DEPOT: A DECENTRALIZED AUTONOMOUS PENSION

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Abstract

Pension systems play a crucial role in the economic and political development of countries and help to maintain purchasing power for decades. Nevertheless, many people do not have access to good pension systems. That's why we propose the development of a blockchain-based, decentralized and globally available pay-as-you-go pension system. We show how redistribution of contributions towards pension payments works and how voluntary participation in the pension system is incentivized through transparent, fair and unchangeable processes. Creating a premium for the last generation of the pay-as-you-go system ensures that all participants receive a pension and, in addition, creates an incentive to participate in the pension system.

Note: This work is still under active research and new versions of this paper will appear at http://asure.network. For comments and suggestions, contact us at research@asure.io.

Keywords

Blockchain; Decentralization; Cryptocurrencies; Pension; Retirement

1 Introduction

Development over the last 150 years have led to a shift in old-age provision from the family association to larger groups (state, collective of the insured community). Pension systems today are an essential part of the economic development of states and yet, there are 4.1 billion people without access to social security. [1]

There are a variety of pension systems. For instance, in Germany pension systems are categorized into the three pillars of old-age provision. The three pillars include statutory, occupational and private pension systems. Many countries use a similar classification. As a general rule, the more pension systems a person participates in, the better he/she is protected against old-age poverty due to risk diversification.

Financing. Occupational and private pension systems finance themselves through the funding method and generally follow the performance principle: those who contribute a lot to the pension system also get paid a lot when they get old.

Statutory pension systems finance themselves through the funding method, the pay-as-you-go method or a hybrid of the funding and the pay-as-you-go methods. In addition to the performance principle, many statutory pension insurance policies also follow the principle of solidarity. In Germany, for example, parental leave can be counted as contribution years in pension insurance.

Both the funding method and the pay-as-you-go method have proven their worth in the past. Both financing methods have their strengths and weaknesses, and opinions differ widely as to which financing method is the better one.

1.1 Challenges of old-age provision

Good old-age provision is hard to build. In the following we will discuss some of the challenges of old-age provision and existing pension systems.

Demographic change. Life expectancy is increasing all over the world, and especially in industrialized nations, the proportion of people over the age of 60 is growing and the problem of retirement provision is becoming more pressing. The burden on pension systems, and in particular PAYG-funded pension schemes, is rising sharply as fewer contributors become available to provide pension payments. The population of developing countries will increase in the future, and thus the problem of retirement provision. For example, the United Nations estimates that by 2050, approximately two billion people will be over 60 years of age, of which as many as 80% live in developing countries [2].

Inflation. In economics, inflation refers to a general and sustained increase in the price level of goods and services (inflation), equivalent to a reduction in the purchasing power of money. The consumer price index (CPR) is most frequently used to measure inflation. The index is calculated with the help of a shopping basket, which is determined in a certain year (base year) representative of an average household. [**?**] At an inflation rate of 2%, this means from $ 1,000 today, which in 2040 has only a purchasing power of $ 672.97 in 2040. For this reason, it is important not to store the values, but to try to systematically preserve purchasing power by means of a pay-as-you-go system.

Mismanagement and fees. Compared to pay-as-you-go systems, funded systems are very strongly subject to inflation. For this reason, different investment options are used, these have a higher workload and resulting administrative costs the customer must bear. Another variable is the higher volatility, it increases the chance that the investments are made well as well as the risk that bad investments can be made.

Instrumentalization by politics. Social security funds are in the hands of politicians and bureaucrats and are perfect for redistributing revenue. This circumstance allows politicians to use social insurance for electoral promises by redistributing them in favor of a group of voters, thus ensuring the next re-election. In addition, governments benefit from more money, power and prestige through social security administration. [5]

Last generation. With pay-as-you-go systems, it is important to ensure that there is a next generation, if this is not the case, the last generation will lose the most in the system as nobody is left to pay their pensions.

Residual risk. We do not want to go into detail about other risks such as economic risk, credit risk, interest rate risk, volatility, currency risk, psychological market risk, liquidity risk, tax risks, information risk, country and transfer risk. All pension systems are not risk-free, this is in the nature of risk-oriented systems, the solutions are based on risk minimization, through various approaches such as risk diversification, risk taking by the country, alternative pensions such as real estate and passive income, a pension plan can be well implemented.

1.2 Our approach: Decentralized pension

The invention of the Ethereum blockchain with its build-in Turing complete programming language, made it possible to write smart contracts and decentralized applications that create their own arbitrary rules of ownership, transaction formats and state transition functions. [**?**] Since Ethereum, many more blockchains ([**?**], [**?**], [**?**]) with build-in Turing complete programming languages and different trade-offs are available.

Our approach of a decentralized pension is to provide a state transition function of a **pay-as-you-go** financed pension system as a smart contract and therefore inherit many exiting properties of the underlying blockchain-technology.

Through our **preliminary work** and engagement with pension systems, we've created the **requirements** to a decentralized pension model that define **target audience** and use the **pay-as-you-go** basis and the **incentivation** methods and the resulting **benefits** are described in this chapter.

1.2.1 Requirements

We talked to experts from insurance and pension systems to develop a model that works decentrally.

Since geopolitical reasons make it impossible for us to attach importance to these conditions, we have developed alternative solutions. We create incentives in order to help people to pay contributions. With the contribution value we lead a reference contribution rate representative of members which dynamically adapts to the behaviour of the members.

The most important requirement was to enable the storage of purchasing power. Another important factor is to make risk sharing in the community as fair as possible for the target groups for whom it is suitable.

1.2.2 Target group

The target groups for a decentralized pension system are people:

- without pension access
- where there is a pension, but
  - it is corrupt
  - it is intransparent
  - the country suffers from high inflation
  - too high administrative costs
  - no good investment strategies in the pension system
  - less trust in the government, politics and pension system
- which as a further supplement
  - first mover, technology lover
  - spread their risks over several risk classes
  - want to use a decentralized pension solutions
  - who live as a digital nomad
  - looking for alternatives

1.2.3 Pay-as-you-go system

Pay-as-you-go systems have great advantages in that they can be introduced quickly and no capital needs to be built up.

The goal of pay-as-you-go is to store the purchasing power of the system in the economic sense, to the pension points per deposit are stored as a representation of the contribution and not the contribution value. At retirement, the pension contribution is calculated on the basis of these points at the reference value[1].

1.2.4 Incentives

Decentralized solutions such as decentralized pensions can only grow organically over the years thanks to a well thought-out incentive structure. Since the use is left to a user, it is comparable with Bitcoin [4], as the system is only controlled by trust and incentives.

[1] Example: In germany, it is linked to 18.6% of the salary in 2019.

1.3 Our contribution

As an inspiration we have oriented ourselves on the German pay-as-you-go system. After having implemented the German pension system on Ethereum in outline, we have seen the challenges that needed to be solved.

In addition to the challenges, we also saw opportunities to improve the system, such as the degree of automation and the creation of new incentives that are not dependent on middlemen.

There are many advantages that a decentralized pension system can offer, the most important of which we will discuss here.

Decentralized and Autonomous. With the help of blockchain technology, the system is available decentralized and this allows 24/7 access worldwide. There are no employees required to operate the system and this reduces administration costs enormously.

Reduces costs. Due to the automation and decentralized operation, there is no additional cost apart from the transaction fees [2].

Transparent. It is open-source and anyone can view the transactions and check the validity of the processes in the system.

Permissionless. Access is available to everyone and worldwide unconditionally. Access to this system is available to anyone with Internet access.

Without any intermediaries. There is no organization or middleman who have money access, the system is a closed economy in itself.

Corruption free. There's no way we can steal the money.

Tamper-proof. The permitted changes of the system are left to the members.

[2] Except for the Tx fees, these charges may differ depending on the network used, such as Ethereum.

Fraud free. Fraud is avoided by the fact that we do not need external information for the operation.

100 years life cycle. The system is designed to last 100 years, with a 20-year system start and a 40-year payment period [3].

Base points limit to 2.0 points. Pension points are limited on the basis to 2.0, this has the background that no one may have an incalculable claim in the later redistribution.

Fully inheritable. The total pension entitlement can be inherited by passing on the private key.

GDPR compliant [3]. We do not use any external data sources such as age, death certificate and average salary as reference values.

Incentive system. Several incentives ensure the sustainability and adoption of the system in the community.

2 Decentralized pension

The decentralized pension is essentially based on the pay-as-you-go system and the Performance principle. The longer a contributor pays into the pension system, the longer benefits are paid out in old age and the higher the contributions, the higher the pension payments in old age.

Generic currency unit. The design of the pension is not fixed to a specific currency unit such as ETH or BTC. Instead, the design of the pension system uses the generic currency unit "**unit**". The unit must be replaced by a specific currency for the concrete implementation.

Periods. The pension system is divided into periods, which are defined as P. Each action within the pension system takes place in a period $P[p]$. The

[3] Different products with different running times can be created.

duration of a period ($P_{duration}$) is freely selectable. Within the following consideration $P_{duration} = 1month$ applies.

Users. All users of the pension system are defined as U and individual users are defined as $U[u]$. Each user has a state $U[u]_{state}$ which can be either **UC** (Contributor), **UP** (Pensioner), or **UD** (Done). The initial state of all users is $U[u]_{state} = UC$

Accounts. The decentralized pension has two accounts: Savings ($W_{savings}$) and Laggards ($W_{laggarts}$). Contributions and pension payments will be charged using these. The savings account contains the total amount of the managed contributions and is used for the monthly processing of deposits and withdrawals. The laggards account manages a reserve, which is paid to the last generation of the pension system.

2.1 Payment of contributions

Contributors can contribute in a period $P[p]$. The total amount per period and user is defined as $U[u]_{units[p]}$. The total number of periods in which a contributor has paid is defined as $U[u]_{contrib}$.

$$U[u]_{contrib} = \sum_{p=0}^{|P|} \begin{cases} 1 & if U[u]_{units[p]} > 0 \\ 0 & otherwise \end{cases} \tag{1}$$

All contribution payments of a period $P[p]$ are credited to the savings account $W_{savings}$. Entries from contributors who do not have any pension entitlement periods ($U[u]_{pensionperiods} = 0$) will also be credited to the $W_{laggarts}$ account.

$$W_{savings} = W_{savings} + \sum_{u=0}^{|U|} U[u]_{units[p]} \tag{2}$$

$$W_{laggarts} = W_{laggarts} + \sum_{u=0}^{|U|} \begin{cases} U[u]_{units[p]} & if U[u]_{pensionperiods} = 0 \\ 0 & otherwise \end{cases} \tag{3}$$

2.1.1 Pension entitlement periods

The pension entitlement periods ($U[u]_{pensionperiods}$) of a pensioner determines the number of periods, in which a pension payment is made. The higher the number of contribution periods $U[u]_{contrib}$, the higher the number of pension entitlement periods.

To incentivize a large number of contribution periods, a target value (P_{target}) is used for the number of contribution periods.

$$P_{target} = 40years \cdot 12months \tag{4}$$

If the number of contribution periods corresponds to the target value, the number of pension entitlement periods should correspond exactly to the target value. If the number of contribution periods below or above the target value, the number of pension entitlement periods are correspondingly disproportionately smaller or larger.

The number of pension entitlement periods is defined as follows:

$$U[u]_{pensionperiods} = \frac{U[u]^2_{contrib}}{P_{target}} \tag{5}$$

2.1.2 Decentralized pension points

For the contributions paid for a period ($U[u]_{units[p]}$), a contributor receives decentralized pension points in the form of decentralized pension tokens (DPT). The total number of DPT of a contributor at retirement age is used to calculate the amount of the pension payable.

$$U[u]_{dpt[p]} = DPT(u,p) \tag{6}$$

$$DPT(u,p) = DPT_{base}(u,p) \cdot DPT_{bonus}(p) \tag{7}$$

Current contribution value: The current contribution value (CCV) is calculated at the beginning of each period $P[n]$ and defined as $P[p]_{ccv}$. The CCV is the reference value for a DPT of the corresponding period.

To calculate the CCV of the $P[p]$ period, the CCV of the previous period $P[n-1]$ is used. If the difference between CCV and the average contribution for the period $P[n-1]$ is greater than 10%, the CCV of the period $P[n]$ is increased or decreased by 10% accordingly. If the average contribution fluctuates sharply, the CCV slowly feeds on the new average and large jumps are avoided.

$$P[p]_{units} = avg(\sum_{u=0}^{|U|} U[u]_{units[p]}) \tag{8}$$

$$P[p]_{ccv} = \begin{cases} P[p]_{ccv} \cdot 1.1 & if P[p]_{units} \cdot 1.1 > P[p-1]_{ccv} \\ P[p]_{ccv} \cdot 0.9 & if P[p]_{units} \cdot 0.9 < P[p-1]_{ccv} \\ P[p]_{ccv} & otherwise \end{cases} \tag{9}$$

Decentralized pension points basis: The pension points is the ERC20 tokenization of purchasing power in blockchain systems and is an abstraction to purchasing power where the CCV value represents the reference as to how the willingness to pay was present in past periods. For a deposit equal to CCV, 1.0 DPT points are credited to the sender. Anything above the CCV value will be credited with a maximum of 2.0 DPT, it is possible to pay more than twice the CCV value. If the CCV value is lower than the CCV value, less DPT will be credited proportionally to the min value.

$$DPT_{base}(u,p) = \begin{cases} min(\frac{U[u]_{units[p]}}{P[p]_{ccv}}, 2) & if U[u]_{units[p]} > P[p]_{ccv} \\ \frac{U[u]_{units[p]} - min}{P[p]_{ccv} - min} & if U[u]_{units[p]} < P[p]_{ccv} \\ 1.0 & otherwise \end{cases} \tag{10}$$

Decentralized pension points bonus: Up to the period $P_{bonus} = 480$ additional bonus DPT (DPT_{bonus}) will be issued to contributors. Bonus DPT are intended to create an incentive for the first users of the pension system and thus reward the users who believed in and invested in the system at an early stage. The concept of Bonus DPT is based on the reduction of mining rewards known from the Bitcoin protocol.

$$DPT_{bonus}(p) = \begin{cases} 1 + \frac{(P_{bonus} - P[p] + 1)^2}{2 \cdot P_{bonus}^2} & if P[p] < P_{bonus} \\ 1 & otherwise \end{cases} \tag{11}$$

2.2 Pension payment

Contributors are free to choose when they retire. If a contributor retires, no more contributions can be made and, depending on the contributions paid, pension payments can be made instead. The transition from contributor to pensioner is marked by the change of state $U[u]_{state} = UP$.

The pension to be paid is calculated on the basis of the total number of DPTs of a pensioner ($U[u]_{dpt\_total}$).

$$U[u]_{dpt\_total} = \sum_{p=0}^{|P|} U[u]_{dpt[p]} \tag{12}$$

The pension entitlement periods $U[u]_{pensionperiods}$ determine in how many periods a pension is paid out. In which periods a pensioner claims his pension payments is left to the pensioner and can be freely chosen. If all pension payments have been claimed, the state will be replaced by $U[u]_{state} = UD$.

If a pensioner has always paid the average contribution into the pension system in his contribution periods, his pension payment should also correspond to the average contribution payments of the current period and thus the purchasing power stored in DPT should be restored.

The amount of a pension payment results from the following three components: Contribution pension, reserve pension and latecomer pension. For each component, a conversion rate is calculated that determines per period $P[p]$ how much a DPT from the corresponding component is worth.

The pension payment is therefore defined as follows:

$$\begin{aligned} U[u]_{pension[p]} = U[u]_{dpt\_total} \cdot (CPR(p) \\ + SPR(p, W_{savings} - W_{laggarts}) \\ + LPR(p, W_{laggarts})) \end{aligned} \tag{13}$$

2.2.1 Contribution pension rate (CPR)

All contributions for a contribution period ($P[p]units$) are collected and paid out proportionately to pensioners. The contribution pension rate $CPR(p)$ defines the conversion rate from DPT to contributions.

$$P[p]_{units} = \sum_{u=0}^{|U|} U[u]_{units[p]} \tag{14}$$

The pensions to be paid are determined by the average contribution payment of the period ($avg(P[p]units)$) is capped. If there are more contributors than pensioners in the system, any surpluses are used as a reserve and are not paid out directly. If the contribution payments are not sufficient to pay the average contribution payment for the respective period, the contributions are distributed proportionally to all pensioners and pension payments using the DPT.

$$\begin{aligned} &P[p]_{dpt\_pensioner} \\ &= \sum_{u=0}^{|U|} \begin{cases} U[u]_{dpt\_total[p]} & ifU[u]_{state}=UP \\ 0 & otherwise \end{cases} \end{aligned} \tag{15}$$

$$CPR_a(p) = \frac{avg(P[p]_{units})}{P_{target}}$$

$$CPR_b(p) = \frac{P[p]_{units}}{P[p]_{dpt\_pensioner} \cdot avg(P[p]_{units}))}$$

$$CPR(p) = min(CPR_a(p), CPR_b(p)) \tag{16}$$

2.2.2 Reserve pension rate (SPR)

Surplus contributions are reserved as a reserve and $P[p]$ is paid out proportionately in each period. The reserve is paid out in such a way that it is distributed evenly over all active users ($P[p]_{auc}$), their DPT and all active pension entitlement periods of the pension system ($P[p]_{top}$). The reserve pension rate $SPR(p, units)$ thus defines the conversion rate from DPT to reserves.

$$P[p]_{auc} = \sum_{u=0}^{|U|} \begin{cases} 0 & ifU[u]_{state}=DP \\ 1 & otherwise \end{cases} \tag{17}$$

$$P[p]_{active\_dpt} = \sum_{u=0}^{|U|} \begin{cases} 0 & ifU[u]_{state}=DP \\ U[u]_{dpt\_total} & otherwise \end{cases} \tag{18}$$

$$TOPP(u) = \sum_{p=0}^{|P|} \begin{cases} 1 & ifU[u]_{pension[p]}>0 \\ 0 & otherwise \end{cases}$$

$$P[p]_{top} = \sum_{u=0}^{|U|} \begin{cases} P_{target} - TOPP(u) & ifU[u]_{state}=DP \\ P_{target} & ifU[u]_{state}=DC \\ 0 & otherwise \end{cases} \tag{19}$$

$$SPR(p, units) = \frac{units}{P[p]_{active\_dpt} \frac{P[p]_{top}}{P[p]_{auc}}} \tag{20}$$

2.2.3 Laggards pension rate (LPR)

The laggards pension is paid only to the last generation of the pension system. This component ensures that the last generation of the pension system also receives a pension and is intended to create an additional incentive for joining the pension system. The idea is that the laggards pension is so large that every user wants to be part of the last generation. The laggards pension rate $LPR(p, units)$ defines the conversion rate from DPT to reserves. In the case that it is the last generation, the calculation of the Defaulter pension rate $LPR(p, units)$ analogous to the calculation of the reserve pension rate $SPR(p, units)$.

$$total\_pensioners = \sum_{u=0}^{|U|} \begin{cases} 1 & ifU[u]_{state}=DP \\ 0 & otherwise \end{cases} \tag{21}$$

$$LPR(p, units) = \begin{cases} SPR(p, units) & if \frac{total_pensioners}{P[p]_{top}}=1 \\ 0 & otherwise \end{cases} \tag{22}$$

3 Simulations

As part of our research, we performed several simulations of the decentralized pension model. The goal is to simulate different user behavior and to further optimize the incentives and the model and to check its carrying capacity. Another aim of the simulations is to identify user groups who benefit from the pension system, as well as the ones who suffer losses.

All simulations were developed in the programming language *Rust* and published on Github [4] under the MIT license.

3.1 Simulation 1: Zero-Win

The first simulations try to determine that there will be no losses in the system, if all users behave equally fair and constant.

Sim01: 100 users pay 1.0$unit$ into the pension system and retire at the same time.

Sim02: 90 users pay 1.0$unit$ and 10 users pay 2.0$units$ into the pension system and retire at the same time.

Sim03: 90 users pay 1.0$unit$ and 10 users pay 0.1$units$ into the pension system and retire at the same time.

[4] Git Repository: `https://github.com/AsureNetwork/asure-pension-core`

	Sim01		
User	Periods	Contributions	Result
1..10	1..480	$1.0 \cdot 480 = 480$	480
20..100	1..480	$1.0 \cdot 480 = 480$	480

	Sim02		
User	Periods	Contributions	Result
1..10	1..480	$2.0 \cdot 480 = 960$	960
20..100	1..480	$1.0 \cdot 480 = 480$	480

	Sim03		
User	Periods	Contributions	Result
1..10	1..480	$0.1 \cdot 480 = 48$	48
20..100	1..480	$1.0 \cdot 480 = 480$	480

Outcome: The simulation shows that with equal and fair behavior and no influence of inflation and deflation there are no winners and no losers, everyone just gets their deposits back without any influence of inflation or deflation in economics.

3.2 Simulation 2: Inflation/Deflation

This simulation series simulates the behavior of inflation and deflation of the units. It is the devaluation and revaluation of the units that has an influence on the user. If the units were devalued, the users would pay more and if the units were revalued, the purchasing power would remain the same. By CCV this is automatically absorbed and the pension payment and payout behavior is adjusted accordingly.

Sim14: With an inflation of 5% the value of the units is missing and accordingly the user numbers more units. If we take 2 generations with 100 users each and let them pay into the system at 5% annual inflation, the first generation pays $1 Unit$ at the beginning and $21,725 Units$ at the end.

	Sim14		
User	Periods	Contributions	Result
1..100	1..480	$\sum_{j=0}^{39} 12 \cdot CCV \cdot 1.05^j = 1450$	3831
100..200	480..960	$\sum_{j=40}^{79} 12 \cdot CCV \cdot 1.05^j = 10165$	7783

Outcome: With this result we see that in the case of inflation the units are devalued and in the case of existing inflation the user receives from the system the number of units matching the purchasing power.

Sim15: In a deflation, where the value of units increases, the user will pay correspondingly less into a system. If we take 2 generations with 100 users each and let them pay into the system at 5% annual deflation, the first generation pays $1 Unit$ at the beginning and $0.046 Units$ at the end.

	Sim15		
User	Periods	Contributions	Result
1..100	1..480	$sum(CCV \cdot 1.05^n) = 217$	150
100..200	480..960	$sum(CCV \cdot 1.05^{40}) = 31$	98

Outcome: Todo: Deflationsnevouse With this result, we see that in the case of deflation the units have a higher value and purchasing power, and when the deflations exist, the user receives from the system the purchasing power appropriate number of units.

3.3 Simulation 3: Long-term

Long-term simulation tries to reproduce the behavior of the system over several generations. It should show how the system behaves over several generations, during the increase and behold decline in user numbers.

Sim20: We simulate that every year 10 users come in and constantly pay $1 unit$, after 40 years every generation retires and we simulate 190 years and 1120 users.

Outcome: With this result, it is easy to see that if the number of payers is smaller than retirees, at that

	Sim20		
User	Periods	Contributions	Result
1..10	1..480	$1.0 \cdot 480 = 480$	952
10..20	12..492	$1.0 \cdot 480 = 480$	937
⋮	⋮	⋮	⋮
420..430	12..984	$1.0 \cdot 480 = 480$	484
430..440	12..996	$1.0 \cdot 480 = 480$	477
⋮	⋮	⋮	⋮
1100..1110	1320..1800	$1.0 \cdot 480 = 480$	233
1110..1120	1332..1812	$1.0 \cdot 480 = 480$	2585

moment pensioners start to get less out of the system. The penultimate generations lose in this system. In the last generation, which we call laggards, a reward has been paid as planned. There is room for improvement for the last but one generations to make the system even fairer.

4 Summary

This work had as its goal solving the listed problems with a decentralized approach as well as to show how a social security system can work in the future.

Thanks to public's voluntary participation, the invention of the incentives that makes the system a very interesting alternative became possible. A start for a transparent, fair and barrier-free pension that can be used worldwide.

If everyone adheres to the same rules, the only thing that occurs is that the system store the purchasing power. Without any influence of inflation or deflation in economics, the same number of $Units$ paid into the system will be paid out to users. Therefore there is no profit and no loss, but the value retention was simply being kept for years. [5]

It is assumed that some users will opt for an earlier pension, even if it means partial loss for a user. Some users will lose full access to the system because e.g. the private key is lost, the pension contributions are not inherited and not collected. After some time, the paid-in values will be released, which will benefit the other users in the system.

[5]The only costs incurred will be the transaction costs, in case of a private network, these can be further minimized.

5 Outlook

The present work aimed to develop a concept for the decentralized pension. In closing, it can be noted that there are still open issues to be discussed.

Ethereum Smart-Contract. The next step is to translate the specification in this paper into Smart Contract on Ethereum network and make it available to the community for review.

Scalable network. In order for the system to be able to handle multi-product as well as mass transactions support, it is necessary to develop a scalable network, especially for decentralized pension and, in general, decentralized social insurance systems.

Use of stablecoins. There is still a lack of an evaluation of the ways to use stablecoins to protect deposits against volatility in a pay-as-you-go process.

Pension payouts resolution. There is still no research done for the case if certain claims are not retrieved for a number of years.

Reset: For a full resolution, it would be interesting to reset the system so that the initialization values can be easily reset.

Liability, Governance. The question of the liability and control of the system is not yet fully clarified.

Asset management. In addition to a pure pay-as-you-go system, deposits can be made directly into the system, which involves both risks and reward opportunities, and for those who are more interested in risks, such research and results would be of great interest.

Other use cases. In addition to decentralized pension, other social insurances may also be decentralized, such as: health insurance, accident insurance, unemployment insurance etc. In addition to the well-known social insurance, the future and unconditional basic income can be organized decentrally.

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