## Inflation and Debt, as reported in 2022 and revised in 2023

Leading up to the recent bi-election, one of the major issues seized upon by those seeking office was the so-called burden of rampant inflation, especially of gasoline. As a former electrical engineer with no background in economics, nevertheless I became interested in this subject while doing some research on related matters discussed in Reflections, the last chapter of my new website. My only formal education on the subject was a freshman college class in Introduction to Economics in which I probably received a barely passing grade. Yet you never know. Some of the basics of that course may still be stashed away somewhere in my head. As usual, my plan here is to compile published date, mostly statistical in nature, and let others draw their own conclusions.

First of all, we deal with the misinformation regarding the "skyrocketing" (their much overused term, not mine) cost of gasoline. The cost of gas at \$4 or \$5 per gallon is less per mile now than it was when I got my driver's license in 1949. Cars now get about twice the miles per gallon. Then factor in decline of the dollar, as discussed in this report, and we actually come out slightly ahead now. Furthermore, gas is still cheaper here than almost anywhere else in the world. Nevertheless, the recent sudden price increase makes a handy issue for glib politicians to loudly campaign on.

Being curious, I decided to check with the presumed experts. A search for the *causes of inflation* on the Internet turns up many articles on the subject listing about a dozen different causes. Several of them use the exact same wording, "demand pull, cost push," suggesting to me that one is simply being copied by all the others, but who knows which one first came up with that catchy slogan. Among the other causes named are growth in money supply, organized labor, too low Federal Reserve interest rate, war in Ukraine, consumer expectations, less oil production, supply chain disruption, and COVID-19. Some of them stretch one's imagination, for example the Washington Post blaming the COVID *vaccine*, because it put more people back in the mood of shopping. Forbes Advisor states that "inflation is caused by increases in the price of goods and services;" i.e. inflation is caused by inflation. Fox News predictably blames too much government welfare. Also predictable is Senator Elizabeth Warren blaming corporate greed.

In evaluating some of these presumed causes, I find it useful to plot an easily measurable one, the Federal Reserve interest rate, and compare it with the consumer price index (CPI) over the same period. The average price of things has been fluctuating ever since records were kept starting in the 1700s and mostly upward for the past 100 years. As for my comparison (Figure 1), if there is any cause and effect, positive or negative, I would call it slight. Yet several sources state that the rate of inflation is "controlled" by the Federal Reserve in their setting of prime interest rate. Again comparing the two graphs, one has to wonder how much control is achieved. It would appear to show very little control, with the attempted controls often initiated after the fact rather than in anticipation of; in some cases perhaps even the cause of. Furthermore, when considering the overall historic record of inflation, it looks like the Federal Reserve has little long term control. The conclusion I gleaned from all of this is that there must be many causes of the monthly fluctuations in the rate of inflation, some not well understood, and that no one is able to identify them accurately, or more importantly, predict the future trends, not even the presumed experts in the Federal Reserve Board or others in the Treasury Department. And, incidentally, a lot of the information found on the Internet when seeking answers to questions like mine is opinion of very questionable reliability. So after that discouraging finding I then turned my attention to studying the *long term* trend, which most of the "causes" listed above fail to account for.

First of all, my intention was to concentrate on the overall long-term strength of the U.S. dollar, but this is not so easy. Most accessible is the Consumer Price Index, based on a collection of consumer items. But it does not take into account, for example, average wages or the value of the dollar against foreign currencies or precious metals. The Bureau of Labor Statistics has been measuring and reporting the CPI since 1914, based on the costs of various items such as phones and radios that necessarily change over time, thus consequently subject to possible inaccuracy. Farther back, inflation is for the same reason even harder to gauge accurately. My figures come mostly from a web source called Statista, according to which inflation has been essentially constant from 1810 to 1940, and after that increasing on average of 2% per year to the present (Figure 2). Several sources state that this 2% rate is desirable but does not explain why, or how that exact number was determined. Nor does it account for how our country managed well for 120 years with essentially no inflation.

The Federal Reserve Board began a policy of trying to control inflation in 1978, but the often mentioned "desirable" 2% rate was not adopted until 2012. As noted above and in Figure 2, inflation has averaged around 2% since 1940, with or without the FRB trying to monkey with it or taking credit for controlling it. So what can be the reason?

(Incidentally, I am anything but a student of history; nevertheless I think there might be much to be learned by pondering graphs like Figure 2. Think of all the drama that it reflects: war times and peace times, the Industrial Revolution, the Great Depression, the rise of organized labor, immigration, and much more.)

I wondered if discontinuing our gold standard had anything to do with inflation. The gold (or silver) standard has a long and complicated history, on and off for over a thousand years throughout the world, but finally ending in the U.S. in 1971. One of the many problems with it was that the value of gold and silver, like everything else, fluctuates with supply and demand. Plus, of course, shipping of gold bullion has no place in this modern era of instantaneous electronic international exchange. In more recent times, the U.S. dollar has been the standard of exchange worldwide, but that could change.

I am dismayed by the faulty graphs shown on www.officialdata.org/us.inflation/1800 (page 6). The first one appears to show practically no inflation until around 1960 and then going way out of control in 2017. The second one shows just the opposite. And it could show other misleading times depending upon the scale used. This cumulative sort of data

needs to be plotted on semi-log paper to make any sense, and I am surprised by this major blunder taken from an apparently official government source.

A few of the internet sources mentioned above suggest that excess government spending might have some effect on chronic inflation, while others think not. I have always wondered. Accordingly, I have plotted federal debt since 1790 (page 7) to compare with inflation (page 5) over the same period. The correlation is striking. But correlation does not necessarily indicate direct cause and effect. It might even be the other way around. It would appear that they probably both affect each other in some complicated way. The dip around 1840 is explained by the Jackson administration paying off nearly the entire national debt of about 50 M, but then the Van Buren administration resumed borrowing again. The debt is here plotted on 7-cycle semi-log paper, which is the only way that makes any sense. I placed dots at one-year intervals and connected them all by a crooked line as best I could. Some fine detail may be missing, but I was more interested in the overall trend. An interesting feature of such graphs is that cumulative constant percent changes appear as diagonal straight lines, with the tangent of the angle of slope being proportional to the percentage change.

So next I plotted debt adjusted for inflation (Figure 8), and finally debt further adjusted for increase in population (page 9). All of this would appear to me to suggest that in the long run, our average increase of inflation over the last 100 years of about 2% per year may have been connected at least partly to a steady increase in national debt. Furthermore, if correct, and if our debt continues to increase at the present accelerating rate, the CPI can be expected to do the same unless some drastic changes are made in the federal budget. Incidentally, I have been asked why I did not plot debt as a fraction of Gross Domestic Product. But many others have already done this, and the Internet is already littered with such graphs. Furthermore, the GDP is not easy to measure accurately, and may even be tampered with for political purposes.

Which brings up some thoughts on the national debt. At the present rate of increase of nearly 5% per year for the past 50 years, by extrapolation it could reach 100 trillion around 2037. The interest on that debt can't just be ignored; it must be paid. At 3 % interest rate, that would be 3 trillion. Now, just to put that into perspective, imagine that payment being taken off the top equally from everybody's annual income tax payment. That would be \$8,000 before funding anything else. (But see revised estimate on page 11). That is not likely to happen. More likely it will be financed by ever more borrowing.

So, these are just some thoughts and statistics by a non-expert with time to spare and a curiosity about all things. One final thought. You can look at it this way. Suppose Congress were to continue going blithely about enacting big spending bills, especially those that benefit their supporters and home district, and pay for them simply by borrowing or creating more and more money. There would be no need to raise taxes, or even have any at all. Something must be wrong, and now I realize this does indeed go back to that college course in basic common sense economics some 73 years ago, thanks to Professor S.



Figure 1

Figure 2











## Added note, February 2023

As already explained, I do not claim to be in any way an expert on economics. Nevertheless I do have some knowledge of graphic analysis of statistical information which I can put to good use, and which I find sorely lacking in much of what is found on the Internet, even including official sources. This plot of interest on the portion of the national debt held by the public from 2008 to the present is taken from CBO government sources. I have extrapolated it by dashed line into the future, which shows it reaching one trillion dollars around 2028. The other broken line is an estimate provided by the CBO that instead shows it reaching a trillion in 2032, and I unable to explain the discrepancy. The slope of both lines is about 12% per year. Where does all this lead? When and how does it end?



Another added note, March 2023.

Back on page 1 is a discussion of the Federal Reserve trying to control inflation by adjusting federal interest rate. I take an interest in this for a special reason. In my Reflections, found elsewhere in this website, is a description of my work with regulated power supplies at MIT. I had considered editing that out as being of little interest to most readers, but now I am glad I left it in. Stability or instability of closed loop systems is a subject that has broad ramifications. In general, regulation of such systems can be improved by increasing the "gain" of the system, but only up to some limit. Too much regulation, or too late in applying, can even be counterproductive, often causing unwanted overshoot or even instability and oscillation. Examine the graphs in Figure 1 and also what is taking place right now. This may or may not be the case with the actions by the Federal Reserve in their at best only partially successful attempts to control inflation, but one must wonder how much technical expertise goes into making these important decisions, or can it be more like guesswork? In the same vein, how did they ever arrive at the "optimum" 2% inflation rate? Please show us the science that went into that too.

I would not want to try carrying this analogy too far. The electrical parameters of my power supplies were measurable and the resulting performance was possible to calculate. But, according to some experts, when it comes to inflation, the psychology of saving and spending must also be taken into account. At least based on my experience with the laughable Introduction to Psychology way back in college days, psychology was and probably still is anything but a science.

Yet another added note, May 2023.

In searching for the *causes of inflation*, you will not likely find crime listed as one of them, but perhaps it should be. Shoplifting is reported to be now much on the increase, to the extent of becoming even a new form of organized crime. Every amount of merchandise that is stolen, or lost for whatever other reasons, has a direct cumulative effect on inflation of retail prices.