Understanding Inflation through investigating US Economic Data over Fifty Years: Introducing the Losses Model

Since 1988, the author has investigated the analogy between Macroeconomics and Thermodynamics. Over several year the author progressively established a close relation between Knowledge and Energy leading to deal with knowledge in terms of the commonly used unit for energy Joule or kWh. After these endeavors the author decided to tackle inflation. He opted to investigate the US economic data between 1971 to 2024. For Inflation CPI, the influences of the Personal Consumption Expenditure PCE, Interest Rate, and Unemployment Rate were examined for intervals involving the seven formally recognized recessions encountered between 1971 to 2024. The author identified intervals outside the recessions which are referred to as Era' by the author. The durations of both the recessions and the Era's intervals come into play as well. Some explanations were reached but some observed behaviors proved too complex in particular for the recessions. For the 7 recessions intervals, and the Era's which were subdivided into two, i.e. total of 21 intervals, for each interval key data were selected, these subsequently assigned to 54 years in preparation for a second step simulating "calculated CPI". The author stipulated that the calculated CPI leads to losses at the end consumers. These annual losses in monetary values were converted to equivalent electrical energy using a recently introduced KEI (Knowledge Energy Index- proposed by the author (XXX)). The author argues that the losses (unused, spoilage, and wasted) that with time have the similar ever building-up effect that could not be recovered in its original form.

Keywords: *Inflation, Personal Consumption Expenditure (PCE), Consumer Price Index (CPI), Unemployment Rate. Federal Reserve Funds, Recessions, Minimization of Losses, Sustainability, Conservation*

Preamble

The author has been investigating the analogy between Macrohemodynamics and Macroeconomics since 1988, initially with Professor Oweiss Safwat & Owiess (2002) and later Safwat (2022) and Safwat (2024). Recently, the author intensified search for previous published work in this area and found in the Collected Scientific Papers of Paul A. Samuelson the citation tors). After several endeavors the author decided to tackle inflation in this paper.

The influences of the PCE, Interest Rate, and unemployment rate were examined for intervals for the seven recessions encountered between 1971 to 2024. The intervals outside the recessions are referred to as Eras. The durations of the intervals come into play as well. Through investigating the prevailing behaviors for the various behaviors in some suggest some trends in some cases while explaining the behaviors in some intervals proved too complex in particular close to the formally announces recessions.

From Electrical Systems

In this section, the author draws attention to two aspects that are crucial in the operation of the electrical systems (the grids in various countries), these are i) Supply and Demand, ii) Losses. The reader can refer to (Safwat 2024) for two comparative diagrams of an electricity system and a products & services market to see the similarities leading to analogous characteristics.

i) Electrical System and Demand – Supply

The electrical system (ES) has power generation subsystem consisting of power plants, and the other two subsystems transmission and distribution, through the latter consumers are connected. At a given instance, the various consumers (industrial, commercial and residential) get the electricity they need. The demand is the summation of what the consumers require at this particular time. On the side of the power generation that is the supply side, through the dispatch system of the power grid, the various power plants in the generation subsystem are operated depending on plants capacities and efficiencies at the appropriate load (as close as possible to full load of the plant) in accordance with merit priorities established by the dispatch center. This is the process to cope with the demand from the supply assets. One can refer to this aspect as coping with the mismatch of the aggregates of the supply and the demand at a given instant. The controls from the dispatch center of the electrical grid and the generation plant use signals from the voltage the synchronous speed and of the network to adjust the controls of the generating plants including possible shutdown and start-up of generation units connected to the grid.

In this paper, we are concerned with macroeconomics, thus we are dealing with the aggregate of the goods and services for a nation. This aggregate adjusts between the supply and demand, based on the actions of the central bank, in the US these actions are by the Federal Reserve Board (FRB) that sets the monetary policy mainly, the interest rate, and the money supply.

Comparing macroeconomics to ES operation, there are differences in the ES, we deal with one commodity that is electricity and the demand – supply is monitored and controlled based on momentary / instantaneous changes in the grid. In the case of the nation, the aggregate demand and supply are much more complicated because of the variety of the goods and services, and we are generally concerned with much longer time to monitor the changes, e.g. the Consumer Price Index (CPI) over a month or quarter or annually.

ii) Electrical System – Energy Losses

A typical ES consists of three subsystems, generation, transmission and distribution. The generation is primarily the power plants, the transmission included high voltage transmission lines and substations, and the distribution includes medium voltage substations and cabling to the end consumers. In recent years this delineation has changed as a result of the spread of renewable energy, solar and wind power plants that have been installed closer to the consumers thus now distribution subsystems include generation and in some instances for large renewable plants they connect to the transmission subsystems. This change has altered the previous unidirectional flow of electricity from generation to the transmission then to distribution subsystems.

There are inherent energy losses in the transmission and the distribution subsystems (losses at substations and cables) as well as in the power plants in the generation subsystem. The principals of the subsystems (the operators) attempt to minimize these losses in the design of the assets and through operation and maintenance activities. In the power plants, the highest efficiency is targeted but typically the design has one best efficiency set point and the operation dictates different points of operation depending on the demand, the off best efficiency operation leads to higher losses. In the transmission and distribution subsystems, depending on the economics the sizing of the cables and substations is also commensurate to best operation rating, however, the assets operate at different modes and hence there are larger losses. The principals of the generation, transmission and distribution try to minimize the losses to lower their tariffs. Even when we get to the end consumers, e.g. a household there are inefficiencies of old appliances that may be in use. In many cases the end customers are not pay attention to reducing their consumption particularly when the electricity prices are not high. This is why in different countries energy conservation is receiving considerable attention. From the perspective of the end customer, the household is paying indirectly for the losses that the ES subsystems. The thrust of ES subsystems operators to minimize their costs to offer best tariffs. The losses at the end customers are difficult to estimate but on the aggregate level, the losses at the end users add up and have a negative effect. These losses end up as wasted energy to the surroundings. These losses cause unwanted effects to the environment, particularly if the electrical energy was generated from fossil plants. Among the thrust of the sustainability programs that are to reduce the losses that are mentioned above whether in the ES or in the goods and services.

Workforce Economic Cycle

It is interesting to see the workforce in an Economy of a Nation engaged in a cycle, the cycle is composed of activities the workforce engages in in their daily work that leads to produce goods and products. And the cycle is completed when they and their households buy and consume goods and services. In an economy of nation, the first set of activities relate to the Gross Domestic Product (GDP), Gross National Product (GNP) and Gross National Income (GNI). While the latter is associated with the consumption Consumer Personal Expenditure (CPE). The author chose the to use a cycle as the we have more or less a repetitive set of activities on the production and consumption sides over periods days or weeks etc. Noting the well-known formula for the four parts of the GDP

GDP = C + I + G + NX

Where "**C**" is *Personal Consumption Expenditure* (goods and services people buy), "*I*" *Investment*– Business spending on fixes assets and unsold inventory as well as purchases of homes, **G** *Government Spending* Federal, State and Local governments spending in goods and services, **NX** *exports minus imports*.

This paper aims to investigate ultimately what happens with CPE in relation to inflation.

Human Capital and Energy

The author recently based on his review of price data for labor and electricity in the US and Europe a Knowledge Energy Index (KEI). This index reflects significant values in the ratio of the average wage per hour to the electricity price per kWh. This suggests that the value of the labor which translates to application of knowledge is a lot higher than the value of electricity. Thus, knowledge has many folds higher value than electricity, and we know among energy forms electricity has the highest caliber because of its versatility.

This conclusion is essential to the **treatment of the value added by the working population in a Nation as a high value energy.**

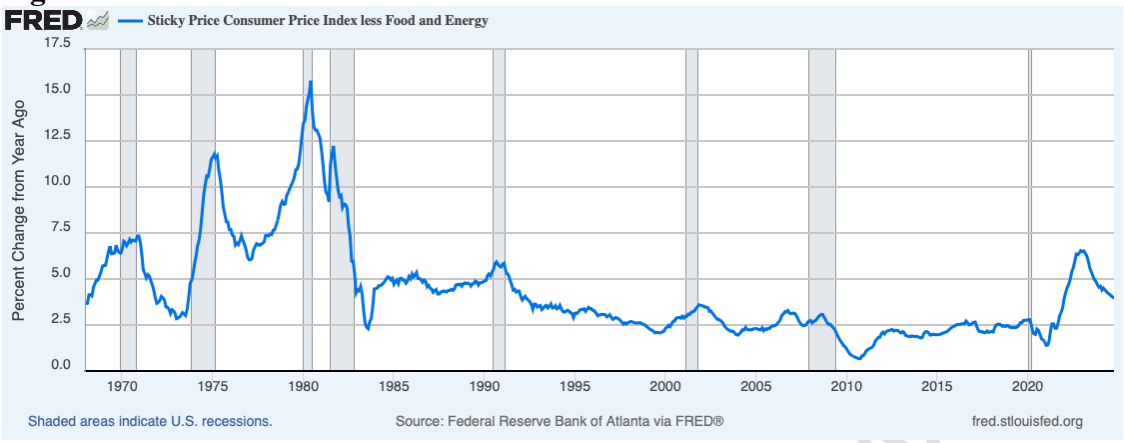
Application of the Newly Introduced Knoledge -Energy Index

Recently the author proposed a Knowledge Energy Index "KEI" (XXX) based on the ratio between the average hourly wage and the price of electricity per kWh. The US wage data and Europe's data have been used to estimate the KEI. For the US, in 2024 the KEI is approximately 200. This prompted the author to recognize that the categorization of knowledge as energy must be higher caliber than that of electricity. For energy, electricity is the most valuable highest form of energy compared to heat or heat content in fossil fuels.

In this section, we cite important information from the US economic data that sets the stage for the presentation of what the author is offering through this paper. In view of the KEI the author concentrated on examining the waste as the main reason for the inflation. The following supported this notion:

a) Figure 1 represents the US Consumer Price Index "CPI" –this is the central parameter the paper is dealing with. We all know that due to inflation, we see the price of what we buy from goods and t services is always increasing with time. Conversely, the same amount of money buys less good / services. .This isof paramount importance for the discussions of this paper.

Figure 1. *US Consumer Price Index CPI*



Please note the shaded area in Figure 1 and the following Figures 2, 3, 4, and 5 depict the formal recessions (XXX).

b) From Macro-thermodynamics, we know that in actual processes, irreversibility's cause increase of entropy (defined (dQ/T), where dQ is change in heat with units as energy and T is the absolute temperature. The author argues that in enterprises, the tasks are combination of Knowledge & Energy application. Please refer to the Knowledge & Energy pair model (XXX).

c) We know from Cycles of Heat Engines, that heat rejection to the surroundings of heat that must take place in accordance to the second law of Thermodynamics. We also, know that we try to deploy the minimum temperature for the heat rejection to attain higher efficiency but we are constrained with the available surrounding temperature of the environment. Further, we know with time, if the heat rejection takes place to a limited size environment (not infinitely large), the accumulation of heat causes the temperature of the receiving body (of the surrounding to increase), an unwanted effect because it reduces the cycle efficiency of the heat engine.

Now we concentrate on evaluating the losses of the economy of a nation. If we start with the GDP and GNI we have what the aggregate of the workforces (the Labor) produces annually. Then if we look at the Personal Consumption Expenditure PCE, this is what the population spends, (the Population – the households (including the working population and associated members e.g. family). It is noted that PCE includes the earnings of working population plus the investments and others see below representative example Table 1 below.

The data found in were used to calculate the values shown in Table 1. The author derived this table base on the information in (XXX)

Table 1. *Example 2024 Per Capita Sources and Uses and Percentage of the Totals*

SOURCES	SOURCES in $		Percentage of SOURCES %	
INCOME		67,242.61		100.0%
FROM EMPLOYMENT		42,397.5		63.05%
ADDITIONAL SOURCES -e.g., from investments	17,939.8		26.68%	
FROM GOVERNMENT	6,879.0		10.23%	

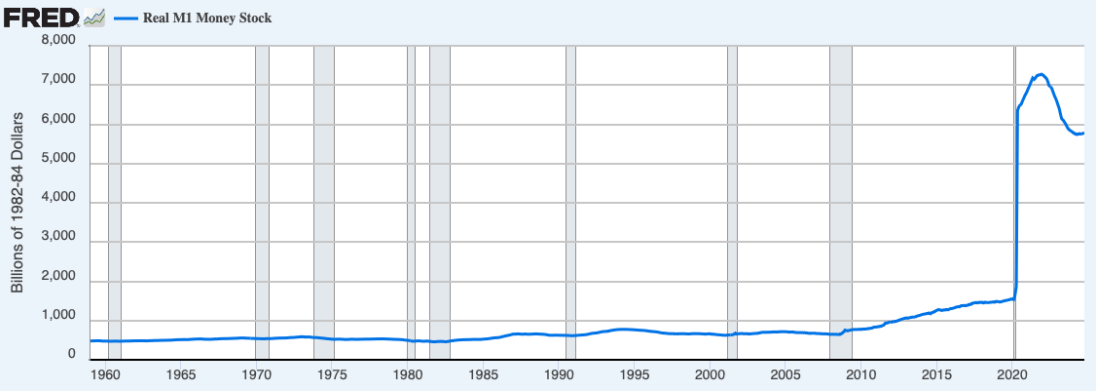
USES	USES in $		Percentage of Uses %	
INCOME	-	67,242.6		100.0%
Personal consumption		54,052.6		80.38%
Payments (taxes, Interest. Transfer)		10,449.6		15.54%
Personal Savings		2,740.1		4.1%

Recognizing that generally economics focus on the evaluating the input and the outputs of the production of a nation. The view suggested here is to examine the utilizations by the households. There comes what is lost (wasted) between the PCE and what is actually utilized by the households.

We start by introduction of important parameters that the Federal Reserve Board (FRB) in the US monitors and uses in the decisions they undertake to steer the economy as needed. The FRD takes steps to alter M1 (Figure 2), VM1 (Figure 3) and the federal funds rate interest Rate (Figure 4) with the obvious concern on Unemployment Rate (Figure 5). The parameters exhibited in Figures 2-5 play important roles in the movement of the CPI's direction (Figure 6).

In Figures 2-, please note the shaded areas representing encountered recessions. The durations in the figures represent the formally accepted recessions durations (XXX). Of interest for this paper are the seven recessions encountered after 1970. Just a comment about recessions generally they are shocks that are encountered due to major ease of an event – could be like in 1973 due to oil embargo as a result of a political action, or in the case of the COVID 19 epidemic. The government and the central bank try to cope with these shocks to dampen their effects on the well-being of the citizens.

Figure 2. *US M1 Money Stock*



In Figure 2, the extra-ordinary injection of funds in 2020 is noted with the steady gradual rise in M1from 2010 prior to 2020. M1 peaked around 2022 before starting to drop.

Figure 3. *US Velocity of M1*

Referring to Figure 3, one notes the decrease in the Velocity of M1 during the recessions except for the recession around 1974.

Figure 4. *US Federal Funds Effective Rate*

Figure 4 is a very important tool the FRB deploys to deal with inflation. Note that in recent years the FRD used slower pace in introducing changes in the interest compared to the time before 1990.

Figure 5. *US Unemployment Rate*

In Figure 5, we see the rapid increase in unemployment rate during recessions. The rise in unemployment due the COVID 19 crisis was extremely sharp in 2020.

Figure 1 shows the large CPI values prior to recessions. Actions by the FRB leads to the reduction of the CPI, and the Interest rate of Figure 4 is a key parameter that the FRB uses. It is noted that since 2000 generally, the US was in a relatively low interest era till 2022. In this paper, the author opted to focus on the time between 1970 till now. Prior to this time, there were some recessions that were severe and of course the FRB has built on experience and learned from the previous occurrences. The period between 1970 to 2024, there were seven recessions. The recessions cause changes in the trends of the economy. Prior to the recession – during the recession and after the recession

One notes that in the last three decades the FRB has managed to control recessions through monitoring and acting in a timely manner.

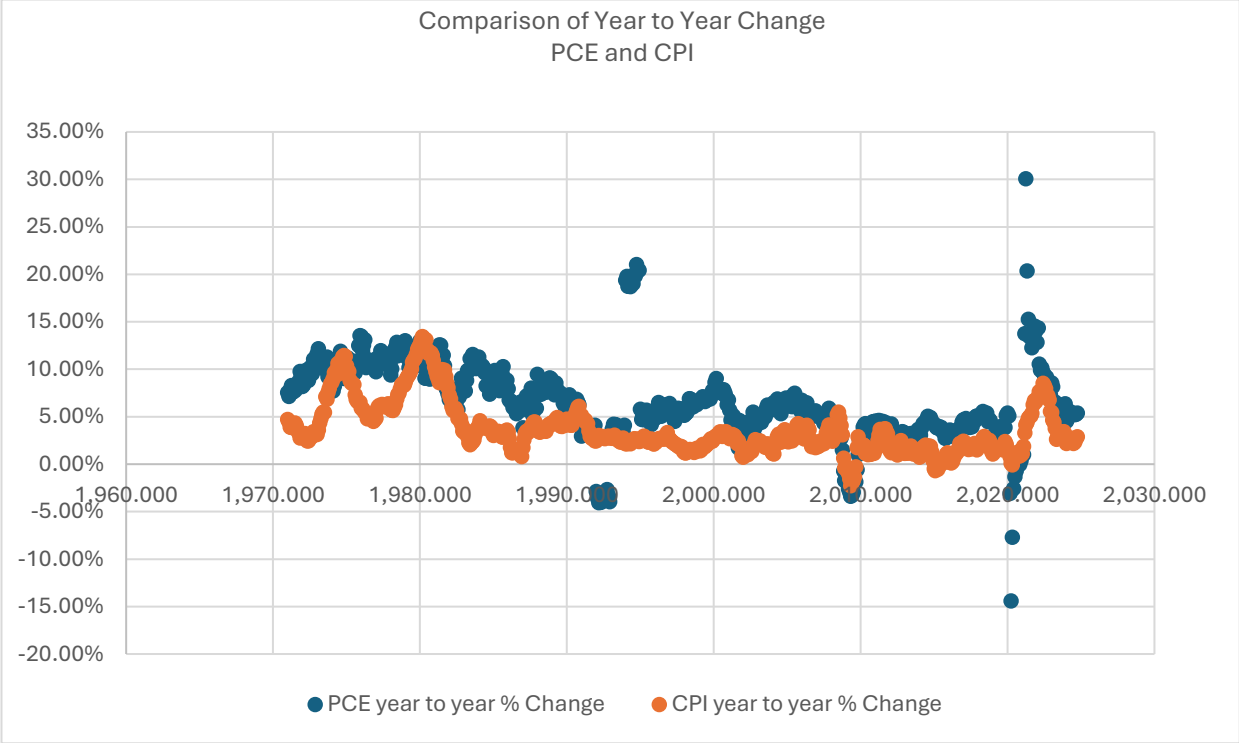
Review of us Data

In this section, we discuss select US A economic data in order to gain insights on the working of the different economic indicators. The author chose the order of presenting these parameters as follows:

In A below, the CPE and CPI year to Yer Changes represent the spending of the consumers CPE and the changes in the CPI. This is fundamental to the theme of the paper. In B. we address the aggregate trends of the economy GDP and GNI.

A. Comparison of PCE and CPI Year to Year Changes

Figure 6. *Comparison of PCE and CPI Year to Year Changes 1970-2024*



The data shown in Figure 6 were calculated from the sources in (XX) and (XXX). The exhibited data are examined in detail in the Appendix. The values in about 1993 and 2020 warrant examination.

Table 2. *Seven Formal Recessions between 1971 and 2024 (XXX)*

	Start	**End**	**Duration Year**	Preceding Duration Year	**Duration Month**	Preceding Duration Month
Rec.1	1,973.92	1,975.17	1.33	12.83	16	154
Rec.2	1,980.08	1,980.50	0.50	4.92	6	59
Rec. 3	1,981.58	1,982.83	1.33	1.08	16	13
Rec.4	1,990.58	1,991.17	0.67	7.75	8	93
Rec.5	2,001.25	2,001.83	0.67	10.08	8	121
Rec.6	2,008.00	2,009.42	1.50	6.17	18	74
Rec.7	2,020.17	2,020.25	0.17	10.75	2	129

The plots in Figure 6 show the year-to-year changes of the CPE band the CPI. As expected generally the CPE change lead the change of the CPI because the calculation of the CPI takes time from collecting the data to producing the results, this time has been reduced recently. The Effect of the recessions can be seen in light of the timings for the seven recessions shown in Table 2. Three recessions lasted about 1.5 year each. The most recent recession associated with the COVID 19 had the shortest duration (2 months). In Table 2, the blue cells, one can see the durations

of intervals between successive recessions. Only a little over one year lasted between recession 2 and recession3. It is observed that outside the recessions the amplitude of the CPE year-to-year change is larger than the year-to-year change of CPI. The difference in the amplitudes is much less during the recessions. This is quite an important observation suggesting that during good times consumers spend more, that is expected and leads to increases of the spending and the waste at time of consumer confidence. However, there are other factors that come to play

GDP & Gross National Income

Figure 7. *US GDP 1970 - 2024*

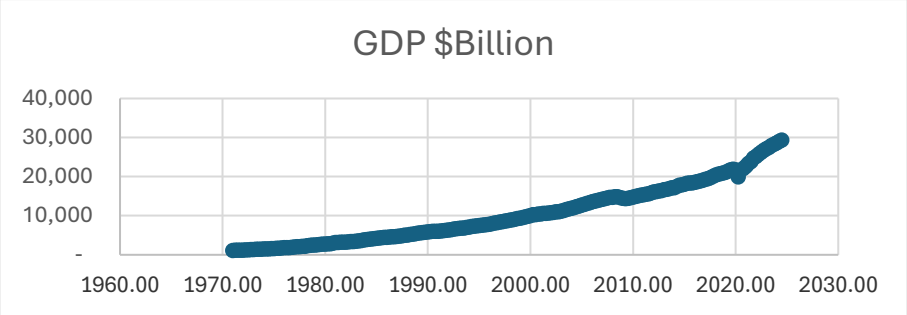


Figure 8. *GDP Year to Year Change*

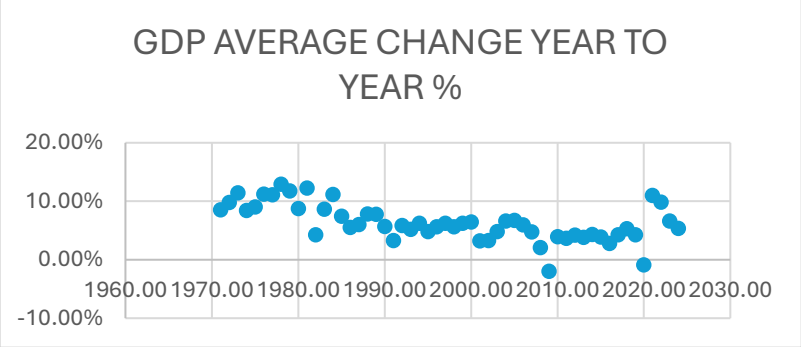
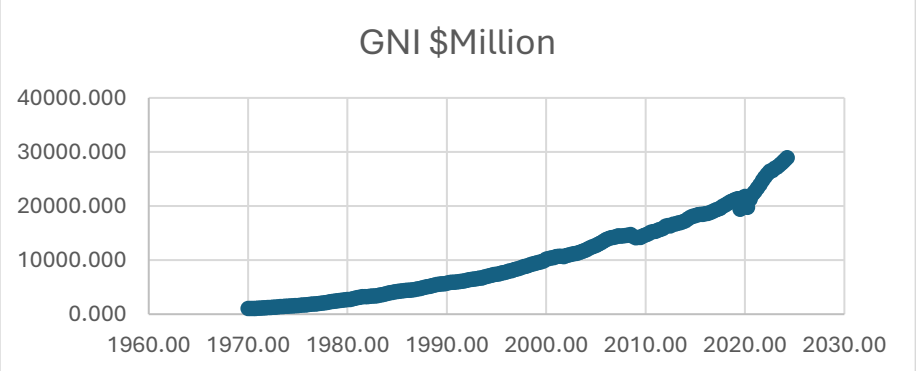
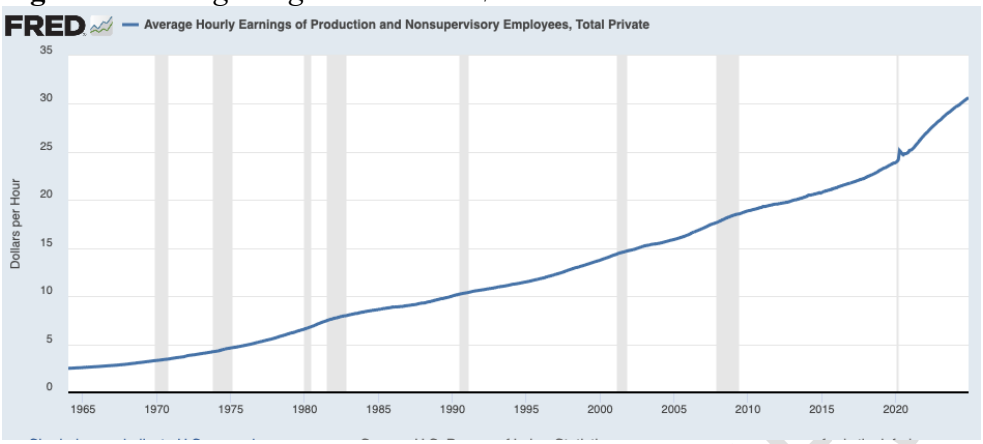


Figure 9. *US GNI 1970 -2024*



Average Wage

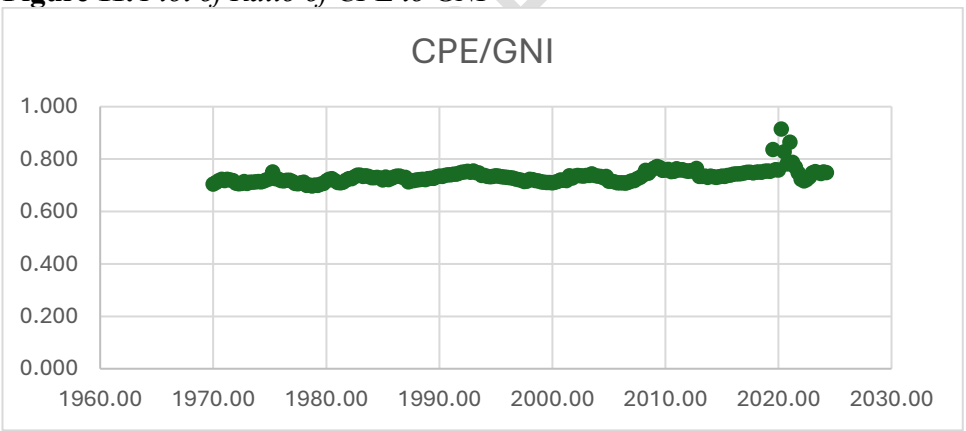
Figure 10. *Average Wage in the US in $/h*



Referring to Figure 10 one sees that recessions temper the rising of average wage, prior to the recessions generally, the wages show steeper rise. Application of new innovations is accompanied by increase of the average wage.

CPE and GNI

Figure 11. *Plot of Ratio of CPE to GNI*

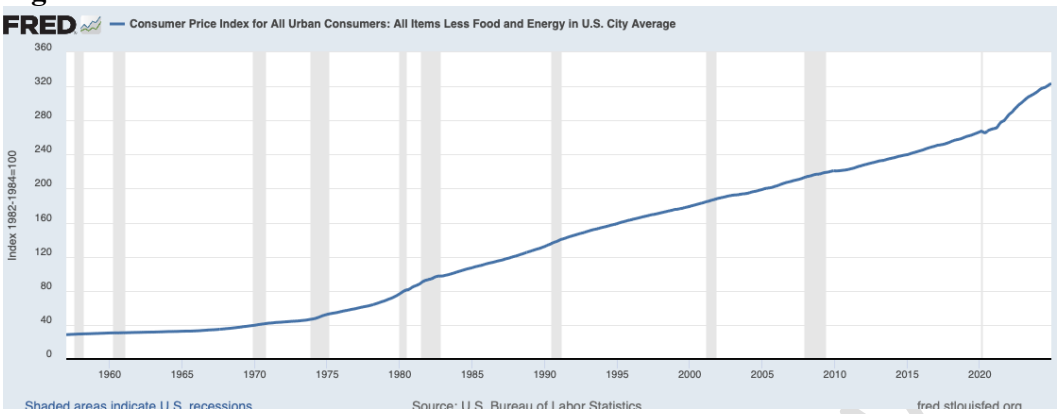


For the US, in 2024 the KEI is approximately 200. This prompted the author to recognize that the categorization of knowledge as energy must be higher caliber than that of electricity.

Thus, in view of the KEI the author concentrated on examining the waste as the main reason for the inflation. The following supported this notion:

> *The rise of prices with time is well known to all of us. One can see it the amount of money to procure a product, or a service is generally higher compared to earlier time. The difference in the price is typically much higher if one is comparing to price several years ago. Conversely, we also know that an amount of money today buys less than years before. we examine the trend of inflation, we see it always increasing, please refer to Figure 4.*

Figure 12. *US Consumer Price Index*



Now we concentrate on evaluating the losses of the economy of a nation. If we start with the GDP and GNI we have what the aggregate of the workforces (the Labor) produces annually. Then if we look at the Personal Consumption Expenditure PCE, this is what the population spends, (the Population – the households (including the working population and associated members e.g. family). It is noted that PCE includes the earnings of working population plus the investments and others see below representative example Table 2 below.

Recognizing that generally economics focus on the evaluating the input and the outputs of the production of a nation. The view suggested here is to examine the utilization by the households. There comes what is wasted between the PCE and what is actually utilized by the households. The author attempted to investigate this. In the process came up with a suggested formula of an overall efficiency for the economy of a nation defined by the utilization versus the GNI, or the GNI-Waste / GNI.

The author notes, that other economic indicators are available among US data, e.g. the savings, and exports and imports. These parameters have indirect effect to the thrust of this paper and the author opted not to present them. Also, the effect of taxation is beyond the scope of this paper.

Analysis of Select us Economic Data (1971-2024) with Focus on Inflation

The key data for the current analysis lie in PCE, and CPI for the time of interest 1971-2024. The recessions in this time are listed in Table 1, as noted before the recessions warrant close examination. The data of the population and the ratio of the working population were also used in the analysis. For the CPE the per capita data was the starting point. The chosen data had the categories of goods and services expenditures. Please refer to the Appendix for the details of the steps used in analyzing the CPE data and application of the CPI data to the PCE data to estimate the losses from the end consumers.

Takeaway from the Appendix

In the earlier sections of the paper, the thinking that led the author to examine the explanation of the losses at the end customers to be behind inflation. In the Appendix, the author presented his endeavors to demonstrate this stipulation through the analysis of the US Economic data for the period 1971-2024. The investigation in the Appendix boiled down to examining the seven economic cycles that were encountered during this Fifty plus years. In reality recessions, due to shocks as result of unexpected events such as political conflicts, or an epidemic, or financial failure etc. happen. It takes concerted effort to remedy the unwanted effects of the recessions large unemployment, and increased inflation rate. The interval that follows inflation starts with recovery post a recession and the tail end of this interval shows heating up of the economy associated with higher inflation, leading to the following recession that usually is triggered by a shock. The analysis in the Appendix examines in detail the PCE – CPI comparison data shown in Figure 6. The reason behind choosing PCE per-capita is its close representation of what the end consumers do. The CPI is the central parameter of inflation. The key factor that the FRB uses to control inflation the Interest Rate is added to the two aforementioned parameters. This set was complemented by the adjusted (to present it per capita versus that of the working portion of the population). The analysis in the Appendix progressed in three steps, step 1 examining the data for 7 seven recessions and seven Era's yielding representative values for theses intervals. The second step of the Appendix concentrated on selecting components of goods and services losses for each year per the categorization of the intervals identified in step 1, on the basis of per-capita PCE data. Step 3, entailed expanding the per-capita losses results to the total population, thus showing the total **PCE** in $billion and the corresponding **Losses** in $billion and as percentage of the **PCE**.

Before we address the last action of transforming the Losses to Energy units. It is worth to comment on the PCE changes with GDP and GNI, Figures 8, Figure 11, respectively. Here we should note the positive effects of innovations that lead to steeper increases in the GDP and GNI.

Further, it is worth noting Figure 11 shows the nearly constant ratio of PCE/GNI with time. One observes, very large drops at 2008 and 2020 for the GDP in Figure 8. The associated correspondence can be seen in Figures 7 and 9 for the GDP and GNI at the same times.

As noted earlier, the author introduced the KEI index (XXX) which relates the wages forming the application of knowledge by the work force to the average price of electricity as a means to relate the knowledge a high category of energy versus the well-known highest energy form, we know till now, being the electricity. Thus, the last action of step 3, was to convert the Losses into Electricity units. Please refer to the end results shown in the last plate 5-1 in the Appendix. Please note that this table is for years 2007 to 2024, since the available data for the average wage and electricity price was limited to this time frame. We shall now focus on the results of 2022 from plate 5-1.

For the year 2022, we extract the economy Losses for 2022 from plate 5-1 of the Appendix. Please refer to part i of Table 3 below. Part ii in Table 3, (XXX) shows

the electricity sales to residential users representing residential1.51 trillion kWh 38.4%, commercial1.39 trillion kWh 35.4%, industrial1.02 trillion kWh 26.0%, and very small for transportation (mostly to public transit). Of course, if we include all the sum of the residential, commercial and industrial, that is total of trillion kWh 3.92. Now we are debating what the PCE cover, is it only the household expenditures. That is why the author included in the last row of Table 3, the residential electricity usage noted above

Table 3. *Comparison of Economic Losses and Annual Electricity Sales for 2022*

Year	2022
Part 1 - From Plate 5-1 of Appndix	
Population million	333.6
PCE $Billion	17,528
Losses $billion	*960*
Losses/PCE %	*5.48%*
PRICE $/kWh	0.152
KEI	*210*
i) Equivalent Losses GWh	**6,330**
Part ii) - Electricity in 2022	
ii) Resedential Electricity sales GWh	1,510

The message from Table 3 above, is that the equivalent losses from the economy at the end consumers (taken here for the residential users only) amount to more than four times the residential

Electricity consumption for year 2022, with relatively high inflation rate 5.48%.

Thus, inflation has a serious detrimental effect on the economy, the significant knowledge dependance of the economy (as reflected by the high KEI) is accompanied with undesirable effect particularly when the inflation rate is high.

- Analogy of losses in Economy to losses in an Electrical System

In light of the discussions included in the Preamble, we revisit the analogy between the Economy and the electrical system, again in both cases, we are looking ate meeting the demand by the supply side. In the case of the electric system, we are dealing with the electricity, that is a single commodity, and in the electric system, we got used to deal with the demand -supply instantaneously. For an economy we are dealing with aggregate demand of variety of goods and services, there is time-lag for adjustment of supply to demand. In the case of economy, we have storages that help dealing with the evolving situations to some extent. Now, in recent evolutions the electric systems deploy energy storage to afford some means to cope with the variations/intermittent nature of renewable energy.

When, we deal with the operation of the electric system, we are concerned with the operations of the assets in the subsystems, generation, transmission and distribution. In the two systems, the first, second, and even in the third, the losses

encountered are born by the producer, or the service provider, hence they remain opaque ad far as the end users that are buying the final outcome. At that stage, the attention moves to what the end users do, is that user getting full utilization of what he or she bought, is the gest of what the losses model of this paper addresses. Further, discussions are included in the following section.

Sustainability / Conservation/ Spoilage / Waste

The losses model exemplifies the negative effects of inflation beyond the financial difficulties well known to all people have been exposed to. By household paying attention to minimization of losses, the society gains because there will result reduction in inflation, Additionally, there will be real contributions to sustainability (XXX). The minimization of losses through conservation and avoiding intentional or unintentional spoilage will result in lower inflation. The relevance of the inflation to curb climate deterioration e.g. global warming should be noted (XXX).

Approximate Estimate for Inflation from Interest Rate and Adjusted Unemployment Rate

In the Appendix's the author presented an approximate method that could be used to estimate CPI using the Interest Rate and the Adjusted Unemployment Rate, (Adjusted to transform through the employment ratio the unemployment rate to per-capita basis). This may have some use in predictive economic analyses.

The author proposed this as earlier he attempted to apply the formula (XXX) in Eq. 1as noted briefly, hereafter

How to predict Inflation?

$$\% \Delta P = \% MS - \%\Delta Q + \%\Delta V \qquad \text{Eq. 1}$$

- The % change in Price
- The % change Money Supply
- The % change in Production – the growth rate of the GNP
- The % growth of the Velocity of M1

Please note that Eq.1, was behind the introduction of Figures 2, 3 and 7, M1, Velocity of M1, and DDP, respectively, earlier in the paper.

The author, used USA data for years 2005 through 2024, comparing the calculated value using Eq. 1versus the CPI of that year, the two values agreed within 1% only for four years out of 20 years. While Eq. 1 may have served some uses in the past, the results of the comparison that the author applied, was not encouraging and that is behind why the author investigated and presented in plate 6-1 through 6-14 in the Appendix, the author acknowledges that some of the noted plates indicate poor agreement. This is the reason, for using Approximate in the title of this section.

Concluding Remarks

This paper suggests that the inflation is primarily the losses (waste or spoilage, unutilized) by the Personal Consumption Expenditures. The losses were estimated through matching CPI values for 54 years between 1970 to 2024. Some approximations were adopted to overcome some lack of source data (as discussed in the Appendix) but these approximations were justified and hence there could be small effect on the final results. The author believes that the paper puts forward strong evidence for the losses at the end customer are responsible for the inflation.

1) The subject of inflation is quite complex, because of the interdependence of many parameters, the time delay in seeing the effect of a change in one parameter, with difficulties to see the effect of individual parameter change when on see the combined effect of simultaneous changes in multiple parameters
2) The paper did not address taxes and import-export aspects. These topics were outside the scope that the author was set out to undertake. They have an impact on the inflation as what has been seen lately (in March 2025), as a result of the new policies of imposing tariffs on imports to the USA. These alter what was driving the globalization for nearly three decades, naturally has major impact on the economy.
3) The paper did not address the changes of the Financial Markets, which represents the sentiments of the investors, again that is a factor that the author did not try to address at this point.

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