Catching Up On Your Retirement Fund

Getting Near 45 Years Old. Time To Make Up For Lost Time

by: **Guy R. Fleury**

My friend asked me, ”How about people starting their retirement fund later in life, like at 45, rather than the 25 to 35-year-old scenarios you already presented?”

My recent writings[1] were on how anyone could build their retirement fund on their own. It was shown there were considerable advantages in doing so. The most valuable was providing a significant and **increasing** income stream for the rest of their lives once they retired. The emphasis is on the word increasing.

Catching Up On Your Retirement Fund, provides the underlying equations to rebuild and validate any of the presented scenarios. You can fire up your favorite spreadsheet and redo everything yourself.

There is no secret sauce, only common sense stuff. If you do this, it will result in that kind of thing. The big question is: Will you dare do any of it for yourself and your children? You will figure out ultimately that money spells freedom.

Of course, **Catching Up On Your Retirement Fund** should not stop you from using annuities if it is what you want or prefer, no matter the underlying reasons. Financial institutions are ready to service your retirement needs, whatever they are. These institutions have had over a century to prepare for you and have profited greatly from those services.

Nonetheless, see if anything in this paper might also be of help. It is not because you are older that you should not retire with more than you need and be financially independent.

We can give the process of building a retirement fund two distinct phases.

1. *The building-up phase to feed your fund and grow it up to retirement.*

2. *The withdrawal phase to generate an increasing income stream once retired.*

Usually, the second phase does not provide increasing monthly income checks. It is more the outcome of some annuity with fixed payments for the duration of its contract. That contract might be time-limited to a set number of years. You will find many options in these annuity funds, including lifetime annuities and indexed.

[1] See list of related papers and articles at the end.

Also, most of these contracts have rates of return lower than 10%. You can often see some of these with ads in the 5 to 8% range. It usually results in barely maintaining your pre-retirement salary and often forces you to downsize and lower your lifestyle.

We will go another route in **Catching Up On Your Retirement Fund**. We will look at how you could do it all yourself. You will be in charge of building up your retirement fund and managing its increasing income stream once you retire.

In prior publications, we had most examples set for a 25 to 35-year-old planning to retire at 65. Also, the various scenarios considered were relatively easy to implement.

You could design your retirement scenarios based on whatever setup you prefer. I will present a convenient set of guidelines and readymade templates you could use.

Do your variations on what will be outlined, or design something new. You can set up your retirement fund to the best of your abilities and you should want it to give you what you want.

To resume from the recently published papers, all anyone needed to do was make monthly contributions to their retirement fund and buy QQQ shares. It might be an oversimplification, but it worked. And that is the main thing: it worked.

Will it be boring? Yes. Once a month, for some 20 to 40 years, you will enter QQQ[2] on the keyboard, determine the number of shares to buy with the monthly contribution and press enter. Job done.

Let me repeat. Once a month, you would buy some shares of QQQ, and that's it.

All the while, you would be effectively dollar-cost averaging the NDX Index composed of the 100 wealthiest companies on the NASDAQ exchange. NDX is an index, and it is not tradable.

That is why we use the QQQ ETF as a proxy. QQQ will mimic every move of the NDX Index. It is tradable, very liquid, and has a large following. You can buy or sell QQQ shares anytime you want at the prevailing price.

The most significant advantage of using QQQ as the cornerstone of your retirement portfolio might be that it will not go bankrupt. It is due to its composition. QQQ has, at all times, the top 100 wealthiest companies listed on NASDAQ. None of them will go bankrupt while on that list. None have to date.

And if ever one did, it would represent less than 1% of the entire portfolio due to the

[2] QQQ has been around only since 1999. There is no way to backtest over 40 years.

weighting method used. Any stock losing its top 100 status is automatically liquidated and replaced by a newcomer with more potential. A stock drops from the bottom of the list, and its weight will be less than 0.01 of the portfolio by then.

Building a retirement fund based solely on QQQ is sufficient to say you have a diversified portfolio, even if it contains a single ETF.

> *Anything we want to do that could last years and years needs a plan describing what needs to be done, how it will be done, which tools will be required, and how long it might take.*

This retirement fund of yours is no different. You have to plan for what you will do. You do not have that many years to make it. You cannot try and try again. You cannot go out there with many untested ideas and try to finance all of them simultaneously. You are not a big corporation, a hedge fund, or a venture capitalist. You are an individual trying to build a worthwhile retirement fund and do not have the option of missing your objective.

Hacking it should not be a solution, either. It carries too much uncertainty and too much risk. For the same reasons, you should not be a venture capitalist or risk it all on an IPO.

Playing it safe should be your mantra. Your retirement fund is your future and should not be a crapshoot. There should be very little or no gambling involved in this process.

You will have to choose among your available and doable alternatives which investment strategy could suit you best or that could be acceptable within your available capital and time constraints.

Starting Late

In **Catching Up On Your Retirement Fund**, I will consider the individual trying to do that job, building a worthwhile retirement fund, but starting late in the game, at age 45. The emphasis will be on the word worthwhile.

It will give our aspiring retiree 20 years to make up for the lost time the best he/she can with the means available. Later, we will determine what was given up by starting late in this portfolio-building process. The last few years of exponential growth are lost, not just the early years. By shifting the starting date, we moved the entire time interval forward.

I pointed out in a previous paper,[3] those last few years were quite valuable depending on the chosen scenario.

[3] **How To Make It Anyway**.

Overall, the problem is relatively simple.

The same equation as used in the prior papers can be put on the table again.

$$\mathsf{E}[FV] = PV \cdot (1 + \mathsf{E}[\bar{g}])^t \tag{1}$$

where the expected future value depends on the expected average growth rate $\bar{g}$ applied to the initial capital (PV) over many years (t). The average growth rate $\bar{g}$ has for composition: $\bar{g} = \bar{r}_m + \alpha_1 + \alpha_2 + \alpha_3$, thereby expressing that the average growth rate could have multiple sources, including $\bar{r}_m$ the long-term market average.

We can rewrite the future value equation above to include the alpha sources:

$$\mathsf{E}[FV] = PV \cdot (1 + \mathsf{E}[\bar{r}_m + \alpha_1 + \alpha_2 + \alpha_3])^t \tag{2}$$

Equation (2) gives us the tools we can use to accomplish our task.

We have a compounding equation that depends on how much we put on the table, the average growth rate we can achieve over the period, and how long this fund can last. For any value of t, you can get the average growth rate $\bar{g}$, but you will know it only after reaching t. Nonetheless, you could make estimates based on past trends and know that as you approach t, we also tend to $\bar{g}$.

Anything before reaching t should be considered an estimate of what might or could be. We cannot declare it a forecast or a prediction. At most, it is an educated guess, an expectation.

It is like estimating the market's future average growth rate. The best guess for $\bar{r}_m$ would be about the same as its past value. That would be reasonable since we do have the value of $\bar{r}_m$ over the last 200$^+$ years. And that could easily classify as an educated guess.[4] What we have are historical observations.

The only things we know from the start of this enterprise are the present value PV and how much time we have t, especially in this retirement scenario. We know how many years we have before reaching 65. As for $\bar{r}_m$ or the alpha sources, we will make guesstimates based on observations and historical data. We have a lot of that.

The long-term average growth rate $\bar{r}_m$ is relatively easy to determine. The long-term market average of about 10% per year is often used as a market return proxy. Buying SPY could do that job and would not require more work than buying QQQ.

You would be even more diversified buying SPY over QQQ. SPY has 500 of the most valuable stocks, while QQQ has only 100. Old portfolio management textbooks on diversification say about 30 stocks are sufficient for a diversified portfolio. Those 30

[4] See chart (#1) at the end.

stocks could track about 95% of market index activity. On that basis, buying QQQ could be considered a diversification overkill. Even more so, buying SPY.

The difference between SPY and QQQ that will matter to us is in their respective average long-term growth rates. We already know that QQQ has a structural advantage, that is, rate-wise. QQQ will generate a higher CAGR: QQQ $>$ SPY.[5] This is not the result of any prediction. The difference comes from the two ETFs' stock composition and, therefore, their stock selection processes.

My latest paper,[6] provided the equation we are interested in. Here, it is modified to start at age 45.

$$FV = PV \cdot (1 + \bar{g})^{20} \cdot (1 + \bar{g} - 0.05)^{t-65} \tag{3}$$

The first part covers the 20 years before retirement, and the second all the years in retirement with $t > 65$. Living up to 95 ($t = 95$) can give you 50 years of compounding.[7] Many people live longer than that, so these investment methods should cover it all no matter how long you live.

The equation proposes your retirement fund should continue to prosper even after you retire. The needed condition would be $\bar{g} > |0.05|$, meaning that the portfolio's average growth rate should be larger than the withdrawal rate. That is it.

It is a critical point. While in retirement, your portfolio could grow at the differential rate $\bar{g} - |0.05|$. All your retirement portfolio needs is an average return greater than 5%. Yet, we have already conceded that buying SPY could do the job long-term with its 10% average CAGR.

The first part of equation (3) limits our time to build this portfolio to only twenty years. It is a relatively short period to make it as worthwhile as for our 25-year-old. Nonetheless, we will try to make do with what we have and find procedures that will enable us to catch up for the lost time.

Equation (3) will remain the same starting from any age. We can change the exponents for any duration we want to analyze. It will not change the structure of the equation or its purpose.

Every proposal in **Catching Up On Your Retirement Fund** will be stuff anyone can accomplish by having the means to do so. It is not a universal thing that will solve the problems of all poor people worldwide. It is limited in scope.

However, it could help millions and millions do better than they thought they could.

[5] Refer to recently published **How To Make It Anyway** and figure #1 of **Retire A Multi-Millionaire**.
[6] **How To Make It Anyway**.
[7] Mr. Buffett is now 93 and is still at it with 50^{+} years on the job managing Berkshire Hathaway.

That was a sufficient reason for me to publish this paper.

As a reminder, here is the core Python pseudo-code used in Jupyter for all these tables. You could use the same logic in any other software program or spreadsheet.

```
# initialize variables
for month in range(months * years):
    total_fund = total_fund * (1 + rate_month - inf_rate) + contrib
print(total_fund)
```

Suppose we want our 45-year-old to do as well as our 25-year-old. Equation (1) can help answer that problem. We have two investors with their version of equation (1) but with the same objective: $FV_1 = FV_2$.

$$PV_1 \cdot (1 + \bar{g}_1)^{t_1} = PV_2 \cdot (1 + \bar{g}_2)^{t_2} \tag{4}$$

where we specify that both investors have a limited time before retirement. It is known that $t_1 = 40$ and $t_2 = 20$. The QQQ growth rate in previous papers for our younger investor was at a 15% CAGR.

$$PV_1 \cdot (1 + 0.15)^{40} = PV_2 \cdot (1 + \bar{g}_2)^{20} \tag{5}$$

We are starting to fill in variables. PV_1 for your younger investor was \$200k in a prior paper. And what we would like to know is $\bar{g}_2$ and a plausible value for PV_2.

Rearranging equation (5) would give:

$$(1 + 0.15)^{40} = \frac{PV_2}{\$200,000} \cdot (1 + \bar{g}_2)^{20} \tag{6}$$

And rearranging again, would provide:

$$\left[267.86 \cdot \frac{\$200,000}{PV_2}\right]^{1/20} - 1 = \bar{g}_2 \tag{7}$$

The above formula states that we can convert time using initial capital and growth rate. For instance, raising the initial stake for our older investor to one million would generate:

$$\left[267.86 \cdot \frac{\$200,000}{\$1,000,000}\right]^{1/20} - 1 = 0.22 \tag{8}$$

For our older investor to catch up, investing one million and getting a 22% CAGR over those 20 years would give him the same outcome as our 25-year-old.

Therefore, the methods available for a 45-year-old to catch up are to provide a higher CAGR and more initial capital. However, the price to catch up might be higher than anticipated. And our 45-year-old might be content with less, but maybe not that much less.

They will still want a worthwhile retirement account that should enable them to live a prosperous and enjoyable future. Nonetheless, we can convert time and initial capital into CAGR. At least, we have the equation to make it happen. In real life, the conversion might be more challenging. The higher CAGRs are harder to get.

Let's Get Down To It

We first solved the problem with equations (4) to (8). We know we can convert or exchange the main elements in equation (3) for the other parameters, especially converting time and capital to CAGR.

With these equations in mind, we will now build the retirement fund to achieve high results for older retirees.

We will use this 45-year-old as an anchor point and give him/her 20 years to build that fund before retiring. Depending on the age, you can easily adjust equation (3). Equations (4) to (8) can help you make conversions should you need to.

First, at 45 years old, you should already have been preparing for your retirement somehow. You might have a better-paying job than a 25-year-old, have invested some of your earnings, inherited some assets, or bought a house.

You should already have a company-sponsored and a government pension plan. I will avoid analyzing the merits of any plans you might have or their pros and cons. I want to do something else here. After this presentation, you could do your comparative study and determine what is best for you. You are at the center of it all. You have to make your choices.

Moreover, you must have looked at many investment opportunities and made a few errors, including having failed investments. But, whatever, you are again at a starting or a continuation point and have 20 years to push for more in the hope of a better retirement.

> *I want you to consider managing your retirement fund so that once you retire, you will let it provide you with an increasing income stream for the rest of your life. Your new fund will give you some 20 years of on-the-job training.*

This might sound ambitious, but all we are talking about is the desired future value FV, your current fund status PV, and the growth rate you can achieve $\bar{g}$ before and after you retire.

Equation (3) covers it all, where we have already specified that in retirement, we would like to extract an income stream equivalent to 5% of the fund value every year.

Evidently, 5% of nothing is not very much.

Therefore, if you do not have any money ($PV = 0$), also meaning you have zero put aside, equation (3) can only be solved with its own zero as future value. It's not the brightest spot to be in. And the advice: you can only look up is not much of a consolation. In a retirement scenario, zero is a dreadful number.

Nonetheless, at 45, you must have some savings put aside. At least, you should have a better job than when you were 25, meaning you should have a higher income.

I will base the salary on the 25-year-old in my paper: **How To Make It Anyway**. His salary was set at $50,000 to start with, making $500 contributions per month.

For a 45-year-old, salary should be exceeding $100,000. It would represent a yearly salary increase of about 4% per year compared to the 25-year-old. So contributions of $100, $500, and $1,000 are feasible. They represent, respectively $1,200, $6,000, $12,000 in annual contributions.

Using only monthly contributions, with SPY's expected return, would give Table (#1).

Pension Contributions - 10% Return - 20 Years

Contrib. Monthly	Return Rate	Total Contrib.	In 20 Years Total Value	Real CAGR	First Year Withdrawal	First Month Withdrawal
$100	10%	24,000	75,937	5.93%	3,797	316
$500	10%	120,000	379,684	5.93%	18,984	1,582
$1000	10%	240,000	759,369	5.93%	37,968	3,164

Table 1: Expected First Year Withdrawal - 20 Years.

The first-year withdrawal represents 5% of the total value of the fund at age 65.

Table (#1) provides a measure of what was accomplished using contributions over those 20 years. Each contribution was at an average 10% growth rate and treated individually. It implies that the amount of money earned from each contribution would decrease as we approach retirement.

The last few months of contributions generated less accumulated profits than the first few months. Those early contributions provided more profit-wise because they had more time compounding.

The first thing we should say about Table (#1) is that it is lacking. More is needed.

The cost of living would have increased over those 20 years. Even with a 3% inflation rate we would have: $FV = PV \cdot (1 - 0.03)^{20} = 0.5438 \cdot PV$. Based on the numbers in Table (#1) for total value, the first year and first month withdrawals would have to be reduced by 46%. Cutting the outcome by almost half its value.

It would appear as if our 45-year-old would be condemned to a life of forced simplicity.

But there could also be remedies for this. We will start with the notion that a 45-year-old should have a salary of around $100,000. Our investors have been working for 20 years already. They should have had pay increases during that time. It would make the $500 monthly contributions more feasible; they would be 6% of the annual salary. As the salary will continue to rise, these contributions will represent less as a percentage of the total salary, while these same contributions will remain fixed.

The average savings rate for people in that age group ranges from 2% to 7.5%. Some do better and get closer to 10%.

With a $100,000 salary at the start of the 20 years, rising at 4% per year, it should reach about $219,112 by age 65. But what might count more over those 20 years is the total income received from the job, which should be somewhere near $3,096,920.

We know our individual, on average, will receive about $3 million over those 20 years, and the big question becomes: How much of it could he or she save?

Table (#1) gives the sum of contributions made based on the monthly numbers. The $1,000 per month contribution represents about 7.75% of total revenue ($3,096,920). A person using the $500 per month contribution would have put aside 3.87% of the total income received over those same 20 years. Nonetheless, it still represents $115.38 per week.

I used a 10% growth rate to calculate the returns, making it like buying SPY with every contribution, thereby getting SPY's average long-term return, expecting that the individual did the job on their own.

Passing the task to a financial institution might lower average returns, making Table (#1) look better. There is a possibility that a financial institution did better. It is often said that some 25% of money managers outperform market averages. By how much is never specified. The other 75% did worse than the market average, saying they underperformed SPY. Should you feel lucky or go for SPY, which in itself is a variation of closet indexing for your retirement portfolio?

It is simple: our investor needs remedies and methods to improve the overall portfolio outcome. You want, at 65, to avoid being faced with a retirement fund worth peanuts. You deserve better than that.

Looking At Some Available Options

It should be evident from Table (#1) that there is a need to catch up and fast. You have only 20 years to do so.

We need to feed equation (2) to make it happen.
Equation (3) depends on it.

But, you cannot add much to equation (2). You could put up more initial capital and increase the growth rate, which would mean getting some alpha since $\bar{g}$ already includes $\bar{r}_m$ the average market return.

We cannot add more time since we have a limit date at age 65 unless we accept to retire later. But that would defeat the purpose of this retirement fund. You want out, and 65 looks like the age to do so. If you could do it even earlier, you would.

Our investor's role is to feed equation (2). Nobody else will provide the needed capital. There are exceptions to that, but I will not go there. I want general solutions that will apply to most.

Our 45-year-old must have put aside some money for a rainy day even if we hear that most Americans (≈60%) do not have $400 in reserve to answer emergencies.

At 45, a person has had a lot of time to think about what to do concerning their retirement years. Some 60% have homes. So, a lot of these people do have equity.

Even though all my examples relate to a 45-year-old American, the principles presented apply to anyone in any country. This paper is about building a retirement fund, not some socio-econometric geopolitical study.

Let's give our investor a starting point.

You have an objective, and that is FV, the future value of your fund at age 65. You do not know and cannot predict its value. But it remains the objective.

You know from equation (2) that you could rearrange it to extract $\bar{g}$ whatever the future value FV might be.

$$\left(\frac{FV}{PV}\right)^{1/t} - 1 = \bar{g} \tag{9}$$

It would be sufficient to make realistic estimates of your objectives since in equation (9), you know t and PV. To get a general idea, let's say you have $PV =$ $200,000 and would like to have $5,000,000 by age 65. Putting those numbers in equation (9) would result in a 17.46% CAGR.

To also put this in perspective, if your growth rate were 7.5% over those 20 years, you would get: $FV = \$200,000 \cdot (1 + 0.075)^{20} = \$849,570$.

To reach your $5 million objective, you need a 17.46% CAGR or better to get there. Then, the problem becomes relatively simple. You will need to increase the growth rate above what SPY offers.

First, you can upgrade the return expectation by going to an average 15% return over the period, and buying QQQ instead of SPY will do the job. As simple as that. This way, you fill in your first alpha: $\alpha_1 = 0.05$, from equation (2).

Second, add an initial stake of $100k to the venture. It is your retirement fund, and you will control it all anyway. If you have a fund returning less than the proposed 15%, it might be a good reason to switch to this expected higher return. It is part of your choices and investment decisions.

Should you already have a higher average return, you should keep going at that rate. And if applicable, include some of the stuff presented later in your strategy. The objective is to raise $\bar{g}$ in equation (2) by providing additional alpha, as you should have guessed.

Making those two adjustments (the increased return and the $100k in initial capital) will produce the following table:

Contributions - 15% Return - Initial Cap. $100k - 20 Years

Contrib. Monthly	Return Rate	Total Contrib.	In 20 Years Total Value	Real CAGR	First Year Withdrawal	First Month Withdrawal
$100	15%	124,000	2,121,273	15.25%	106,064	8,839
$500	15%	220,000	2,720,169	13.40%	136,008	11,334
$1000	15%	340,000	3,468,789	12.31%	173,439	14,453

Table 2: First Year Withdrawal - Initial Cap. $100k - 20 Years.

Looking at Table (#2), things look much better. And yet, we have done very little. We provided an initial capital to start the ball rolling. Kept the same level of contributions and changed from holding SPY to holding QQQ. That's it: all decisions made before entering the game.

At 65, our fund ended with $2,720,169 as in Table (#2) instead of only $379,684 from Table (#1). Yet, all we did was add some initial capital and change which ETF we would buy. We should not deserve any merit for making those two decisions, but we do. Together, they were worth over $2,000,000.

The last month's salary before retiring could have reached $219,112 based on an

average 4% annual increase. Therefore, Table (#2) is still not making enough to keep pace with our investor's lifestyle.

More is needed. Note that no financial institutions offer rates of return of 15% on their annuity contracts. Yet, they could switch to using QQQ in the interest of their clients. So, why don't they? They offer more like 5% to 8% that gets you back to Table (#1), which clearly was not enough to retire on. A lesser growth rate would be even worse. Would you have guessed that many of these annuity funds use some form of closet indexing?

Since the salary should be increasing during all that time, why not add a small percentage of wages to the mix as an annual contribution? The money needed to feed your retirement fund has only one source: you.

Your fund's appreciation is something else. It depends on your investment decisions and the effective growth rate you can achieve.

Say you add an annual contribution of 3% of your salary each year. The first year would be $3,000, and this contribution would rise in sync with your wages. It represents a little boost but would still raise the overall portfolio value.

Contributions - 15% Return - Initial Cap. $100k - 3%/y - 20 Years

Contrib. Monthly	Return Rate	Total Contrib.	In 20 Years Total Value	Real CAGR	First Year Withdrawal	First Month Withdrawal
$100	15%	216,908	2,574,060	13.17%	128,703	10,725
$500	15%	312,908	3,172,956	12.28%	158,648	11,334
$1000	15%	432,908	3,921,576	12.31%	196,079	16,340

Table 3: First Year Withdrawal - Initial Cap. $100k - 3%/y - 20 Years.

The $500 contributions represented 6% of yearly salary, which would decrease over those 20 years to about 2.7% of salary just before retiring. For the last month before retirement, total contributions would amount to 5.7% of yearly wages. They would have started at 9% to reduce gradually and slowly to 5.7%. Therefore, the added contributions become barely noticeable. Nonetheless, these contributions provide a little boost, as seen in Table (#3).

We are improving, but still, we are not there. More is needed.

What Was The Objective Again?

We are starting to get there, but more is needed. We want a retirement account high enough to, at least, maintain the attained lifestyle at age 65. It means having a continuation, or better, than the previous year's salary. That was set at $200,000^{+}

to also compensate for inflationary pressures. It would take some 20 years to see one's salary double, implying an average 3.53% per year growth rate.

Moreover, we want this fund entering retirement to be of sufficient size to provide rising withdrawals over the years. If all we do is take 5% off the fund every year, that fund will deplete with time. Not only that, but the withdrawals will get smaller and smaller as the years go by.

A 5% withdrawal rate would slowly deplete the fund. However, even after having 30 successive declines of 5% each, there would remain some 21.46% of the fund at the end of the 30-year withdrawals (Check: $(1 - 0.05)^{30} = 0.2146$).

It would still translate to not having enough to do the job. Furthermore, you would have to include inflation in those calculations.

This would produce: $(1 - 0.05 - 0.03)^{30} = 0.0820$ which did not improve the picture. At 95 years old, you would have only 8.2% left of the fund you had at 65.

We have only 20 years to do this job. That is our deadline, and it does set limitations.

We could use the same trick as used in **How To Make It Anyway** where the proceeds of a $100,000 loan went into the retirement account. The loan came from outside sources to maintain independence from financial institutions and brokers. The interest on the loan was set at 7.5%, which would appear to also be reasonable in this case.

Using Table (#3) as base, and adding the $100k loan, generated Table (#4).

Contributions - 15% Return - Initial Cap. $100k - $100k Loan - 3%/y - 20 Years

Contrib. Monthly	Return Rate	Total Contrib.	In 20 Years Total Value	Real CAGR	First Year Withdrawal	First Month Withdrawal
$100	15%	316,908	3,560,321	12.86%	178,016	14,835
$500	15%	412,908	4,159,217	12.28%	207,961	17,330
$1000	15%	532,908	4,907,836	11.74%	245,392	20,449

Table 4: First Year Withdrawal - Initial Cap. $100k - $100k Loan - 3%/y - 20 Years.

With the $500 monthly contributions, we have reached the equivalent of the last year's salary for the first year of withdrawals. But it took a $100,000 loan to make it happen. And that would be a burden on one's salary. That is why the retirement account itself will be repaying this loan. The monthly loan payments will come from the retirement account. The numbers in Table (#4) include the loan repayments.

It makes the above scenario behave the same as Table (#3) since it did not change

the amount of money supplied by our investor. The retirement account pays back the loan and does not affect our investor's wallet or purse.

He or she is still making the monthly contributions as before and has the 3% of salary added to their fund each year. This way, they maintain their total contributions to their fund at less than 10% of income.

As was often said by Mr. Buffett: take out the savings first and live with the rest. And in doing so, you now have reached a level where your retirement could start with the same income level as your salary the year before retiring.

I expect you still want more. Once retired, you need your fund also to provide a rising income stream of significance. You want more than the years of austerity you will need to put in to have your fund grow faster.

Putting In More Initial Capital?

How about putting more down as initial capital? At 45, you should have more available than a 25-year-old. So, let's jack the initial stake to $200k and see the outcome.

Contributions - 15% Return - Initial Cap. $200k - $100k Loan - 3%/y - 20 Years

Contrib. Monthly	Return Rate	Total Contrib.	In 20 Years Total Value	Real CAGR	First Year Withdrawal	First Month Withdrawal
$100	15%	416,908	5,531,870	13.80%	276,594	23,049
$500	15%	512,908	6,130,766	13.21%	306,538	25,545
$1000	15%	632,908	6,879,386	12.67%	343,969	28,664

Table 5: First Year Withdrawal - Initial Cap. $200k - $100k Loan - 3%/y - 20 Years.

With Table (#5), even with the $100 monthly contribution, we have exceeded the last year's salary. While at the $500 contribution level, we would get about a 50% rise in revenue for the first year in retirement. We are finally getting there.

We have done all these operations using the base salary of $100k, making monthly contributions plus an annual contribution of 3% of wages. We seeded the account with $200k and took a $100k loan paid for by the retirement account.

The above was sufficient to get us to a level that could overcompensate for the lack of a salary once we retired.

I suggest going for more.

If we look back at equation (2), we can get a sense of where we could put more

pressure to increase overall performance. We need to add more alpha.

Anyone can pick QQQ instead of SPY, requiring only one decision. When you buy SPY or QQQ, it is the same operation. Only the ticker symbol changed.

However, using QQQ, you raised the expected average and long-term CAGR from 10% to 15%. You added 5 alpha points due to the stock selection process. An administrative decision technically bought those 5 alpha points. And with very little work, typing QQQ instead of SPY and placing the order once a month.

Table (#5) above shows you got there. That is, reach a level where your first year in retirement could have more revenues than your previous year's salary.

You should want more. You need your retirement fund to survive you. Your fund may have to last another 30^{+} years. That task still needs to be addressed.

OK, You Retired. Now What?

Let's start with Table (#5) at its $500 contribution level. Your fund, entering retirement, is at $6,130,766, and from it, you can get for your first year in retirement $306,538, which will start you on your first month with $25,545. It's not so bad, so let's see what happens for the next 30^{+} years.

Once Retired: 15% Return - Init. Cap: $200k - 5% Withdrawal

Age	Growth Rate	Init. Fund Value	Value 10 Years Later	First Year Withdrawal	First Month Withdrawal
65	15%	6,130,766	16,666,281	833,314	69,443
75	15%	16,666,281	45,186,357	2,259,318	188,276
85	15%	45,186,357	122,391,386	6,119,569	509,964
95	15%	122,391,386	331,388,603	16,569,430	1,380,786

Table 6: Expected Return: 15% - Init. Capital: $200k - Withdrawals: 5%.

What we can observe from Table (#6) is that the portfolio continues to grow at a decent pace. You have, on average, a 15% growth rate from which is taken 5% per year. Leaving your portfolio to grow at a 10% rate.

Year after year, your income stream from your retirement fund will grow at the same 10% rate as the portfolio. At age 75, your first-month withdrawal will be $69,443. And for the year: $833,314. We could classify that as sufficient income to live well.

At least, it is much better than what would have been the outcome from Table (#1). Furthermore, during all that time, you were building a legacy fund for the people you will leave behind if that could be a consolation.

You could also have extracted more should it have been something you wanted. The portfolio would grow by the rate difference if the withdrawal rate did not exceed the average return rate.

You technically lost a lot by starting at age 45. The 25-year-old had quite a head start, as shown in Table (#6). Nonetheless, you managed to raise your retirement fund to a sustainable and higher level than if you had worked well into your 80's.

Knowing your portfolio is growing at a long-term average of 15%, you could take as much out as your yearly income any year. Your fund is expected, on average, to stay at the same level as the year before. Should you need a boost, then consider your retirement fund your piggy bank. It is all under your control to do as you please.

What is also remarkable in this scenario is the rising income stream from your fund. It is as if you indexed your fund at a rate higher than the prevailing inflation. On average, your income stream is rising at 10% per year. You do not see that in any annuity contract. Furthermore, you could add or remove money from your fund anytime and for any amount you wanted; no restrictions, limits, or fees.

But Could You Still Do More?

Yes, but you will have to add a little work to it. Not much, mind you, but still some. And it can be planned anytime between the age of 45 and 65. However, doing it early would be the most profitable. A 25-year-old could also do these things should he/she have the means.

As was proposed in **How To Make It Anyway**, you could opt to use only the top 50 stocks of QQQ. This move would raise your average CAGR by a couple of alpha points over the period. Just like the top 100 stocks of NASDAQ have a higher average return than the top 500, the top 50 would average higher than the top 100, or the top 500, for that matter. Simple logic, easy to demonstrate.

So, let's start with Table (#5). We will use the same conditions: that is, the $200k initial stake and the $100k loan over the same 20 years. What will be changed is the growth rate. We will go for the 20% CAGR. Note that you will need more than just picking the top 50 stocks from QQQ. What follows will show the importance of seeking that additional 5 alpha points ($\alpha_2 = 0.05$).

Feeding the outcome of Table (#7) with its ending portfolio value of $16,237,393 for the $500 monthly contribution case into Table (#6) would generate Table (#8).

That 20% CAGR did make quite a difference. Your 65^{th} year would provide you with $811,870 for your first year in retirement. By age 75, the withdrawal for the year would be $2,201,267, starting with $183,439 for the month and each month in retirement, getting you more and more. You would see the average withdrawal rising

at about 15% per year.

Contributions - 20% Return - Initial Cap. $200k - $100k Loan - 3%/y - 20 Years

Contrib. Monthly	Return Rate	Total Contrib.	In 20 Years Total Value	Real CAGR	First Year Withdrawal	First Month Withdrawal
$100	20%	416,908	14,993,533	19.62%	749,677	62,473
$500	20%	512,908	16,237,393	18.86%	811,870	67,656
$1000	20%	632,908	17,792,219	18.15%	889,611	74,134

Table 7: First Year Withdrawal - Initial Cap. $200k - $100k Loan - 3%/y - 20 Years.

It is getting impressive. And yet, in your contributions, we stay below 10% of your salary level while building the fund. We stopped contributing to the fund after reaching 65. All the efforts were in those 20 years before retirement. Once retired, there were no out-of-pocket expenses. All the fund did was supply you with an increasing income stream.

Once Retired: 20% Return - Init. Cap: $200k - 5% Withdrawal - No Loan

Age	Growth Rate	Init. Fund Value	Value 10 Years Later	First Year Withdrawal	First Month Withdrawal
65	20%	16,237,393	44,025,339	2,201,267	183,439
75	20%	44,025,339	119,248,462	5,962,423	496,869
85	20%	119,248,462	322,880,577	16,144,029	1,345,336
95	20%	322,880,577	874,121,161	43,706,058	3,642,172

Table 8: Expected Return: 20% - Init. Capital: $200k - Withdrawals: 5%.

Starting with $62,473 for your first month in retirement is much better than the $900 you might have had from your $216,097 ending salary.

How About Even More?

Let's look at Table (#7) and equation (2) again. If we want to do more, we need to impact equation (2). We do not have more time; the fund-building phase was limited to 20 years. We have already put down $200k as initial capital and contracted a $100k loan. We even added a special annual contribution of 3% of salary.

For a person aged 45, are we pushing it too far or not enough?

We have set the loan payments from the investment account and still have to repay them. Without the loan, we could have performed better by raising the initial capital to $300k. That is reasonable, the total cost of the loan was set in **How To Make It**

Anyway at $315,874. So, at least you could save that. But then again, it did not bother your wallet; it was all paid out automatically by the retirement account.

We could add more capital to equation (2). Now we know what could be the impact of those funds, not only in the portfolio-building phase but also in its after-effects while in retirement.

We are in a compounding environment; the more years and capital you can put on the table will reverberate throughout your fund for as long as it is managed (not telling you that, in the end, you will die and leave everything to your loved ones).

With what was covered, you have more than you need to enjoy your retirement. Who needs the numbers of Table (#8) for their retirement years?

Hoping to hear you say: I do!

Therefore, let's go further.

You are in the recuperation mode for the lost years. So, let's push this machine. It requires more money to start with and a higher overall CAGR. The hardest to get might be the capital. It is what is often hindering people from creating their retirement fund.

All the stuff presented so far was administrative. It was more about setting up your fund's conditions and initial values alongside the procedures to follow over the years. Everything was relatively simple and could be done by hand if desired. But, getting above the 17% CAGR will require some work, just as getting more capital.

> *Whatever the chosen scenario, you want a portfolio that will survive all those years. And that is what QQQ is readily providing: long-term sustainability. It is also an easy path to follow.*

You set out to find a program that works with the QQQs or its equivalent that can raise above its underlying historical CAGR. Also, you will push for more simply by putting more money on the table.

We take Table (#7) and want to push it higher since its outcome will feed the fund after retiring at 65.

I will jump some steps and go directly to the point I want to make while leaving some space for you to go further.

You will figure out, at some point, that it is all a matter of choices. Most of those choices are to be made before you even start, and that is, even before you see any of the market's gyrations.

You are designing a long-term plan where you want to ensure you win.

> *Your interest is not in being the best. That has little appeal. You should want a smooth and fulfilling life with peace of mind where you can care for your loved ones and help others. You also want to enjoy it all before it is too late. It is not after that we should say: I should have. It is now where we can say: I will do this.*

Pushing The Machine

Let's push the machine. Raise the initial capital to $500,000. Raise the loan to $200,000, again at a 7.5% interest rate. You can put your funds as collateral for the loan, not with a broker. You do not want any margin calls. Get some other source for those funds. You would have $700,000 in assets as collateral for a $200k loan.

Your priority will be to pay back those loans. That should be easy since the retirement account will take care of that. All the tables thus far tell you you will make it. Not because you have exceptional talents but because you have structured your game to win and win big.

Do not harm anyone who would have put their trust in you. You should ensure you will pay back those loans in full at the agreed rates. There is no need to swindle anybody of what could be part of their retirement fund. So, at the very least, be honest and pay them back.

We will push further on the CAGR in this attempt to increase performance. You might want your program to generate more than 22% over the long term. There are programs to help you do that. They will also require a little work but are doable. For now, I will limit the CAGR to 22%. You can do even better.[8]

With these new initial conditions, let's redo Table (#7).

Contributions - 22% Return - Initial Cap. $500k - $200k Loan - 3%/y - 20 Years

Contrib. Monthly	Return Rate	Total Contrib.	In 20 Years Total Value	Real CAGR	First Year Withdrawal	First Month Withdrawal
$100	22%	816,908	50,828,585	22.94%	2,541,429	211,786
$500	22%	912,908	52,514,457	22.46%	2,625,723	218,810
$1000	22%	1,032,908	54,621,796	21.95%	2,731,090	227,591

Table 9: First Year Withdrawal - Initial Cap. $500k - $200k Loan - 3%/y - 20 Years.

We have raised the stakes considerably. On your first month of retirement, you are

[8] The 22% CAGR is only 2% above what Mr. Buffett has accomplished over the years.

expected to get $218,810 and $2,625,723 for the year. The most important point is you now will enter retirement with a fund valued at $52,514,457.

That will make quite a difference in the following years.

What would be the impact of starting your retirement with $52,514,457 in your account? Your investment program has been running for the last 20 years, and it should be able to do the same thing in the future, meaning keeping the overall return at the same average pace as before.

Make the initial stake for Table (#10) the $52,514,457 reached in Table (#9).

Once Retired: 22% Return - Init. Cap: $500k - 5% Withdrawal - No Loan

Age	Growth Rate	Init. Fund Value	Value 10 Years Later	First Year Withdrawal	First Month Withdrawal
65	22%	52,514,457	142,228,857	7,111,443	592,620
75	22%	142,228,857	385,089,460	19,254,473	1,604,539
85	22%	385,089,460	1,042,523,189	52,126,159	4,343,847
95	22%	1,042,523,189	2,822,223,570	141,111,179	11,759,265

Table 10: Expected Return: 22% - Init. Capital: $500k - Withdrawals: 5%.

By age 95, you would be a billionaire and have $4,343,847 to live on the first month of that year. I do not know about you, but you might not need that much beer. At least you will have enough for the groceries and a few extras. Your 5% withdrawal would amount to $52,126,159 for the year. It should cover it all.

Even though you started late (age 45), we took steps to catch up by responding to equations (2), (3), and (9).

We could not provide more time, but we could put more on the table and increase the CAGR a bit. Note that some have reached higher averages than the 22% presented here (see, for instance, Renaissance Tech with its Medallion Fund with its 39% CAGR over 30 years).

We have yet to cover going higher by putting more on the table using more initial capital or loans. Nor have we gone higher than the 22% CAGR presented in Tables (9) and (10). Both could go higher. The higher CAGR will need better programs with added alpha and procedures to provide those rates. Nonetheless, they are reachable, and some have achieved them.

How About Our 25-Year-Old?

In **How To Make It Anyway**, we stopped with an initial capital of $200k and a $100k

loan. What if we applied the same scenario as in Table (#9) with its $500k in initial capital with a $200k loan and a 22% average CAGR?

It should produce the following table where the starting age was changed to 25 compared to Table (#9).

Contributions - 22% Return - Initial Cap. $500k - $200k Loan - 3%/y - 40 Years

Contrib. Monthly	Return Rate	Total Contrib.	In 40 Years Total Value	Real CAGR	First Year Withdrawal	First Month Withdrawal
$100	22%	1,044,480	3,975,736,758	22.89%	198,786,838	16,565,570
$500	22%	1,236,480	4,109,374,272	22.47%	205,468,714	17,122,393
$1000	22%	1,476,480	4,276,421,166	22.05%	213,821,058	17,818,422

Table 11: First Year Withdrawal - Initial Cap. $500k - $200k Loan - 3%/y - 40 Years.

The initial conditions of Table (#11) were for 40 years (our 25-year-old). It made him/her a billionaire before retiring at 65. It was not the monthly contributions that made that much of a difference. It was the $700k on the table at a 22% CAGR for 40 years. Nonetheless, contributions counted since they were also compounding over those 40 years.

Table (#11) is the part the 45-year-old missed: the last 20 years of compounding of our 25-year-old. Here is a rough estimate of what our 45-year-old missed based on data from Table (#11): $\$700,000 \cdot [(1+0.22)^{40} - (1+0.22)^{20}] = \$1,955,576,082$.

As shown, time has value. But, it is not only that. The 45-year-old also missed the impact it could have had on the retirement years. Out of curiosity, let's do the retirement years based on Table (#11).

Once Retired: 22% Return - Init. Cap: $500k - 5% Withdrawal - No Loan

Age	Growth Rate	Init. Fund Value	Value 10 Years Later	First Year Withdrawal	First Month Withdrawal
65	22%	4,109,374,272	22,227,579,176	1,111,378,959	92,614,913
75	22%	22,227,579,176	120,229,599,496	6,011,479,975	500,956,665
85	22%	120,229,599,496	650,326,043,251	32,516,302,163	2,709,691,847
95	22%	650,326,043,251	3,517,636,724,848	175,881,836,242	14,656,819,687

Table 12: Expected Return: 22% - Init. Capital: $500k - Withdrawals: 5%.

Apply the $4,109,374,272 of Table (#11) ($500 contribution case) using the same calculations as in Table (#10). It would give us Table (#12).

We could be impressed by Table (#12), but that is the result of 80 years of compounding. It is why Table (#11) gains importance. That is why the fund-building phase is to build up the fund as much as possible. And then let it ride as in Tables (10) or (12).

This exercise also says what the person starting at age 45 is missing. It gives the cost of having delayed 20 years before starting his/her retirement fund. Will someone 80 years from now be a tri-trillionaire? Probably. At the very least, Table (#12) shows the power of compounding.

In all this, we have yet to request something from the markets, try to predict what it would do, or set unrealistic goals. Anyone could do all the procedures if they had the resources, meaning the capital, the increased CAGR, and time, which might be the most critical element of the group. Also, at this stage, a more elaborate program would be required to sustain that 22% CAGR. As the fund grows, our investor might need help with the administrative stuff.

> *The ability to find and obtain the initial capital might be the greatest talent since that will make the biggest difference over the long term.*

It is not knowing the market that matters, but understanding and knowing the impact of equation (2) and what it entails. It is a tool to use in planning and executing for the long term.

One could do even better than the astronomical numbers of Table (#12). Are you up for the job? It is your turn. It will be a long journey.

How far are you willing to go? How far can you go within your time and capital constraints? Knowing a 15% CAGR using the QQQs is readily available, with very little work. Will you at least do that?

Pick the level you want to reach, and then go for it. To get the higher CAGRs, design your own program to extract what you want from the markets. Some programs can go higher than 22%, the highest presented here.

What you are playing with is the big picture. The long-term stuff. The stuff that remains no matter what happens. Technically, all **Catching Up On Your Retirement Fund** does is again make a bet on America, a long-term bet at that.

As can be seen in the following chart, stocks have outperformed other asset classes since at least 1926. That is almost 100 years on that chart.

Similar charts can show the same over the last two hundred years.[9] There has been a long-term uptrend for other asset classes, but the highest has been stocks.

[9] For instance, see figure #2 in **Make Yourself A Glorious Retirement Fund**.

This paper also proposes to use stock ETFs for their staying power and potential above-average returns.

Any combination of these curves with stocks will produce less than with stocks alone.

Your business, should you undertake the task, is to build the highest valued portfolio within all your constraints, including within the years before retirement. And it should start by using assets that can appreciate the most to give you a better chance at reaching your goals.

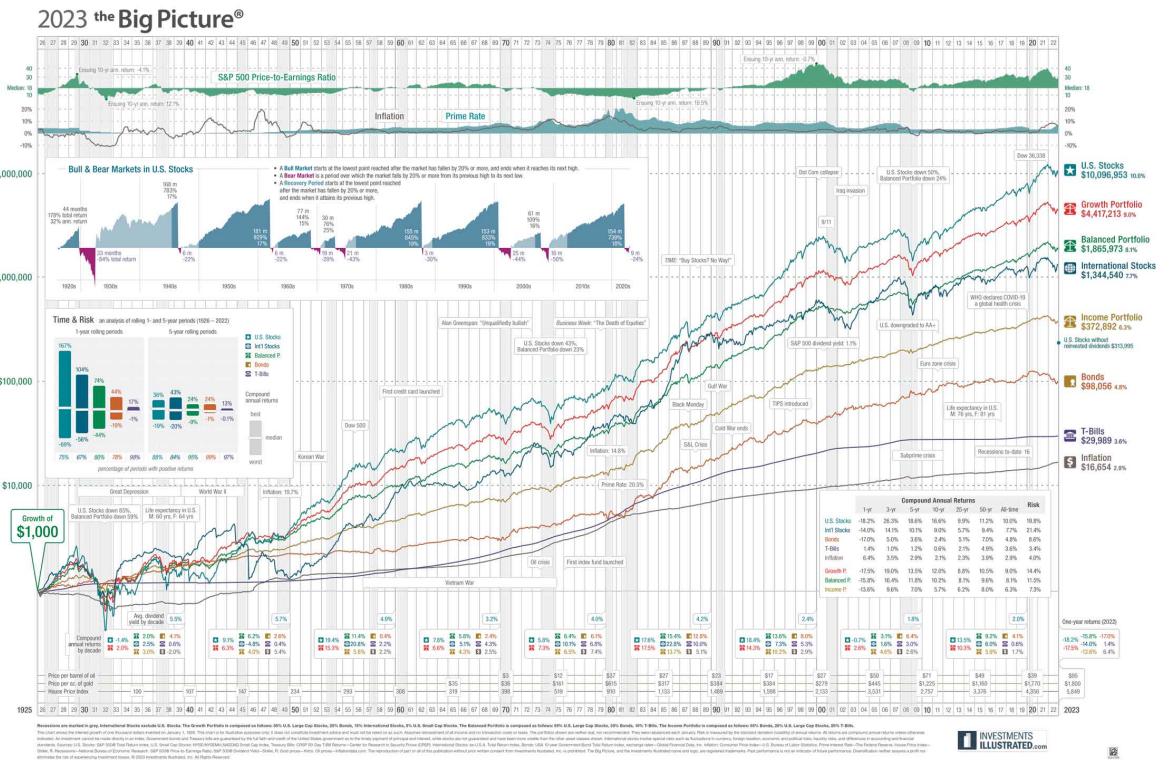

Figure 1: The Big Picture - From 1926 Onward

(*Get a larger version of this chart at* Investment Illustrated).

Millions of people could use this paper as a template, a blueprint on what to do, or to determine what can or needs to be done. You do this, and it might generate this or that. But you need a fundamental look at the big picture. What you should see in the above chart is the lives of millions of people resumed in a few lines. Those lines also translate into the wealth of a nation.

Look at the big picture. Over 20 years, the wiggles from day to day in price or econometric time series do not matter much. The long-term trend of things matters since we usually expect them to continue their way. Any regression line over the data can tell you that. It does not tell us what will be tomorrow, but it can tell us what to expect over the next decade or two.

You can always draw a line between two points, which is what the future value formula does. We could have used a straight line between the endpoints, but the exponential nature of the curve made it preferable to use an exponential function like the future value formula.

It is what you are interested in when designing a retirement fund. What is the endgame? And how are you going to get there?

It is time for you to reconsider what was presented in this paper. See how far you can go and determine the tools you will need to get there. Let equations (2) and (3) be your guide. Understand the nuances, measure the doubling time, and view the impact of the last few doubling times.

You will need patience and perseverance to win in this retirement fund-building thing.

You might also need conviction. The conviction that what you do or will do is an extension of your thinking. Saying you need to believe in yourself first. And based on those beliefs, let your convictions mold the investment system you need.

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