



A US Treasury issued fungible cryptocurrency – the Interest Rate Reduction Token – not only reduces the outstanding student debt, but also makes a profit for the US Government

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Abstract

Student loans make up greater than \$ 1.6 Trillion of outstanding debt owed to the US Government. There are no ideas; nor is there any consensus, as to how to address this long-standing challenge. *Ad-hoc* suggestions range from tax-payer bailouts euphemistically termed ‘debt-forgiveness’ to punitive measures. We propose an idea that not only decreases the debt burden on the student - therefore discouraging delinquency - *but also generates revenue for the Government*. We suggest that the Treasury issue a fungible cryptocurrency - we tentatively term it the Interest Rate Reduction Token (IRRT) - that will allow a student to decrease the interest rate on their loan. These tokens can be turned into the Treasury by the student at any time during the loan term period for an interest rate reduction. In our version, we propose an interest rate reduction of 1 basis point, or 0.01% per token. Thirty tokens are airdropped (given gratis) to the student every year for the term of the loan, resulting in a 0.3% reduction in the interest rate on the amount owed from that time forward. The tokens are also floated on the open market. We anticipate that the tokens will increase in value - appreciate - because parents/guardians of children that are not yet of college age will buy them as a hedge against interest rate increases in the future. We calculate that 3.87 billion tokens will need to be created - double those that will be airdropped. The Treasury will float ¼ of the tokens; 967.5 million on the open market, and retain the remaining quarter. Our plan creates an initial (and the only) liability of \$38.7 billion for the Treasury. We calculate that - at a conservative appreciation of 5%, the lowest percent return on investment (ROI) for the Government would be 62.9% at the end of 10 years.

Keywords

Cryptocurrency, Federal student loans, Interest rate reduction, Federal reserve, Treasury, Fungible cryptocurrency, 529 Plan, Prepaid tuition plan, Student loan repayment, US Government debt

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Introduction

According to (1), there were an average of 16.8 million students enrolled in undergraduate degree programs per year, calculated for the years 2010 to 2020. The percent of those students who took out Federal student loans was 38.4% (2), representing 6.45 million students who took out loans per year. The average student loan amount per student was \$30500 (3) and the average student loan repayment length was 10 years. The interest rates for Federal student loans during the period from July 2023 through July 2024 was 5.2% (4). According to the Education Data Initiative (5), one out of every ten Americans has defaulted on a student loan, and 5% of all student loan debt is in default. An average of 7% of student loans are in default at any given time. At the time of writing of this manuscript, President Biden has so far ‘forgiven’ \$169 billion in student debt, and is likely to ‘forgive’ more (6).

This paper suggests that the US Treasury issue a cryptocurrency - termed the Interest rate reduction token (IRRT) - that will allow students to reduce their Federal student loan interest rate, either over the entire period of the loan, or sporadically, depending on when and how many tokens they choose to turn in to the treasury for the interest rate reduction. For Federal student loans, there is no penalty for prepayment and additional principal payments can be made at any time. The Treasury will hence require 1935 million (1.935 billion) tokens for 6.45 million students at 300 tokens per student for a period of 10 years. Note that the number of students is not multiplied by 10 because tokens are being turned into the

treasury, hence the same tokens can be used for succeeding batches of students (this is explained in detail later). We recommend that the treasury create 3.87 billion tokens (double that required) at a face value of \$10 each; thus creating a liability of \$38.7 billion in the first year - and probably for ever; i.e. never after. Out of these 3.87 billion tokens created, 1.93 billion tokens will be airdropped to 6.45 million students per year (the first year). Each student will be airdropped (given gratis) 30 tokens at the beginning of each year, for an anticipated total loan period of 10 years, or unless the loan is paid off; whichever is lesser.

The Interest Rate Reduction Token (IRRT) is a new paradigm that helps students pay back their Federal student loans, while at the same time earning revenue for the Government. This revenue not only constitutes the paid back principal and interest on the loan; but also the book surplus generated from the appreciation of the IRRT. This appreciation occurs due to the propensity of future student loan applicants - and their parents and guardians - to guarantee themselves (the students) an interest rate that does not rise if Federal student loan rates increase at any future time. They can avail themselves of this facility by either selling the (appreciated value of the) IRRT on the open market and using the proceeds toward loan repayment; or by turning in the airdropped tokens to the Treasury for an interest rate reduction on their student loans that is in proportion to the amount of tokens turned in (or a mix of both). It should be noted that 30 IRRT are airdropped to the student at the beginning of every year until either for the term of the loan (usually 10 years) or until the

student loan has been paid off; whichever is earlier. Each IRRT is priced at \$10.0 per token; and each IRRT guarantees an interest rate reduction of 0.01% when turned into the treasury. Hence, by default, a student is guaranteed an interest rate reduction of 0.3% per year, at the beginning of each year, for the term of the loan if they turn in the airdropped tokens immediately to the treasury (see Table 2).

The appreciation of this fungible asset (IRRT) also occurs because parents or guardians of children that are not yet of an age to attend college find it advisable to buy these tokens on the open market as a hedge against inflation and higher interest rates. In that respect, the proposed paradigm is different from a 529 plan because holders of these plans can lose money. In addition, students are less likely to qualify for Federal aid anyway if their parents or guardians are enrolled in a 529 plan. Holders of the IRRT can also lose money if the token decreases in value; but they are still guaranteed an interest rate reduction depending on how many tokens they turn into the treasury. In a sense, the IRRT paradigm can be considered most similar to a prepaid tuition plan where parents or guardians can buy education credit hours at today's tuition rates to pay for their child's tuition in the future; the advantage being that the vagaries of the market are eliminated from the equation. There is one significant difference; the prepaid tuition plans are often underwritten by the state and the state can lose money if the assets (such as the stock market) they invest this money in, depreciate or decline. In a sense therefore, the state takes

over the risk of investing from the individual, while at the same time guaranteeing the latter, a fixed income (the bought credit hours are good anytime in the future regardless of how much tuition inflation occurs). Since tuition inflation historically has been significantly greater than long term equity returns, this is partly the reason why there are not many of these prepaid tuition plans available; the limited number that are still functioning, limit enrollment to in-state residents (7).

Conceptually, the IRRT methodology can also be considered analogous to paying down 'points' on a home mortgage to reduce the interest rate (8). The difference is that in the IRRT paradigm, these 'points' can be paid at any time during the loan term period - not just at loan origination. The 'points' paid by turning in the IRRT tokens into the Treasury grant an immediate reduction in the rate of interest that is a function of the amount of tokens turned in. Each token reduces the interest rate by 0.01%.

The IRRT has a high probability of appreciating over the long term because it is a hedge against uncertainty, the interest rate reduction per token is guaranteed by the US Government and does not change, token inflation (the amount of tokens increasing year-on-year) is expected to be minimum and kept in check by the number of tokens floated by the Government (similar to the M2 money supply) and by the tokens returned every year for the interest rate reduction. Note that the Treasury can sell the tokens on the open market at the prevailing price to regulate the supply of tokens as well as to generate profit.

Table 1. Treasury profit and ROI for lent tokens at a token appreciation of 5% per year

	Linear appreciation			Logarithmic appreciation			Exponential appreciation		
Year	Dollar value	Surplus	%ROI	Dollar value	Surplus	%ROI	Dollar value	Surplus	%ROI
1	2.03 X 10 ⁹	9.68 X 10 ⁷	5.0	5.88 X 10 ⁹	3.94 X 10 ⁹	204	2.12 X 10 ⁹	1.82 X 10 ⁸	9.4
2	2.13 X 10 ⁹	1.98 X 10 ⁸	10.3	6.73 X 10 ⁹	4.79 X 10 ⁹	247	2.33 X 10 ⁹	3.85 X 10 ⁸	19.8
3	2.24 X 10 ⁹	3.05 X 10 ⁸	15.8	7.22 X 10 ⁹	5.28 X 10 ⁹	273	2.55 X 10 ⁹	6.07 X 10 ⁸	31.3
4	2.35 X 10 ⁹	4.17 X 10 ⁸	21.6	7.57 X 10 ⁹	5.64 X 10 ⁹	291	2.79 X 10 ⁹	8.50 X 10 ⁸	43.8
5	2.47 X 10 ⁹	5.35 X 10 ⁸	27.6	7.84 X 10 ⁹	5.91 X 10 ⁹	305	3.06 X 10 ⁹	1.12 X 10 ⁹	57.6
6	2.59 X 10 ⁹	6.58 X 10 ⁸	34.0	8.07 X 10 ⁹	6.13 X 10 ⁹	317	3.35 X 10 ⁹	1.41 X 10 ⁹	72.6
7	2.72 X 10 ⁹	7.88 X 10 ⁸	40.7	8.25 X 10 ⁹	6.32 X 10 ⁹	326	3.67 X 10 ⁹	1.73 X 10 ⁹	89.1
8	2.86 X 10 ⁹	9.24 X 10 ⁸	47.7	8.42 X 10 ⁹	6.48 X 10 ⁹	335	4.02 X 10 ⁹	2.08 X 10 ⁹	107
9	3.00 X 10 ⁹	1.07 X 10 ⁹	55.1	8.56 X 10 ⁹	6.62 X 10 ⁹	342	4.40 X 10 ⁹	2.46 X 10 ⁹	127
10	3.15 X 10 ⁹	1.22 X 10 ⁹	62.9	8.69 X 10 ⁹	6.75 X 10 ⁹	349	4.82 X 10 ⁹	2.88 X 10 ⁹	149

194 million tokens are lent to 6.45 million students (at 30 tokens in the first year per student). These tokens have a face value of \$10. The total amount of dollars lent in the first year is hence \$1.94 billion. At a rate of 5% per year, their value; at the end of 10 years; increases to \$3.15 billion, \$8.69 billion and \$4.82 billion when calculated linearly, logarithmically and exponentially respectively, generating a percent return on investment of 62.9%, 349% and 149% respectively.

Scenario 1

The student is airdropped 30 tokens at the beginning of every year until the loan is repaid or for the term of the loan, whichever is earlier. The student turns all the tokens into the treasury immediately after they have been airdropped, thus guaranteeing a 0.3% interest rate reduction on the principal outstanding at the beginning of that year. This is somewhat different from the way the amortization schedule is calculated (9) because the interest

rate changes at the beginning of each year (see supplementary file tab titled scenario1). On a borrowed amount of \$30,000, the interest amount saved in this scenario is \$541.86.

Scenario 2

In this scenario, the tokens appreciate *linearly* over the period of the loan (typically 10 years). The appreciation of the token can be from 10% to 100% over the loan term (see Table 2). Depending on the percent appreciation, the student pays minimum interest according to Table 2. For example, when the appreciation is 30%, the total interest paid is minimized when 0 tokens are turned into the treasury for an interest rate reduction and all the 30 tokens (at their appreciated value) are applied to the reduction of principal at the end of each year. The table shows that, it requires 7 years to pay off the loan amount (see see supplementary file tab titled scenario 2). It can be seen that this ratio changes depending on how much the token appreciates.

Scenario 3

In this scenario, the tokens appreciate *logarithmically* over the period of the loan. Again, the appreciation of the token can be from 10% to 100% over the loan period (see Table 2). Depending on the percent appreciation, the student pays minimum interest according to Table 2. For example, when the token appreciation is 30%, the total interest paid is minimized when 8 tokens are turned into the treasury every year for an interest rate reduction and 22 tokens (at their logarithmic appreciated value) are applied to the reduction of principal at the end of each year. The latter is transacted by selling the tokens on the open market at their logarithmic appreciated value; then using the proceeds to pay off the corresponding loan amount at the end of the year. The table shows that, it requires 5 years to pay off the loan amount (see see supplementary file tab titled scenario 3). It can be seen that this ratio changes depending on how much the token appreciates.

Scenario 4

In this scenario, the tokens appreciate *exponentially* over the period of the loan. The appreciation of the token can be from 10% to 100% over the loan period (see Table 4). Depending on the percent appreciation, the student pays minimum interest according to Table 2. For example, when the appreciation is 30%, the total interest paid is minimized when 0 tokens are turned into the treasury for an interest rate reduction and 30 tokens (at their exponentially appreciated value) are applied toward the reduction of principal at the end of each year. The latter is transacted by selling the tokens on the open market at their exponentially appreciated value; then using the proceeds to pay off the corresponding loan amount at the end of the year. The table shows that, it requires 8 years to pay off the loan amount (see see supplementary file tab titled scenario 4). It can be seen that this ratio changes depending on how much the token appreciates.

Table 2. Ratio of [Tokens turned in for interest rate reduction at the beginning of each year] to [tokens exchanged on the open market and the proceeds used applied toward principal payoff] that results in minimum interest on student loan for various token appreciations.

Percent appreciation	Linear appreciation		Logarithmic appreciation		Exponential appreciation	
	Ratio*	Loan payoff time (years)	Ratio*	Loan payoff time (years)	Ratio*	Loan payoff time (years)
10	30:0	10	0:30	7	30:0	10
20	0:30	8	0:30	5.8	30:0	10
30	0:30	7.5	8:22	5	0:30	8
40	0:30	7	17:13	5	0:30	7.2
50	0:30	6.2	22:8	5	0:30	7
60	7:23	6	25:5	4.8	0:30	6.5
70	14:16	6	27:3	4.5	N/A	N/A
80	19:11	6	28:2	4	N/A	N/A
90	22:8	6	N/A	N/A	N/A	N/A
100	24:6	6	N/A	N/A	N/A	N/A

*Ratio of [Tokens turned in for interest rate reduction at the beginning of each year] to [tokens exchanged on the open market and the proceeds used applied toward principal payoff] is calculated so that the lowest total interest is paid upon completion of loan repayment. See the supplementary file for calculations.

Discussion

Appreciation required for interest free loan repayment

It can be seen that (supplementary file) an appreciation of 52.89%, 22.88% and 64.74% in the price of the token per year is necessary for the linear, logarithmic and exponential models respectively so that - when the proceeds of the appreciated tokens (exchanged on the open market) are applied toward additional principal at the end of each year, the interest rate on the student loan effectively becomes zero. In other words, with these appreciation percentages (for different models), the student effectively only pays back the principal. It takes 5 years for the linear and exponential models and 4 years for the logarithmic model for the student to pay back the loan at the above rates of token appreciation (supplementary file). The logarithmic model is the most advantageous from the student's point of view, then followed by the linear and exponential models because it requires only approximately half the appreciation (22.88%) to pay back the loan without incurring any interest.

Preservation of principal (value of tokens in terms of interest rate reduction)

Regardless of whether the token appreciates or depreciates, one token is *guaranteed* to decrease the interest rate by 1 basis point upon being turned in to the US Treasury. This is similar to savings deposits in banks being insured to a certain amount by the Federal Deposits Insurance Corporation (FDIC) (10).

Preventing speculation

The IRRT may morph into a speculative asset and may be hoarded (much like Bitcoin) when floated on the open market. Such a scenario will erode projected profit to the Treasury since the Treasury will be forced to issue new tokens; thereby creating more Federal debt. To prevent such a scenario from materializing, a limit may be placed on how many IRRT tokens may be bought in the open market (much like the US Treasury limits US bonds to \$10000 per year per individual) (11). Furthermore, these limits may be designed to be inversely proportional to the Annual Gross Income (AGI) reported on the individual tax return. In addition, to dissuade long term hoarding, a 20% Capital-Gains Tax may be levied even on *unrealized gains* on IRRT or when IRRT is exchanged for other cryptocurrency tokens (12). There may doubtless be other methods to prevent hoarding which can be implemented as required. As a hypothetical example, investors who buy IRRT but do not foresee using them for a student interest rate reduction can turn in the tokens to the Treasury at their face value (for a loss against their appreciated value). In return, they are compensated by a tax deduction or credit that is proportional to the loss. This will ensure that the US Treasury is not forced to issue new debt because of the hoarding of IRRT. It should be noted that there is a fine line between disincentivizing IRRT as an investment and discouraging its hoarding, because, while inflating the token is in the students' and in the Treasury's interest,

disproportionately shrinking its supply in the market is not.

Comparison with other fungible cryptocurrency tokens

The IRRT can be freely exchanged on the market. The exchange rate against any other cryptocurrency [for example, against Ethereum (ETH)] is determined by the market forces of demand and supply. For example, the token when issued first (at a value of \$10 per token) will be equivalent to $(10/2670) = 0.0037$ IRRT/ETH (ETH price as of August 12, 2024). One of the maximum appreciation periods of ETH was from \$600 on 7th December, 2020 to \$3900 on 7th May, 202, an appreciation of 1320% (13). A conservative appreciation of 5%; and even that of 100% (an order of magnitude less than that of ETH) hence does not seem to be out of the realm of possibility for the proposed IRRT.

Additional considerations

It may be argued that low-income families and students – who anticipate entering college in the distant future – may not have the money available to buy the tokens (which may already be appreciated) in the open market. This argument is fallacious however, since students who take out loans do not have the money to pay for tuition themselves and taking out a Federal loan automatically entitles them to the IRRT airdrops, thereby not necessitating them to buy those tokens in advance of their college entry year. However, those low income families and students who do buy the tokens may be given additional consideration for approval of their Federal student loan applications.

The IRRT will take time to appreciate. This means that introductory batches of students will not be able to avail of its appreciated price to be able to engage in the ‘mix-and-match’ scenarios as presented in the ‘Ratio’ column of Table 2 for the maximum benefit. These benefits will amplify when the token has been in use for some time and has had time to find its inflationary equilibrium. However, the interest rate reduction capability of the token manifest on day 1 and will remain constant, regardless of appreciation and/or the current interest rate as determined by the FED.

Limitations

We realize that that Treasury issuance of cryptocurrency (14) needs to be carefully thought out, may need legislative and regulatory changes, congressional and senate approval and fairly tight oversight by relevant committees before issuance and allowing a free float. We also do not know if this decrease in the student loan interest rate over the entire term of the loan is admissible and/or calculable within the Treasury and/or Federal Reserve guidelines and/or remit. However, the concept of cryptocurrency, blockchains and the related *Fintech* ecosystem has now been time-tested and has moved on from its admissibly radical revolutionary and idealistic origins (15). This is becoming more evident as cryptocurrency trading becomes more mainstream; with Bitcoin futures Exchange Traded Funds (ETFs’) already approved (16) and comparable ETFs for Ethereum awaiting approval in the near future. Furthermore, at least one country (El Salvador) has explicitly adopted Bitcoin as part of its macroeconomic policy (17). In the light of these precedents, we believe it makes

sense to adopt a proactive approach and aggressively pursue the proposed avenue articulated in this manuscript. The beauty of this approach is that it not only helps students pay off debt but also forecasts a profit for the Treasury in the process. The proposed plan could not be farther from current ‘bail outs’ at the taxpayers’ expense and creating more debt for future generations.

Macroeconomic policy formulation requires deep thought. The proposed plan of action outlined in this paper, seems to us, conceptually sound but will need – as previously mentioned – much time and thought to craft execution and implementation details (the devil is after all; in the details), mull over all possible financial and numerical scenarios, create accounting and book keeping procedures, predict and find ways to control market volatility upon float, conform to regulations and laws, and foresee any unintended consequences.

Conclusion

The non-affordability of a college education dilutes the premise of equal opportunity and meritocracy. While Federal student loans offer respite, student loan recipients are often saddled with interest payments spread over the majority of their working lives, limiting them to getting by; rather than to getting ahead. Loan delinquencies add to Federal debt and increase the debt burden on future generations. We propose an idea that not only decreases the debt burden on the student - therefore discouraging delinquency - *but also generates*

revenue for the Government. We suggest that the Treasury issue a fungible cryptocurrency - we tentatively term it the Interest Rate Reduction Token (IRRT) - that will allow a student to decrease the interest rate on their loan. These tokens can be turned into the Treasury by the student at any time during the loan term period for an interest rate reduction for the subsequent period of the loan. In our version, we propose an interest rate reduction of 1 basis point, or 0.01% per token. Thirty tokens are airdropped (given gratis) to the student every year for the term of the loan, resulting in a 0.3% reduction in the interest rate on the amount owed from that time forward. The tokens are also floated on the open market. We anticipate that the tokens will increase in value - appreciate - because parents/guardians of children that are not yet of college age will buy them as a hedge against interest rate increases in the future. Our plan creates an initial (and the only) liability of \$38.7 billion for the Treasury. We calculate that - at a conservative appreciation of 5%, the lowest percent return on investment (ROI) for the Government would be 62.9% at the end of 10 years.

The fine-print, mechanics, algorithms and management of this approach/policy can be worked out in detail and can even be put to a referendum. The paradigm can also be introduced as a subset of the Central Bank Digital Currency’s (CBDC) Digital Dollar initiative. The IRRT paradigm represents a feasible method to address and solve the student loan debt crisis.

Supplementary files and calculations

<https://github.com/SharveshRamakrishnan/IRRT-Scenarios.git>

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