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An Economic Profile for the Family Income Consumption Based on Domestic Energy Cost in Developing Countries

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Abstract

This paper treats the energy cost evaluation relative to the family income. This statement is implemented to an ideal model for the domestic energy consumption as populations. The determined title of domestic energy consumption is selected to represent the aimed operation and data processing. Also, Cairo (the capital of Egypt) is considered to represent the developing countries. The designated model contains 15 ideal samples of customers (has a period of 26 continuous years), starting at January 1992 and ending at January 2018, where the cost of energy consumption is analysed. The corresponding cost is estimated according to the history of energy tariff in Egypt and then the calculation of energy cost is based on the occupied houses strategy. All data are processed for the average value once the month readings are treated directly for the occupied houses analysis. The transformation of month coordinates of data to the annual readings coordinates is based, and then, the annual analysis is implemented. The approximated annual family income is introduced, and the cost of domestic energy is accounted according to the tariff history for the domestic energy in Egypt. The annual results of the average cost function are derived for three cases: average and the two limits of maximum month reading as well as the minimum month reading per each year in the annual coordinates. Thus, 3 annual readings for each year (average, maximum, and minimum) are found to be inserted for processing. The energy cost dependency is decided based on the assumed family income for Egypt with the annual bonus of 10% as Egypt represents the developing countries. The generalization of results through a chart style is stated due to the time dependent function of family income. The saving of cost consumption is a main target so that the average growth of cost consumption may be computed. The resistive part of growth is proved and clarified. The results are extracted where a simple artificial neural network having 3-layers (input, hidden, and output layers) is proposed for the implementation of this calculation. It is concluded that, the reduction of computational time and effort can be achieved in addition to the importance of transformation from the month coordinates into the annual coordinates for either exact correlation or simplicity.

Keywords

Family Income Consumption, Economic Profile, Neural Network, Domestic Energy Cost, Developing Countries

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1. Introduction

Economically, home energy consumption is a major source of typical different countries household's carbon emissions where homes built in the decade after energy codes were first adopted spend between 1.5% and 4% less on electricity compared to homes built prior to their adoption. Private investors interested in buying a solar installation look at its price (it is relatively high, nonetheless the prices are continuously falling) and whether it will bring a profit (or at

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least will payback during operation). The issue of investment profitability is complex when each time requires a consideration for several parameters, depending on the assumptions, getting different conclusions [1].

In economics, there are many indicators to assess the profitability of investment as the global consumption of electricity in households in Poland is marked since stability in 2010. In the structure of energy consumption for households (year 2015), electric devices together with lighting constitute only 8.1% (heating of rooms, 68.8% and water heating, 14.8%) [2].

Whenever, the European Union's efforts aimed at reducing energy consumption, ("ecolabel" and growing public awareness), an electric consumption decrease in a single household may be reached. For example, 73.5% of households in Poland are still equipped with traditional incandescent lamps, 23% have got CRT TV and more than 4% have a rotary (wringer/mangle) washing machine (with an average age of over 17 years) [2].

As a demand response plan, the step tariff policy for electricity has been fully implemented for several years in China. Yet, it is not clear whether the step tariff policy for electricity is effective and sequentially the combining macro-scale statistical data and microscopic research data, may be necessary.

For the electric grid infrastructure in rural Kenya, electricity distribution is a canonical example of a natural monopoly because experimental variation in the number of connections, combined with administrative cost data, reveals considerable scale economies, as hypothesized. Randomized price offers indicated that, demand for connections falls sharply with price. Among newly connected households, average electricity consumption is very low (implying low consumer surplus). It was noted that, no meaningful medium-run impacts on economic and noneconomic outcomes.

Investments in infrastructure, including transportation, water and sanitation, telecommunications, and electricity systems, are primary targets for international development assistance. For example, the World Bank directed a third of its global lending portfolio to infrastructure of Kenya in 2018 where the basic economics of these investments tend to involve high fixed costs, relatively low marginal costs, and long investment horizons.

It can justify government investment, ownership, and subsequent regulation if development economists have begun to measure the economic impacts of various infrastructure types, including transportation, water and sanitation, telecommunications, electricity systems, and limited empirical evidence that links the demand-side and supply-side economics of infrastructure investments because of methodological challenges. For instance, often it is difficult not only to identify exogenous sources of variation in infrastructure presence but also to obtain relevant administrative-cost data on infrastructure projects.

2. Input Data

Since the deregulation of retail electricity market has a major effect, a concentrated investment may be appeared. In China for example, there has been a rapid increase in the number of electricity retail companies. There were more than 3342 electricity retail companies registered nationwide while new participants in the market, electricity consumers have a chance to choose from among several retailers. Due to the increased competition, consumers are encouraged to switch electricity retailers, which, in turn, poses risks to electricity retail companies, thus affecting the retail electricity market. The electricity retail companies first design retail electricity price packages, after the consumers reaction will affect the goals of package (based on user preference and response efficiency to analysis the impact (bi-level programming) of flexible appliances on electricity prices). The retailer sets the prices to be charged to consumers and these react by scheduling flexible appliances according to those prices and their comfort requirements. Scholars put forward novel approach to optimize the retail electricity price of household appliances although this makes consumers to reduce the electricity cost reasonably by improving the household consumption mode. Therefore, the retailer faces a trade-off between selling prices and customers' consumption and power consumption mode [3].

2.1. Tariff History

Recently, the development of energy consumption becomes the today title because the traditional energy is going towards the less, globally [4-5]. The use of machine learning techniques in energy forecasting is gaining popularity due to their ability to solve complex non-linear problems, however this is predominately seen in the residential and commercial sector [6]. Besides, the forecasting of future energy profile is necessary to establish a baseline because a business-as-usual reference scenario is purely market-driven. Thus, no energy efficiency incentives will be given if the adoption of energy efficient equipment becomes a major item [7]. High-fidelity forecasts of construction cost indexes and material prices are critical for the successful delivery of infrastructure works. Unfortunately, existing models tend to underperform because they either ignore relevant explanatory factors or incorrectly specify system feedback and structure. So, new energy sources have been created such as the natural type of solar and wind energies, but newer chemical and bioenergy may be

the next replacement for traditional energy [5, 8]. Then, the use of energy in the current time and future would depend on a saving system for the consumption despite its negative effect on economics. Then, a rationalization strategy should be inserted to support the infra-structure so that it will be widespread field of works as a major concept to cover the ascribed requirements [9]. Otherwise, this subject is considered in a lot of works and researches around the world where several procedures are known for planning and forecasting [10]. The results depend on original populations where the development and design may be the target. Contrary, the present work deals with the hidden idea inside the data (population) where an excavating base will be the way to get non-extracted results by programs. This is a main goal for the work to be proved for importance because the neglection of such idea may bring a deduction loss [11].

Primary, the data input would be an interesting item where the selected one will be the domestic energy consumption besides its cost [10]. Then, the place is important so that Cairo (the capital of Egypt) may be reflected [9]. Originally, the tariff history of domestic energy in Egypt (PT/kWh) is implanted in Table 1, (LE = 100 PT).

Table 1. The tariff history of domestic energy in Egypt (P T/kWh).

Range (kWh)	1/80	1/90	7/92	7/93	7/01	2/13	2/15	2/16	2/17	2/18	2/19	2/20
0-50	1.8	1.8	4.	5.	5.	7.5	7.5	7.5	11	13	22	30
51-100	1.8	1.8	6.5	8.3	13	14.5	14.5	14.5	19.	22.	30.	40.
101-200	2.4	3.	6.5	8.3	13.	16.						
0-200							16.	16.	21.	27.	36.	50.
201-300	2.86	3.8	6.5	8.3	19	24	29	35	42	55	70	82
301-350	3.2	4.2	8	11	19	24	29	35	42	55	70	82
351-400	3.2	4.2	11	15	29	34	39	44	55	75	90	100
401-500	3.48	4.6	11	15	29	34	39	44	55	75	90	100
501-650	5.29	5.29	11	15	29	34	39	44	55	75	90	100
651-800	5.29	5.29	17	21	53	60	68	71	95	125	135	140
801-1k	5.29	5.29	18	21	53	60	78	71	95	125	135	140
›1k	7.6	7.6	20	25			78	81	95	135	145	145

Source: Ministry of Electricity of Egypt

Formerly, the original data of domestic energy consumption consists of 15 customers (C1-C15) as an ideal model for north Cairo and the data are treated to in two steps: first is the occupied houses stipulation and then, cost accounting is realized with the tariff of Table [10].

2.2. Income Data

Originally, the term “Family Economy” describes the family as an economic unit although the early stages of development in many economies were characterized by family-based production [12]. Early, pre-industrial stage, technology was limited and simply unchanging. Most economic activities took place within the household, and production since distribution in each country was organized by custom and tradition.

To sustain a viable family economy during the pre-industrial era labour was necessary. The labour needed to operate the farm and provide old-age support came from family members; fertility was high [13]. High mortality rates and low productivity mean that, either on farms or in towns, life was short and living conditions were harsh so that existence is accepted fatalistically. Generally, the family played a central role in society after social economic status is defined by birth, family ties, and local custom. Mostly, the family was a productive unit, and physical strength (typically a male attribute) was an essential element in survival [12].

The family economic unit has always been dependent on specialized labour done by family members because the family was a multi-generational producer with capital and land provided by older generations and labour provided by younger generations. Goods are produced not only for home consumption but also to sell and trade in the market as well.

Family production is not only limited to agricultural products, but also manufacturing goods besides provided services. Around the time of post-industrial stage, the family changed from a unit of production to a unit of consumption. Europe (in industrialization era) found itself in brought numerous changes. Nowadays, farming could be done with less individuals, removing the importance of children (Old System) as economic assets and instead created a view in which they appeared as liabilities.

Additionally, new ideas and inventions that allowed for the Industrialization to take place further contributed to the demise of family economy. The new social norms (capitalist market) encouraged production in large scale factories, farms, and mines. Wage labour would become a staple of a society and saw family members no longer working together. They had earned to buy goods which they consumed as a family unit. The industrial revolution, in the 19th and 20th centuries, is the force that changed the economic family and

is basically responsible for the "modern family".

Thus, the present paper starts from the family income in developing countries however, Egypt is selected to sample the developing countries. Otherwise, the recent family income for Egypt is given in Table 2. The short history for the individuals is listed in Table 3. It is noted that, the income is decreased in 2020 to be $3111 as the Median per-capita is $623 in 2020.

Table 2. Family Income ($ & LE).

year	$/Year	LE/Year	LE/Month	$/PT
2015	4977	44200	3683.33	888
2018	3558	58900	4908.33	1655

Source: https://yallafeed.com/balarqam-dkhl-alfrd-alsnwy-fy-msr-mnth-aam-1966-3349
https://worldpopulationreview.com/countries/median-income-by-country/

Table 3. The short history of individual income in Egypt (Min. of Standard Income = 500$).

Year	$/Year	LE/Month	($/PT)
1966	155	5.17	40
1967	170	5.67	
1969	200	6.67	
1971	230	7.67	
1980	500	25	60
1986	640	32	
1988	800	40	
1991	730	36.5	
2001	1450	362.5	300
2004	1230	307.5	
2010	2390	995.83	500
2015	3340	2505	900
2018	3105		1655

Source: UN & International Bank Reports

However, the cost trend is usually used to anticipate the total costs of a project at several points of time during its implementation. The tool is based on the milestone plan analysis which focuses on the time needed to terminate work. Whatsoever, the cost analysis is the current target for study if the above energy handling is reflected as the base work for investigation. Limits parameters of statistical procedure may be utilized to be processed. Therefore, the cost evaluation in a family income should be reported if its history analysis will be the target. Assuming that: Annual average income of the family is 146 LE in the beginning of 1992 (4 earn persons/family) in addition to the annual bonus of 10% for the present derivation for the energy cost consumption as a percentage of the assumed family income where the results are plotted in Figure 1.

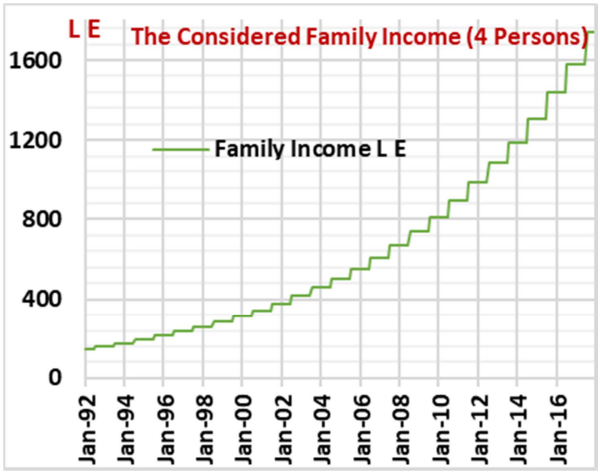

Figure 1. The assumed family income.

It was stated that, the experiment generated a temporary reduction in the price of a grid connection. If credit-constrained households valued grid electricity services, the ability to raise the funds required to complete the purchase will be absent. The demand curve would underestimate the willingness to pay and thus consumer surplus (based on the potential importance of credit constraints) [2].

Electricity systems serve as canonical examples of natural monopolies in microeconomics textbooks. Empirical estimates in the literature date back to Christensen and Greene (1976), who examine economies of scale in electricity generation. In recent decades, initiatives to restructure electricity markets around the world have been motivated by the view that economies of scale are limited in generation, the transmission and distribution of electricity continue to exhibit standard characteristics of natural monopolies [2]. Though most of energy and environmental policies worldwide have set targets with the goal to shift from classic fossil fuel driven vehicles to electrified transport, the share of electric vehicles is still rather low. The complexity of changing the human perception of transportation goes beyond technical and economic aspects and very few research activities managed to capture the additional factors.

A comprehensive analysis of political, economic, social, technical, legislative, and environmental aspects and rigorously assesses achievability of the electric vehicle's integration goals may be required.

3. Month Energy Cost

Nevertheless, most studies found energy codes were effective in reducing energy consumption or expenditure, the magnitude of findings in the studies they reviewed ranged from no effect to 6%, which is small compared to ex-ante estimates produced before these codes were enacted [1]. The

need for resilient and reliable electric power sources have led to the rise of microgrids which can provide continued electric power supply to those connected in times of very large-scale events, affecting a portion of the larger electric grid. Microgrid systems have also being proposed as a route to "leapfrog" the development of electric power systems in parts of the world that still lack access to electricity [15].

Recently, the production of energy for own purposes from photovoltaic (PV) panels enjoys growing interest in Poland. In 2016 and 2017, more than a dozen thousand micro-installations (in the vast majority PV) have been yearly connected to the network. However, the share of micro-installations in the total electricity production in Poland (as advanced country) is still very small. Total power below 200 MW gives a share in the order of 10% (generated by prosumers and their micro-installations) although the average of the European Union is over 3550 MW (looking at the power of PV sources installed in Poland and other European countries as well as at the power per capita) [2].

So, the introduction of the Law on renewable energy sources must be a strong impulse for growth. The instantaneous readings may be the actual populations for any study; however, the present paper starts at these instantaneous readings for the Cairo model.

The present paper defines the c*ost consumption* as an e*nergy cost %* of the family income (which is assumed having 10% annual bonus) where this expression is used above as well as next. Meanwhile the overall vision for the chopping part for energy consumption inside the family income, the average monthly value of energy cost would be preserved. Otherwise, a random selection for the consumers must be inserted to extract the exact results for the major investigation when 4 customers are deduced as C1, C5, C10, and C14. As the input data depends on the Cairo model, the model can be treated as a single unit. The percentage monthly of energy cost consumption $(C_m\%)_i$ as a function of the cost reading (C_m) for a specified month $(_i)$ relative to the family income $(I_f)_y$ of the year $(_y)$ may introduced mathematically in the form:

$$(C_m\%)_i = [(C_m) / (I_f)_y] \times 100 \quad (1)$$

Nevertheless, some samples inside the model may be considered so that the 4 samples (C1, C5, C10, and C14) would be introduced for the next subtractions while the model is represented by its monthly average values. So, the average readings for the model should be the base if the 4 chosen customers will be added for computations. The percentage cost consumption of the family income, monthly, is demonstrated in Figure 2 for the average of the Cairo model and the two samples C1 and C5 while Figure 3 presents the same results of C10 and C14 in addition to the model average, too.

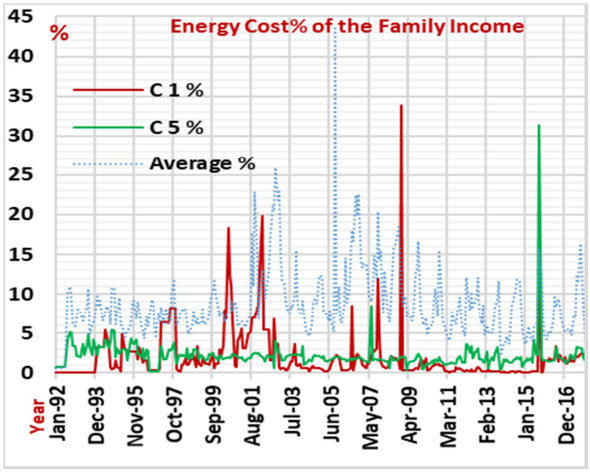

Figure 2. The cost consumption dependency for C1 and C5 on the family income.

It is seen in Figure 2 that, C5 is approximately as the average value and C1 is near to the average in higher values relative to C5. It is noted that, the maximum readings for C1, C5, and the average value are 33.88, 31.33, and 43.6%, respectively. These readings are percentage of the corresponding family income during the period of the model (26 years). Contrary, the minimum values for C1, C5, and the model average are 0.0, 0.23, and 0.61, respectively. Also, the average of the readings of customers C1, C5, and the model are determined as 1.951, 2.142, and 8.706%, respectively.

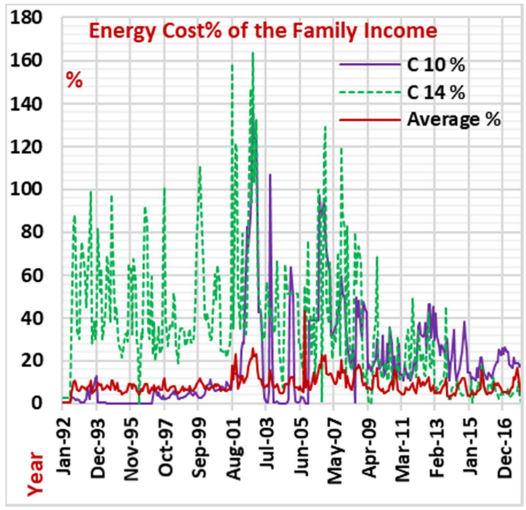

Figure 3. The cost consumption dependency for C10 and C14 on the family income.

It is seen from Figure 3 that, the maximum readings for both selected customers C10 and C14 are higher than others because the maximum readings for C10, C14, and average are 106.59, 163.6, 43.6%, respectively. Contrary, the minimum values for C10, C14, and the model average are 0.03, 0, and 0.61%, respectively. Also, the average of the readings of customers C10, and C14 are driven as 0.03, and 0%, respectively while average, maximum and minimum of the model are basically 643.769 L

E, 1740 L E, and 146 L E, respectively.

Currently, it is important to schedule smart appliances and charging/discharging of electric vehicles optimally to mitigate energy costs. For the rapid growing of electricity demand, utility planners need to be informed on the energy consumption to implement energy efficiency measures so that it is required to manage sustainable load growth and avoid the high costs of increasing generation capacities [7].

Whatever, an energy storage system for efficient energy utilization will be a solution for the smart grid depending on the renewable energies and so, a smart home may interact with the grid to make autonomous decisions for electricity consumption to alleviate the electricity cost. Mainly, the specific nature of an approach is checking convergence of the series for not only equal time lapses but also the starting point of energy reduction.

4. Annual Cost

Globally, the trend technology may be successfully implemented to energy consumption in economically developed regions, whereas the use of forecasting tools is useful for assessing the energy intensity of developing economies. Cost analysis incorporates various efforts for a corporation spearheads to monitor to find how much it spends overall, identify units that bleed money and those that post rosy returns, and foresee internal resentments over budgeting unfairness that could fester over time. Whatever, the paper tends to evaluate the part of family income spent in domestic energy while the minimization of that part would be a great target to support the economic level of each family.

Rapidly, the full adoption of electric autonomous vehicles will revolutionize the global transport system in general and road freight transport so that traditional business models based on manufacturers selling trucks to operators could conceivably disappear. Despite the recent growth in research on Mobility as a Service in passenger transport, these issues have been neglected in freight transport [16]. Previous research has shown that, firms engage in sustainable technologies as a response to environmental regulation, for instrumental reasons, or as a reflection of managers' green values however various studies also argue that sustainable innovation can lead to a competitive advantage.

Otherwise, the smart grid or new mobility services may be dependent on technological as well as societal changes meanwhile autonomous innovation and systemic innovation are fundamentally different. Whereas autonomous innovation lies at the discretion of a focal company when the success of systemic innovation requires the industry to engage in a transition, otherwise chances for success of the individual company are limited. Dominant theoretical explanations for firm behaviour regarding disruptive, autonomous innovation might therefore not hold for systemic innovation. Then, the saving in the domestic energy cost can be a parallel way for these systems.

Therefore, the instantaneous readings for each month (1-12) reading (C_{month}) of each customer (i) with the high vacillations can be transformed into a more stable as the annual readings (C_{annual}) instead if a deep vision is the goal. Thus, the above results for the month readings would be repeated in the annual domain where this will be tailored into three cases (man value, maximum, and minimum). This strategy may be represented mathematically in the form:

$$C_{annual}\,(i) = \sum_{(1\text{-}12)} \{C_{month}\,(i)\} \quad (2)$$

4.1. Average Value

Consumers needs and behaviours have continued to change due to the era progresses and technologies advance and consequently, relationships between consumers and grids (micro/mini) or utilities are being altered. The components and relationships in retail competition are diverse and complicated, in comparison to a simple provider and customer relationship in the traditional electricity industry [3].

There is a diverse scale of retailers that can exist in the retail electricity market, which is different from the vertically integrated, monopoly-dominated market where only state-owned utilities are present (most developing countries). Facing an increasingly competitive power market, electricity retail companies can be expected to design diverse retail electricity price packages to adapt to the market environment, meet the differentiated needs of consumers, and improve the economic benefits of electricity retail companies. Following the new electric power structural reform (as advanced countries), the retail electricity market environment became the essential factor affecting the adaptability of retail price [3]. The absolute value of the average $C_{average}$ (i) for each customer (i) is expressed by

$$C_{average}\,(i) = C_{annual}\,(i) / 12 \quad (3)$$

The econometric analysis showed that, the supervision effect is not obvious because most existing research mainly concentrate on the impact of market competition on retail electricity price with a little attention to the operation efficiency, price mechanism and power supply and demand relationship of the retail electricity market [3].

This can lead to a reduction in the cost consumption with respect to the family income so that the detailed investigation may be necessary. Theoretically, the percentage annual average cost $(C_{average}\%)_y$ of domestic energy as a function of the deduced mean value of all months of the year $(C_{average})_y$ and the annual family income $(I_f)_y$ may be formulates as

$$(C_{average}\%)_y = [(C_{average})_y / (I_f)_y] \times 100 \quad (4)$$

The domestic energy consumes a large part of the family income if it is out of control. Thus, a deep analysis for the relationship between energy cost and the family income should be required where the percentage consumption in the family income would be accounted. The percentage results of this income consumption for the annual value are inserted for deduction as shown in Figure 4.

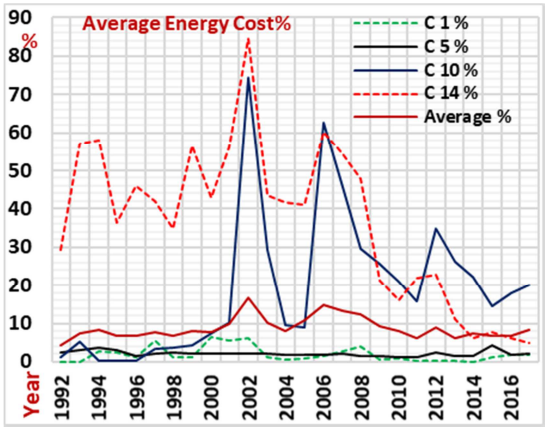

Figure 4. The computed average cost consumption (%).

Figure 4 indicates that, the maximum and minimum values for the average of the studied model is 16.627% in 2002 and 4.242% in 1992, respectively. Then, the customers C1 and C5 indicate smaller cost consumption as illustrated above in Figure 2 for the month analysis while the samples C10 and C14 have higher readings for cost as proved in Figure 3.

4.2. Maximum Value

Scholars have quantitatively analysed how competitiveness in both the wholesale and retail electricity market led to price decreases from 2014 to 2017 in Singapore, using daily data for electricity and oil prices and more retail liberalization has possibly led to a combinatorial decrease in electricity prices by up to 9.11%. Similarly, power supply competition and retail liberalization may lead to a decline in electricity prices in the retail market [3].

Previous research results show that, the effects of retail market on the electricity prices are different. The scholars applied the asymmetric price transmission modelling technique to conduct a quantitative analysis of electricity trading market of the partially and the fully liberalized period. So, various periods lead to different influence for price transmission despite there have other factors of market that affect the retail price. Many scholars have analysed the influence of electric power market reform environment on electricity price based on the random effects model as independent power producers were found where privatization, structural adjustment and deregulation led to lower electricity prices [3]. Mathematically, the percentage annual maximum cost $(C_{Max}\%)_y$ of domestic energy as a function of the maximum month value per each year $(C_{Max})_y$ and the annual family income $(I_f)_y$ may be expressed by

$$(C_{Max}\%)_y = [(C_{Max})_y / (I_f)_y] \times 100 \quad (5)$$

This idea may need to the cost consumption relative to the consumer income where a tailored study could be benefit. However, the limit values may be required to explain the philosophy of these calculations where the maximum value for the present model has been evaluated. The appeared results are drawn in Figure 5 for the above case of average condition of Figure 4.

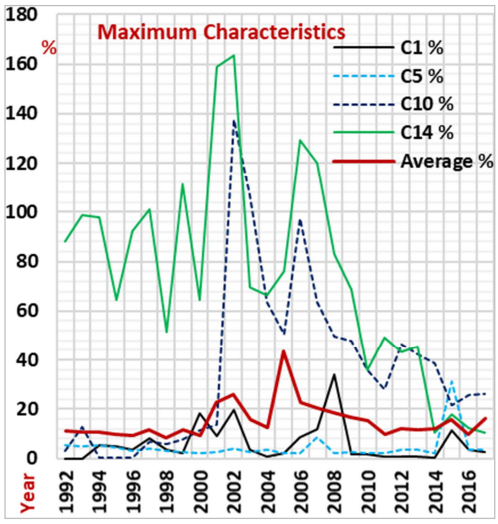

Figure 5. The derived maximum cost consumption relative to the family income.

Referring to Figure 5, the maximum and minimum values of the model maximum is appeared as 43.6% in 2005 and 8.24% in 1998, respectively but the samples C1 and C5 are still the lower. It is remarked that C10 and C14 reached the values 137.42% and 163.6% in 2002, respectively. The exceeding of 100% referred to a higher family income. This means that the inserted family income is the mean value for all families (either higher or lower than the mean value) in the country so that the values above 100% means a higher standard of living with high income. Contrary, the micro percentage (if appeared) tends to a poor family although the normal value can be viewed for the middle-class level. Finally, the results of processing prove that the chosen model is ideal.

4.3. Minimum Value

Additionally, the minimum value investigation can be inserted to complete the study of limits if the aimed item needs more explanation and illustration. Thus, the values for the minimum percentage are estimated for the cost consumption with respect to the average family income, and

so, the results are established in Figure 6 across the 26 years duration. Formally, the percentage annual minimum cost $(C_{Min}\%)_y$ of domestic energy as a function of the minimum month value per each year $(C_{Min})_y$ and the annual family income $(I_f)_y$ can be calculated according to the expression

$$(C_{Min}\%)_y = [(C_{Min})_y / (I_f)_y] \times 100 \quad (6)$$

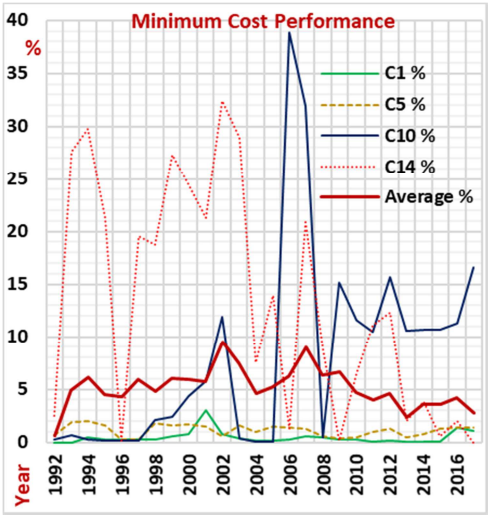

Figure 6. The variation of minimum cost consumption (%).

It is important to indicate that, the highest minimum value is 38.88% for C10 in 2006, pointing that the model function is standing in the middle zone of calculations.

5. Model Profile

Nevertheless, the high reliability for the electric supply is still the major factor to secure the continuity of operation to the different customers at all levels of energy consumption. Previous studies pointed that, household demand for grid connections is lower than predicted, even at high subsidy rates because lowering the connection price by 57% (relative to the prevailing price) increases demand by less than 25%.

The cost of supplying connections is high, even at universal community coverage, where the gains from economies of scale are attained. The preferred specification using revealed-preference data, estimated consumer surplus from grid connections is roughly 20% of total construction costs. A study did not find economically meaningful or statistically significant impacts of electrification across a range of economic and noneconomic (e.g., health, education) outcomes, collected in two rounds of surveys conducted roughly 16 and 32 months after connection [2].

5.1. Family Response

With power system reforming, the retail electricity market in China has gradually been liberalized while the mechanism of freely selling electricity have been set up. To grab market share and increase profits, electricity retail companies have introduced a series of retail electricity price packages so that an adaptive evaluation index system, considering the interests of both the power company and the users is established. Several reliable suggestions on how to design retail electricity price packages are based to provide useful support for customers to choose the price package (to increase the competitiveness of power selling companies and ultimately promote the reform of power selling) [3].

Whatever, either the individual income or the family income is usually varied with time. The current paper simplified the problem through the major assumption of a constant value for the annual bonus of 10%. Sequentially, the actual condition may diverse, the investigation can lead results towards the real. The concentration of this paper is tendency of the cost consumption on the social level where a family needs to save the money consumption in services and continuous livid requirements. Since domestic energy is an example like communications, transportation, and may others, this research touches the meaning to importance of saving money in each field to rise the standard of living of the family.

Generally, the family income for a specified year is defined as it depends on the number of earn person in a family (P), the standard supposed initial individual income is (X) and the inflation rate (R). Then, it can be written in the form

$$(I_f)_y = (P \times X \times R)^{(y-1)} \quad (7)$$

Therefore, the investigation is going to the effect of different number of persons who are the householding together in a family. Thus, different scales (2-14 persons) are accounted as sketched in Figure 7 where low number of persons is appeared in mega cities (such Cairo). Otherwise, the high number is referred to the villages where kids may earn, too. The middle cases could be appeared in poor or rich classes of the society, including cities.

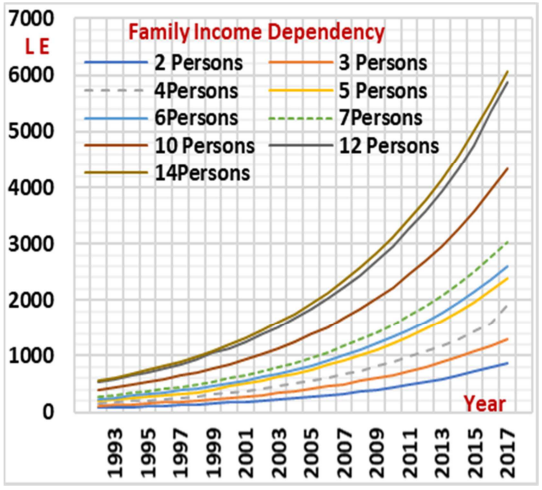

Figure 7. The family household dependency.

Returning to Cairo model, the average cost (L E) is derived as outlined in Figure 8, but the original data of energy consumption has been published before [9]. This cost is the input data for the presented results where these are real data from the readings in Cairo north.

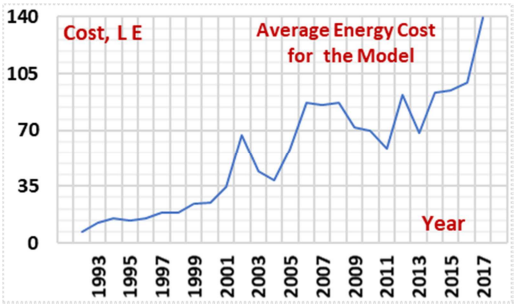

Figure 8. The model cost characteristic

Figure 8 indicates that the domestic energy is slowly raised from 12.265 L E in 1992 to 25 L E in 2000 but this cost for the model is sharply increased to 67.112 L E in 2002. Also, the energy cost of the model is strongly decreased to 38.502 L E in 2004 and then, it goes up to 87. L E approximately in the years 2006-2008. The cost is directed to be reduced to 58.789 L E in 2011 and raised suddenly to 91.855 in 2012 and reduced to 68.291 L E in 2013. After that, it increased without peak. This cost function is used for the derived overall characteristics of cost consumption as a percentage of the family income.

It should be mentioned that Equation 2 can be implemented for each family income (assumed from Equation 5) to get the percentage cost chart for the average values of cost. The results of processed data are plotted on Figure 9 where all above stepfamily incomes of Figure 7 are accounted.

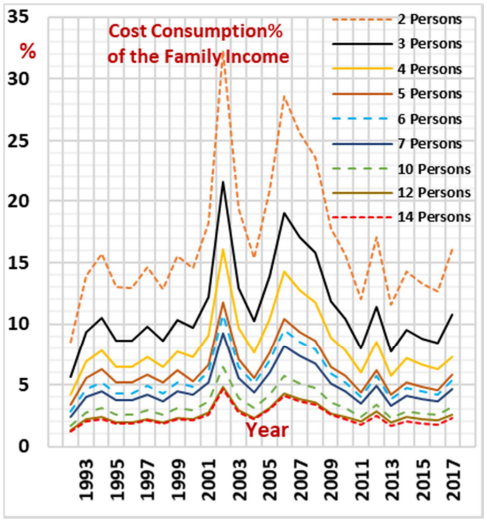

Figure 9. The chart of Cost consumption (%).

Globally, two high peaks for the cost consumption% in 2002 and 2006 although an oscillation behaviour is presented in all times. Otherwise, the oscillation of cost consumption may be disappeared for the higher income, but the peaks are greatly reduced. It should be mentioned that the cost consumption readings in these two years are 67.112% in 2002 and 87.013% in 2006 at a ratio of 0.771 despite the readings are peaks. It is remarked that, the consumption ratio of all years is varied, for all selected family incomes (2-14 persons). in a thin margin (1.131-1.128) in the increasing direction although the cost itself has the ratio 0.771 in the opposite direction (Low). This means that the family income is more decreased from the year 2002 to 2006 because the original value of cost is raised from 67.112 in 2002 to 87.013 L E.

5.2. Boundaries

Globally, activities associated with home energy utilization (space heating, air conditioning, water heating, lighting, refrigeration) together are the source of approximately 14.9% of the average US household's carbon emissions [1]. Also, homes built in California in the decade after codes were adopted use 1.5% less electricity than homes built in the decade before codes, because this estimation is marginally significant. In addition, if energy codes were effective, household electricity use should fall after code adoption relative to states that did not adopt them. It was appointed that, household electricity use falls by about 4% after energy codes were adopted, in states that adopted them [1]. In a panel analysis with state-level aggregate data, find building codes are associated with between 0.3 and 5% lower energy consumption [1]. Econometric studies of energy codes from outside the U. S. include a previous attempt to systematically review the econometric literature on building codes so that this style will be important to save the energy cost consumption for each family.

This tends to support the idea of saving of domestic energy if the reduction of cost consumption w. r. t. the family income is necessary. This will have a high degree of importance after the existence of speedy acceleration for the growth of renewable grids in most countries (including developing countries) is really appeared. Then, the studied model is analysed for the statistical values consistent to the above results as listed in Table 4 because all results are referred to the assumed family income.

Table 4. The evaluated statistical values for the cost consumption.

Date	Average %	Family Income L E
Av (Av)	8.706	643.808
Max (Av)	16.627	1661
Min (Av)	4.242	153.5
Av (Max)	15.113	674.423
Max (Max)	43.6	1,740
Min (Max)	8.24	161
Av (Min)	5.134	613.115
Max (Min)	9.49	1582
Min (Min)	0.61	146

It is determined from Table 4 that; the average characteristics are printed in the first 3 rows when the maximum limits are defined in the next 3 rows of Table 4. Also, the minimum performance is written in the last 3 rows of Table 4.

5.3. Average Consumption

Generally, family structure refers to the combination of relatives that comprise a family although classification on this variable considers the presence or absence of legally married spouses or common law partners; children; and, in the case of economic families, other relatives. Economic family is a group of two or more persons who live in the same dwelling and are related to each other by blood, marriage, common-law or adoption including children. Otherwise, all persons who are members of a census family are also members of an economic family [17].

Consequentially, the structure of economic family is derived from the responses to questions about the relationships among people who live in the household. To determine the structure of economic families, a family reference person must first be identified. This standard presents a concept of the composition of economic family that differs from that presented in *the UN Principles and Recommendations for Population and Housing Censuses, Revision 2, 2007* [17].

The classification suggested by the UN for households containing more than one person and more than just the members of one family nucleus focuses on: whether there is a family nucleus; the number of such nuclei; and the relationship, if any, of other members of the household to the family nucleus or nuclei]. 'Family structure of economic family' is incorporated within the classification of previous standard of *Economic family structure* since the current standards take a more simplified approach, presenting each classification dimension as a separate concept [17].

However, the model is the body of investigation so that the selected samples are inserted for clarification.

6. Discussion

Initially, the transformation from the month investigation into the annual analysis simplifies he study to a great extend so that the processing effort and time can be sharply reduced in addition to the easy clarification. This may be proved through the comparison between presented Figure 3 (where the curve is compact) and Figure 4 (where the curve is simple).

Secondly, the statistical parameters for the studied populations are a good tool for the idea explanation if the data is processed in a short time. Both maximum and minimum values for the average function during the period of study induce the boundaries of allocation for the cost consumption in each budget of a family, in general. Since the analysed model for Cairo (capital of Egypt), the extracted results may represent the developing countries around the world.

Thirdly, the universal variation in the money market leads to the statistical type of data, and inevitably, the results so that the chart characteristics can be the goal. Thus, the artificial neural networks ANN would have a vital role in the analysis schedule. In this case a simple 3-layers ANN (input, hidden, and the output layers) may be suitable for all cases of variations as stated above. So, the ANN can introduce the populations as grouping data where each group would be transformed into the annual coordinates. Then, data should be possessed in the hidden layer for the deduction in the output layer.

Finally, the average profile can be based for the case studied as a sample for the developing countries because the model analysed is given for the capital of Egypt. The three curves graphed in Figure 10 are the upper and lower limits of variation where their average is the middle curve. It is necessary to illustrate that; the three curves of Figure 10 are extracted above in the case of average value of cost consumption above.

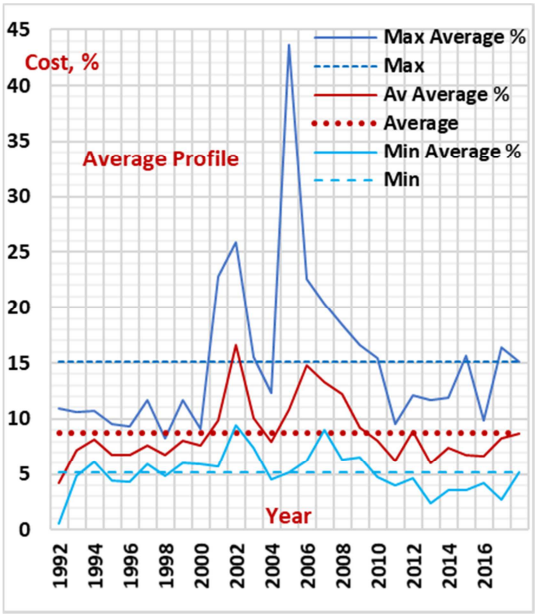

Figure 10. The profile of average cost consumption relative to the family income.

The appeared divergence can be expanded in the trend coordinates as listed in Table 5.

Table 5. Trend characteristics of the average profile.

Item%	start	end	Diff.	Rate	Average
Max.	13.4	16.83	3.43	13.19	15.113
Average	8.3	9.1	0.8	3.08	8.706
Min	5.55	4.7	-1.15	-4.42	5.134

The results in Table 5 illustrate the presence of resistance for the grow up continuously because the minimum values of the average go down in the rate of 4.42%. Contrary, the maximum zone of the average money consumption rises at the rate 13.19% when the equivalent rise becomes 3.08%. So, a slowly practical increase for the average consumption under the given above assumptions. This increase corresponding to future fluctuation in the financial field where the inflation rate must be varied either each year or even inside the year. To save money, the rate of rise of energy cost should be less than that of money market. Also, the essential factors affecting this title like new technology effect and updating the domestic machines and tools as well as the use of LED TV instead of the old CRT TV or the implementation of LED lamps instead of the old lamp type and similar. Thus, changing all old machines and tools (having low power factor) would be a target so that the new rechargeable instruments can be the solution due to the low level of energy consumption. Also, the development and improvement in non-profit (education and health) fields would be utilized for saving the energy cost, especially, the modern instruments of low energy consumption.

7. Conclusion

From the results of the current paper, it can be concluded that:

1. The transformation of energy saving analysis from the instantaneous month coordinates into the annual coordinates simplifies the processing as well as reducing the computational time and effort.
2. The statistical limits of maximum and minimum for the cost consumption function are necessary for processing.
3. The updating system for all electrical appliances is important because the modern appliances consume less energy.
4. The money saving can be deduced in a universal chart to cover all varieties in the international money market since the family income is a function of time.
5. The application of a simple 3-layer ANN for such processing should be beneficial if the control policy is approved.

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