-01-01202020.3678511368.23240729	80.771	31.90649766	129.7797609	58.84567
Costa Rica	2021-01-01202120.6057923667.07941614	81.425	36.17635703	132.0203794	61.628967
Costa Rica	2022-01-01202220.6464381167.28309024	82.042	40.56655498	142.9447686	
Costa Rica	2023-01-01202320.4592538467.99307844	82.622	37.2888642	143.6955052	
Czechia	2019-01-01201931.5302362256.96358697	73.921	73.87978033	116.475542	477.90494
Czechia	2020-01-01202030.6869294158.36769204	74.061	69.94877154	120.1576778	442.5676
Czechia	2021-01-01202130.2656842758.75660961	74.214	72.7282341	124.7715463	466.40598
Czechia	2022-01-01202229.61139528 59.1783657	74.377	76.45232425	143.6122559	455.73114
Czechia	2023-01-01202330.1596136759.75078226	74.552	72.01070037	158.9231321	423.37268
Denmark	2019-01-01201920.7089380965.07011648	87.994	58.64718222	110.3472904	196.04588
Denmark	2020-01-01202019.7206648365.75775012	88.116	55.11980167	110.8115347	176.48528
Denmark	2021-01-01202119.5883379666.40170039	88.24	58.70294413	112.8649228	189.43509
Denmark	2022-01-01202219.6562970967.26537248	88.367	70.01238944	121.5516472	197.27802
Denmark	2023-01-01202321.4859724566.07089109	88.495	69.00899989	125.5691456	195.52307
Estonia	2019-01-01201923.0335681161.61932415	69.051	73.35955444	122.1423128	62.760654
Estonia	2020-01-01202022.7055627463.08379046	69.229	69.21103086	121.5993523	58.73331
Estonia	2021-01-01202123.4017708562.28384349	69.415	80.26909523	127.2575729	61.401203
Estonia	2022-01-012022 23.9599725 61.84817981	69.609	85.78174381	151.9433321	63.392017
Estonia	2023-01-012023 22.3084445 63.79366595	69.81	78.37933194	165.8601638	55.5125
Finland	2019-01-01201923.8782946660.19478191	85.446	39.8806794	112.3317121	326.9818
Finland	2020-01-01202024.03649837 60.1185525	85.517	35.78756333	112.658097	313.94992
Finland	2021-01-01202123.9906807560.22524176	85.596	39.47754763	115.1304627	320.63977
Finland	2022-01-01202225.1379409559.43321865	85.681	45.41647521	123.3317901	320.72968
Finland	2023-01-012023 24.532733 60.67969383	85.773	40.96461054	131.0408203	332.15573
France	2019-01-01201917.4246759770.04358733	80.709	31.59205541	110.0485668	2729.5625
France	2020-01-01202016.7858585170.89236839	80.975	27.32773557	110.5729469	2441.1663
France	2021-01-01202116.3956296270.62424714	81.242	30.03499435	112.3889211	2593.6248
France	2022-01-01202216.8221115470.73364627	81.509	34.68639972	118.2582836	2298.5596
France	2023-01-01202318.6508508469.24009133	81.777	32.67942635	124.0273452	2406.6328
Germany	2019-01-01201926.9911142762.32937357	77.376	47.12758088	112.8548771	3694.8396
Germany	2020-01-01202026.7073769163.22998593	77.453	43.47697967	113.0183789	3443.882
Germany	2021-01-01202127.0340986162.82541569	77.544	47.2795201	116.4842759	3544.581
Germany	2022-01-01202226.9021953662.70640037	77.648	50.92392973	124.4897444	3413.0002
Germany	2023-01-01202328.08185074 62.572334	77.765	47.13524833	131.8924482	3169.5498
Greece	2019-01-01201913.3546849369.50215683	79.388	40.11076393	101.9494141	316.8873
Greece	2020-01-01202014.66704864 68.9288963	79.715	32.06408533	100.6771022	276.95612
Greece	2021-01-01202115.0781596568.38526442	80.038	40.94179961	101.9092137	302.5362
Greece	2022-01-01202216.8228635767.35457004	80.357	49.13682964	111.7386222	314.33743
Greece	2023-01-01202315.6555046267.61912833	80.673	44.86849659	115.6101434	305.181
Hungary	2019-01-01201924.7117816656.41881423	71.644	81.52974061	121.6420474	274.8925
Hungary	2020-01-01202024.3802502656.62920398	71.942	78.67507861	125.6887667	270.3273
Hungary	2021-01-012021 24.1759579 56.99194658	72.245	79.94113828	132.1126761	283.95834
Hungary	2022-01-01202224.6483648857.23795091	72.552	90.41536975	151.4118859	267.01694
Hungary	2023-01-01202324.32018356 57.5565435	72.864	81.20417972	177.3411199	252.93295
Iceland	2019-01-01201919.5316331665.96650908	93.855	43.71324844	129.0033312	63.328125
Iceland	2020-01-012020 20.1810958 65.1821176	93.898	33.30964505	132.6772481	58.08151

Iceland	2021-01-01202120.5581305564.70049056	93.944	37.25462798	138.573743	60.644577
Iceland	2022-01-012022 21.4071174 64.17278589	93.992	45.77997406	150.087496	63.73455
Iceland	2023-01-01202321.0420339264.63683122	94.042	43.36806641	163.1995944	62.83699
Ireland	2019-01-012019 35.3148022 57.51717856	63.405	128.0042429	106.5620392	187.35852
Ireland	2020-01-01202037.63855549 56.3579063	63.653	132.9391552	106.2144512	176.07672
Ireland	2021-01-01202138.4656451754.63156911	63.912	133.7393556	108.7002317	179.446
Ireland	2022-01-01202241.4855667752.61022544	64.183	137.0877814	117.21087	185.96701
Ireland	2023-01-01202337.5918139956.62345644	64.466	134.1361029	124.5944807	180.76672
Israel	2019-01-01201918.6342967370.91960901	92.501	29.04935295	108.1853575	301.50592
Israel	2020-01-01202018.1404458171.81574649	92.587	27.51471658	107.5206533	285.13525
Israel	2021-01-01202117.1721204972.44853741	92.674	29.39727111	109.1444307	292.04428
Israel	2022-01-012022	92.763	31.72837991	113.9397968	308.64883
Israel	2023-01-012023	92.854	30.86278317	118.7541544	309.45895
Italy	2019-01-01201921.52700987 66.2531597	70.736	31.60241973	110.6235956	1819.5557
Italy	2020-01-01202021.55892846 66.8991015	71.039	29.43227703	110.4712586	1651.9623
Italy	2021-01-012021 23.1961729 64.75076548	71.346	32.11291448	112.5412505	1768.6172
Italy	2022-01-01202223.5441113164.43335997	71.657	36.50740165	121.7710848	1718.2512
Italy	2023-01-01202323.1258148464.92288967	71.973	35.05454365	128.6172919	1651.4344
Japan	2019-01-01201928.8040848169.62767166	91.698	17.46352643	105.4842679	5205.5366
Japan	2020-01-01202029.0734005269.46161618	91.782	15.5285155	105.4579012	4825.2485
Japan	2021-01-01202129.2628608769.12976314	91.867	18.12547664	105.2118123	5037.4814
Japan	2022-01-01202226.9164340671.38850987	91.955	21.54172312	107.8396906	5004.881
Japan	2023-01-012023	92.043		111.3640359	4834.3735
Korea, Rep.	2019-01-01201932.6791489257.24215056	81.43	39.27586107	115.1586343	3462.6758
Korea, Rep.	2020-01-012020 32.5381602 57.00752121	81.414	36.35959055	115.7773678	3346.965
Korea, Rep.	2021-01-012021 32.4320155 56.82189945	81.414	41.8772295	118.6698724	3506.508
Korea, Rep.	2022-01-01202231.7263012658.03401549	81.427	48.27176422	124.7095918	3542.344
Korea, Rep.	2023-01-01202331.5941649758.42226999	81.456	43.99566987	129.1901759	3453.8945
Latvia	2019-01-012019 18.9192156 64.38253472	68.222	60.02102714	116.8569846	44.83716
Latvia	2020-01-01202019.6463722963.63650735	68.315	60.7512914	117.1129773	40.858128
Latvia	2021-01-01202120.35116147 62.9128603	68.421	64.59124088	120.9493986	42.6252
Latvia	2022-01-01202221.4500361861.67974694	68.54	72.89352548	141.8860818	38.474934
Latvia	2023-01-01202320.9340759263.06478321	68.671	64.05959465	154.5679254	40.232597
Lithuania	2019-01-01201925.32789166 61.4320691	67.855	77.2441153	118.3820983	70.59712
Lithuania	2020-01-01202024.9114253361.21988992	68.046	73.09807766	119.8025585	70.29448
Lithuania	2021-01-01202124.8821034361.18293944	68.249	80.06601567	125.4135643	70.14949
Lithuania	2022-01-01202225.7245756961.20804216	68.465	86.7990152	150.1263651	65.06625
Lithuania	2023-01-01202324.0765091963.11620596	68.694	78.49444266	163.8138656	66.32199
Luxembourg	2019-01-01201911.5988958179.11892083	91.223	206.4116498	115.0878151	47.288246
Luxembourg	2020-01-01202011.3118944879.75605209	91.453	203.1202633	116.031486	40.540794
Luxembourg	2021-01-01202110.7209988980.11875619	91.672	213.2226787	118.963509	43.215237
Luxembourg	2022-01-01202210.3967225280.38341008	91.881	211.2782056	126.5010465	38.763626
Luxembourg	2023-01-01202310.4719500580.59982558	92.078	212.5306183	131.2339612	37.545822
Mexico	2019-01-012019 31.7765006 59.22502268	80.444	38.4970333	141.542523	2241.414
Mexico	2020-01-01202030.9519950459.23560145	80.731	39.24343244	146.3504877	2041.9174
Mexico	2021-01-01202132.0724604958.19772293	81.016	40.67732036	154.6766721	2175.8943
Mexico	2022-01-01202233.2703399158.00985834	81.3	42.76103074	166.8903693	2273.0837
Mexico	2023-01-012023 31.7515055 58.31887734	81.582	36.20345662	176.1160036	2348.0437
Netherlands	2019-01-01201917.5622805369.96685341	91.876	82.5377127	115.9079949	1022.32947
Netherlands	2020-01-012020 17.856829 69.63403764	92.236	78.2654765	117.3828783	990.14575
Netherlands	2021-01-01202118.1616541569.28405777	92.572	84.10520718	120.5237155	1014.6149
Netherlands	2022-01-01202219.5092791368.68412569	92.886	93.75222341	132.5775428	955.1913
Netherlands	2023-01-01202319.3604787269.31512466	93.179	84.96391983	137.6663907	954.5236
New Zealand	2019-01-01201920.2745492565.58291418	86.615	27.35030566	114.2409118	263.68475
New Zealand	2020-01-012020 19.7803605 66.46015756	86.699	21.72857875	116.1996427	239.25703
New Zealand	2021-01-01202118.9694982267.10921858	86.789	22.33729873	120.7792107	235.5494
New Zealand	2022-01-012022	86.884	24.39482557	129.4417672	232.21115
New Zealand	2023-01-012023	86.985		136.8628745	239.13474
Norway	2019-01-01201929.8244589857.31028928	82.616	36.64092532	120.2696589	516.76984
Norway	2020-01-01202026.8831673459.60411085	82.974	32.21033778	121.8170301	557.34674
Norway	2021-01-01202137.9019230450.56725003	83.323	43.03630192	126.06099	568.4789
Norway	2022-01-012022 49.158192 41.74494892	83.664	55.46006703	133.3273007	532.7134
Norway	2023-01-01202338.9750965149.99343881	83.995	47.17844247	140.684101	553.08405
Poland	2019-01-01201928.6365431956.88400921	60.037	53.19533562	114.1117794	1187.2677
Poland	2020-01-01202028.3483311657.16430705	60.043	52.9909243	117.9624468	1139.2343
Poland	2021-01-01202128.10471774 56.670462	60.075	57.69934428	123.9254804	1224.7583
Poland	2022-01-01202229.05566479 57.2601192	60.134	62.87918751	141.8072466	1186.8682
Poland	2023-01-01202328.67694172 58.752273	60.218	57.81424617	158.1560804	1143.4487
Portugal	2019-01-01201918.8327237665.62641557	65.764	43.50842185	110.6243586	293.05664
Portugal	2020-01-012020 19.400455 65.58349407	66.31	37.04677424	110.6105988	265.24768
Portugal	2021-01-01202119.24268109 65.1921444	66.849	41.40171507	112.0105498	266.48996

Portugal	2022-01-01202218.62083279 66.0928537	67.381	49.59896849	120.7839903	262.67505
Portugal	2023-01-01202318.0187841567.00009623	67.906	47.44143467	125.9913286	263.4581
Slovak Rep.	2019-01-01201929.6043140458.07612357	53.729	91.90868525	115.3389877	184.84892
Slovak Rep.	2020-01-012020 28.3577579 59.57656873	53.76	85.05091836	117.5730362	181.1254
Slovak Rep.	2021-01-01202128.59852317 58.848401	53.82	92.06064246	121.276124	195.22316
Slovak Rep.	2022-01-01202226.33248051 60.971041	53.909	99.29740359	136.7681135	179.89285
Slovak Rep.	2023-01-01202332.7202251256.53508904	54.027	91.43088959	151.1724597	186.63306
Slovenia	2019-01-01201928.8649075556.34164923	54.822	83.61469331	111.0510749	80.00229
Slovenia	2020-01-01202029.2146493557.04246677	55.118	77.7607326	110.9901558	77.29536
Slovenia	2021-01-01202128.4264486457.68334538	55.427	83.56290137	113.1179093	76.58192
Slovenia	2022-01-01202228.1375741958.03596439	55.751	94.14607036	123.1104048	70.60175
Slovenia	2023-01-01202329.1264604757.81823267	56.088	83.999064	132.2782854	72.429436
Spain	2019-01-012019 20.0416214 68.18451514	80.565	34.90690181	110.9614436	1583.871
Spain	2020-01-012020 20.136728 68.30081947	80.81	30.77926024	110.6033122	1422.96
Spain	2021-01-01202120.3240638567.41902494	81.056	34.17642294	114.0244221	1530.2695
Spain	2022-01-01202220.7946214267.89888716	81.304	40.87406425	123.5917283	1591.0308
Spain	2023-01-01202320.2409348568.52927958	81.552	38.95596725	127.9574347	1572.863
Sweden	2019-01-01201921.9037119465.51512104	87.708	47.80921095	110.5092198	625.81903
Sweden	2020-01-01202021.5906876265.84370307	87.977	43.84730253	111.0588566	600.27936
Sweden	2021-01-01202122.6925697364.83447364	88.238	46.4968565	113.4612788	633.67957
Sweden	2022-01-01202223.9507290563.60839922	88.492	52.86155975	122.9571834	621.6937
Sweden	2023-01-01202322.7791593765.27817362	88.738	53.9821811	133.4683318	597.5023
Switzerland	2019-01-01201924.7211591371.86188459	73.849	66.96539368	99.54689637	335.947
Switzerland	2020-01-01202024.8279156871.75040688	73.915	64.09555716	98.82431041	308.59106
Switzerland	2021-01-01202125.5788564970.98408554	73.996	71.28755618	99.39928425	298.0824
Switzerland	2022-01-01202224.8746674371.78913327	74.092	76.93561539	102.2172818	290.10965
Switzerland	2023-01-01202324.92771976 71.8940438	74.202	75.32686523	104.4000305	314.64438
Turkiye	2019-01-01201927.33170171 56.3110349	75.63	33.07421471	234.4371263	1849.1666
Turkiye	2020-01-01202028.0257662254.20113467	76.105	29.12078986	263.2235613	1821.7764
Turkiye	2021-01-012021 31.1327996 52.7548604	76.569	35.74369481	314.8061472	1951.1511
Turkiye	2022-01-01202231.2937674151.73761542	77.022	38.58420213	542.4388079	1972.118
Turkiye	2023-01-01202328.2612849154.04781494	77.463	32.26905871	834.5931428	1945.299
United Kingdom	2019-01-01201917.7588195870.97301113	83.652	31.63478028	119.6227113	2199.0686
United Kingdom	2020-01-01202017.3880191372.14663582	83.903	29.69199083	120.8063621	1971.1879
United Kingdom	2021-01-012021 16.6124289 72.28243857	84.152	29.59731253	123.8487146	1990.9581
United Kingdom	2022-01-01202216.65619173 72.1714171	84.398	33.43046097	133.6600703	2018.8452
United Kingdom	2023-01-01202316.9342204172.83570992	84.642	32.17265199	142.7408914	1930.5928
United States	2019-01-01201918.1611552376.67753687	82.459	11.79500678	117.2441955	26578.494
United States	2020-01-01202017.29290722 77.1756474	82.664	10.08355786	118.6905016	24622.646
United States	2021-01-01202117.6732044676.68176073	82.873	10.80797936	124.2664138	25956.828
United States	2022-01-012022	83.084	11.63390862	134.2112062	26504.305
United States	2023-01-012023	83.298		139.7357936	26189.2