Coins, Covid, Keynes and K-Shaped Recovery

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Abstract. Reckless monetary policy, especially in the wake of a pandemic, amplifies the gap between the extreme ends of the income distribution, thus exacerbating the long term effects of income inequality and loss of human capital. Attempts of federal stimulus bills fall short in timing and size, including directing spending towards those most in need. We propose a general smart contract protocol that distributes funds to targeted individuals with programmatic spending enforceability, alleviating the K-Shape recovery that current monetary policy is creating and turn it into the desired V-Shape. Utilizing incentive structures, our model directs spending to help stimulate the economies of targeted communities and struggling businesses. Smart contracts remove the current inefficiencies in the political trust and permission-based solution and allow for more transparency, verification, and incentives to help one's community in times of need. Such a system allows for a more positive and direct relationship between those with funds and those who need funds.

Keywords: Smart contract · Economic stimulus · Donation fund · Incentive systems · Spend tracking

1 Introduction

Since the middle of March 2020, seeking to reduce the impact of the coronavirus on the economy, the Federal Reserve (FED) has been injecting unprecedented amounts of liquidity into the market with various policies like *Repurchase Agreement Operations (REPO), Quantitative Easing (QE), the purchasing of Corporate Debt Bonds and Mortgage Backed Securities (MBS), direct business lending programs (PMCCF, SMCCF, MSLP, and PPP)*, and "helicopter" cash stimulus to private citizens. Such prescriptions are based on a rigorous framework introduced by John Maynard Keynes, aptly named "Keynesian Economics," which emphasizes the importance of increasing government spending in times of economic crisis to stimulate demand. However, despite the initial objectives of this policy, it does not always stimulate the economy in positive ways according to our analysis of current government spending programs. We introduce the hypothesis

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that although Keynesian monetary policy is arguably most responsible for the large income inequality, inflated asset prices, and sub optimal full employment, it could be rescued with the help of a decentralized and transparent fund distribution system based on smart contracts. In this report, we examine this hypothesis in two ways. First, we analyze historical interest rates, Federal Reserve balance sheets, and unemployment data among other data sets to analyze the correlations between these variables and the FED mandate. Second, we propose a design of a decentralized smart contract protocol to generate a V-shaped recovery, thus blunting the sharp inequality that could result from a K-shaped recovery.

Keynes and Modern Stimulus

Keynesian monetary policy rose to prominence as an antidote to the Great Depression, and continued to be deployed during times of crisis, such as the 2008 housing recession and the 2020 COVID-19 crisis. Keynesian monetary policies were aggressively deployed and sustained throughout the Obama administration as an antidote to the 2008 housing recession, leveraging sustained lowered interest rates and increased federal spending to bolster economic growth. They were again installed with the onset of COVID-19 and the ensuing recession as the federal government under the Trump administration plummeted the already deflated interest rate to all-time lows. As shown by both responses to these crises, the three main tools the Federal Reserve utilizes to establish Keynesian monetary policies and stimulate the economy comprise of the following: (1) Interest rates, which determines the spending and borrowing in the economy; (2) Quantitative Easing (QE) and balance sheet expansion, which refers to when the Federal Reserve buys financial assets from the open market; and (3) Repurchase Agreements (Repo), loans the Federal Reserve credits to businesses overnight. With these tools and policies, the Federal Reserve hopes to stimulate recovery during recessions. However, despite the Federal Reserve's initial objectives or intentions, it does not always stimulate the economy in a positive way—one must judge policies by their results, and not by the intentions of its founders. We attempt to prove this in the following sections by analyzing historical macroeconomic data against the Federal Reserve's mandate. We will also further explore possibilities made ubiquitously accessible via decentralized and "trustless" smart contract technologies.

Keynesian Supply Side Shocks

With the onset of the Covid-19 pandemic, governments began shutting down contact-intensive sectors of the economy to protect public health. A shutdown in one sector of the economy, although endogenous, may create a negative spiral in the demand of sectors unaffected by the shutdown [1]. Demand deficiencies can thus spiral multiplicatively, and cause an anemic recovery as opposed to the desired V-shape due to firm exits and heightened levels of unemployment, resulting in permanent losses of human capital.

To illustrate, imagine a market sector comprised of K-12 teachers and daycare firms during the pandemic. Teachers that are sent home no longer require daycare

services as they can take care of their own children. Although the shutdown did not directly affect the daycare sector, its demand is still affected by the shutdown of K-12 schools. Additionally, some of the teachers who are laid off no longer receive income, diminishing their overall spending on other sectors and adding to demand problems of firms originally unaffected by the original shutdown. Another example: restaurants that closed due to pandemic reasons no longer require accounting services, leaving accounting firms with fewer customers and decreased cash flows. This decrease in cash flow results in many firms deciding that they no longer require office spaces, chaining adjacent sector shocks into a series of cross-sector demand losses.

These Keynesian supply shocks can have dire consequences to the overall economy and drag on the recovery process. The exits of firms can also cause a spiral of demand shocks—if sector one shuts down and sector two requires their goods as material inputs, they would also be forced to shut down. These endogenous outcomes feed back into themselves and perpetuate their losses throughout the economy as a whole.

We propose that the fundamental issue with sector imbalances and monetary policy is the lack of complete information acquirable by central planners, as the computation required to understand the holistic needs of individuals and businesses are far greater than any central authority can efficiently manage. Instead, we propose a decentralized smart contract system that allows for intertemporal demand imbalances to level out through programmable monetary policies across sectors, created and governed by trusted agents who decide upon the rules and methods of fund distributions. Decentralization allows for small community-driven structures of distribution that better understand the needs of participants, stemming from locality-driven information completeness.

We will explore the effectiveness of current centralized policies in the following section, and propose a smart contract protocol that would allow anyone to create a fund with enforceable distribution and spending rules.

2 Effectiveness of Current Monetary Policy

Our experiment requires performing linear regression on predictor and response variables. Each of the predictor variables are key levers the Federal Reserve uses to enact monetary policy. Since these variables are ubiquitously observable, suitably parametrized smart-contracts can be implemented to embody Keynesian framework scalably, evolvably and decentrally. In the years prior to 2008, interest rates were the key tool the Federal Reserve used to influence the amount of spending in the economy. However, due to recent economic downturns along with other political and macro economic factors, interest rates have been historically low, hovering between 0–2%. This constraint requires the analysis of the other predictor variable—the Federal Reserve balance sheet. The FED balance sheet shows the outstanding assets and liabilities at the FED, which grows when the Federal Reserve "prints money" to buy assets from financial institutions to inject money into the economy, and contracts when the FED sells these

assets. The combination of these variables shows us a clear picture of Federal Reserve actions. While there are certain desirable qualities to such centralized approaches, it is not necessarily the only plausible approach - especially in the absence of suitable institutions and their governance. To test this hypothesis, we evaluated the "standard" centralized approach as follows.

The Federal Reserve's core mandate states that their mission is to keep unemployment rates low while maintaining a slow and steady growth of inflation, which we measure through Consumer Price Index (CPI). Based on their respective actions through balance sheet expansion and interest rates controls, we are looking to find high correlations between each predictor and response variables that reflect this core mandate. Correlations are measured by adjusted r-squared values and high r-squared values will be interpreted as values above 0.2, which compensates for the lagging indicator effect.

Linear Regression Analysis

For each regression set we provide the regression statistics, coefficient table, and the corresponding interpretation. The full set of predictor vs. response variable analysis can be found in the appendix (Fig.1).

Regression Statistics	
Multiple R	0.05777537
R Square	0.00333799
Adjusted R Square	-0.0009766
Standard Error	2.04393569
Observations	233

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	5.97983406	0.26158063	22.8603852	3.0614E-61
WALCL	7.0197E-08	7.9807E-08	0.8795789	0.38000156

Here we see a slight positive relationship between balance sheet and unemployment, which is the opposite of what the Federal Reserve intends. Based on the Federal Reserve mandate, we expected to see balance sheet expansion lower unemployment rates, not increase. This is not what our regression shows. The adjusted r-squared value of ~0.0 shows almost no relationship between the two variables. With a p-value of 0.38, we cannot conclude with statistical significance that the relationship between unemployment and balance sheet even exists. This provides a strong argument against the Federal Reserve employing Keynesian monetary policies for the purposes of lowering unemployment.

Fig. 1. Balance sheet vs unemployment

Statistical Conclusion

The key finding from this study is the statistically significant, negative correlation between interest rates and unemployment and the nonexistent correlation

between the balance sheet expansion and decreased unemployment. This finding is strong evidence against Keynesian monetary policies as it is currently employed, indicating that funds injected through the current monetary system appears to have no effect on unemployment—and where there is an effect, the effect is counterproductive. There are a couple of reasons we conjectured to explain this phenomenon. First, it is possible that decreased interest rates make it easier for businesses to accrue bad debt as the threshold for borrowing is substantially lowered. This disparity increases the rate of loan delinquencies and decreases the rate of overall productivity in the economy as businesses with low productivity are propped up in the system. Secondly, our data hints that the majority of monetary stimulus does not trickle down to people in the bottom rings of the socioeconomic ladder, and is instead captured by large corporations and the wealthy in the form of equity markets. The current rise of stock market prices is strong evidence of the latter, as we see the stock market grow to unprecedented highs as an effect of FED monetary policies.

Through careful analysis and examination of our hypothesis, we reach the conclusion that Keynesian monetary policy as enacted today, whose initial objective is to stimulate the economy in times of crisis, is responsible for inflated asset prices and sub-optimal full employment. Therefore, we propose a smart contract system that would alleviate the fundamental issues of fund distribution and accountability, as discussed in our analysis in modern US monetary policy, by removing existing bottlenecks between those with funds and those in need of funds.

In the full research paper, we will perform realistic simulations to gauge the effect of monetary policies deployed on smart contracts.

3 Maneki Protocol Fundamentals

From our analysis of US monetary policies, we identified several glaring problems with money distribution today. These problems plague both public and private fund distribution, eroding trust between fund providers and recipients due to the lack of built-in accountability and transparency at the fund distribution layer. We discuss each of the problems below.

Distribution Fraud

Perhaps the most prominent problem with current government spending programs is the lax verification (fraud detection and credible threat) systems associated with them, leading to billions of taxpayer money lost annually. A couple of figures illustrate the enormity of the problem:

– A report from Association of Certified Fraud Examiners (ACFE) in 2012 finds that non-profit fraud amounts to roughly 5% of organizational revenue each year. Using this estimation, public charities alone are losing around $100B to fraud annually [3].

- The US Department of Labor estimates a loss of around $3.5B in unemployment insurance fraud annually [4].
- In September 2020, the Department of Justice (DOJ) charged 57 individuals who received more than $157 million from the Paycheck Protection Program (PPP) with fraud after they revealed the funds collected were not spent on employee wages, and instead on enriching the individuals. The DOJ went on to say that "the total amount of fraud is unclear at this point, and more charges are expected over the coming months and year" [5].
- From the March 2020 $2.2T government stimulus alone, an estimated $40B in losses can be attributed to collection fraud [6].

The issues with money distribution cannot only be attributed to a failure of fraud detection systems. Rather, it highlights the inability of current spending programs to prevent recipient and spending fraud at the distribution level. For example, PPP's goal of protecting employee wages falls short because a significant portion of the money received by corporations are not paid out to employees. This narrative signals a need for change in the way we distribute money today.

Loss of Trust

The inability to prevent monetary fraud in existing distribution systems directly results in a loss of public trust in money distribution systems. This trustlessness is especially prevalent in young adults today, who according to Pew Research Center, have become increasingly less confident in key institutions (e.g., police officers and business leaders) compared to older generations [10]. The loss of trust creates a negative cycle of people becoming less willing to make donations compared to before. Indeed, donation levels are at historic lows, only 73% of the US population donated to charities in 2020, down 9% nationwide since 2017 [9].

Large and Fragmented Network

A large part of why distribution fraud exists can be attributed to the scale, complexity, and fragmented nature of many spending programs. A popular form of collection fraud (Sybil fraud) occurs when an individual creates multiple aliases to double or triple one's collection from the same or different programs. Because many programs do not have robust Know-Your-Customer (KYC) infrastructure in place, and programs generally do not share recipient information with other organizations, it becomes impossible to track fund distribution across many spending programs.

Today's spending programs are very limited in their ways to control recipient spending once the funds are distributed. Government programs rely on financial audits, which are costly and non-exhaustive; nonprofits and charities rely on accumulating funds to distribute capital and goods to the right people, using distribution processes that often lack transparency and public trust. This issue deflates the overall amount people would donate, perpetuating the negative cycle.

Centralized Brokers

A centralized broker provides a single point of failure for any fund. If the broker is compromised, all donations are instantly compromised as well. Donors looking for a way to ensure their funds are properly distributed to the right people need to trust and verify the entities they donate to, increasing the barrier of entry for donors.

Smart Contract Protocol

To address the many issues surrounding money distribution systems today, we propose the creation of a smart contract protocol that leverages the distributed, synchronized, and immutable nature of blockchain systems to protect donors and recipients, expose spending insights, such as historical spend for a fund, and improve on fund distribution infrastructure through programmatic rules.

Maneki leverages blockchain properties like immutable transaction trails to enable the quick detection of fund abusers, and provide smart contract-enabled guarantees to fund distribution such as fund dispensing from the contracts only if certain conditions are met. These conditions are provided by donors who create the funds at the outset, and enforced at distribution time. Recipients who are eligible may then apply, having fully understood and agreed to the conditions for receiving such funds. More examples of fund rules and their creation process are provided in the next section. By using smart contracts, needed transparency can be provided to both parties.

The next section explores the protocol in more depth, identifying the different stakeholders, smart contract flows, and real-world use cases.

4 Maneki Protocol

The Maneki platform is a smart contract protocol that enables trustless distribution of funds in a transparent manner. The protocol aims to strengthen trust between fund providers and recipients through mechanisms that incentivize people to donate and receive more. Maneki leverages existing benefits of blockchain technology and is designed as a Layer-2 solution built on top of payment tokens. As such, any payment-based blockchain supporting smart contract implementation can deploy the Maneki protocol on top to further secure fund distribution and spend tracking on the original payment system. Such payment tokens may include any form of Central Bank Digital Currencies (CBDC), ERC-20 payment tokens, and other payment-based tokens with smart contract capabilities.

Best conveyed by Hayek, "law and language have been allowed to develop for millennia while the improvement of money has been frozen and restricted from private experimentation." This is no longer the case today. With the advent of Bitcoin and other decentralized payment tokens, governments and citizens alike are rethinking the role and functions of money. Maneki is a smart contract protocol that provides private citizens, philanthropists, and even governments the ability to experiment on an ever-improving system of money distribution

enforced by smart contracts. Maneki utilizes smart contracts to enforce accurate distribution and spending of allocated funds, providing trust through the transparent system of execution. It aims to serve as a general framework to improve upon the money distribution system, much like how language and law have developed in the modern time.

In this paper, we outline several real-world use cases that can greatly benefit from the use of Maneki.

Stakeholders

The Maneki protocol revolves around two types of stakeholders. *Donors* create public or private funds that other donors can also contribute to, and distribute to *recipients* specified by the funds' rules. Fund rules are smart contract enforced logic that is programmed into each fund that specifies how funds are distributed and spent. Public funds can be contributed to by any blockchain-registered entity, and donors can specify and vote on fund rules based on the amount of funds contributed. Private funds are controlled by the entities who create them, and new donors may be added to contribute, determined by the administrators of those funds.

Recipients apply to funds and are approved based on existing fund rules. For example, a fund may only distribute to teenagers in low-income areas, and dictate that the money can only be spent on educational supplies. Once a recipient is approved for a fund and agrees to the fund rules, they receive those funds and can only spend them in accordance to the rules. If recipients try to spend funds against the fund rules, a penalty can be enacted against them in the form of reduced reputation that may influence future fund applications. Repeated offenses may lead to participation withdrawal from the funds they attempt to abuse. Through these smart contracts a crypto coin circulating among the recipients may get connected and valuated against donors' funds, and this in turn may attract or repel additional donors.

Smart Contracts

Maneki's smart contracts leverage blockchain's history of immutable transactions to perform integrity checks and verify distribution before money is deployed. After fund deployment, they serve to enforce and incentivize spending habits dictated by the fund rules. We believe that over time, these fund rules can create creative and complex incentive structures that are utilized to deploy money to the right people and for the right causes. The smart contracts enable distribution and tracking processes that provide security and trust to the fund distribution process for both donors and recipients, ultimately resulting in more efficient money deployment through targeted spending.

Fund Distribution

There are two types of accounts registered on Maneki. Individual accounts, which comprise of donors and recipients who transact in fund distribution, and business

accounts who receive payment from fund recipients. Business accounts will be discussed in more detail in the Recipient Spending section. Account creation is enforced by a KYC/identity solution powered by either the central government, in the case of a CBDC implementation, or existing providers such as Civic. Each account is then remembered by the Maneki protocol, who register each individual with exactly one account to protect from double dipping and reputational Sybil attacks.

Once recipients authorize their accounts, they allow the sharing of certain information with funds, similar to using OAuth solutions like Google login today. Recipients can specify funds to automatically enroll in based on their needs, and also request to join funds they are qualified for. A REQUEST_FUNDS contract allows a business or individual to request funding from a specific program.

Donors create and manage funds using a suite of smart contracts:

- The FUND_CREATE contract allows donors to create a fund. Each fund exists as its own entity and administrators of the fund provide rules that govern it. These rules include requirements for recipient eligibility, fund governance and voting structure, distribution schedules, and spending conditions, among other fund settings. Funds can be donated to by anyone if public, and selected individuals if private.
- The FUND_UPDATE contract updates existing contracts' rules that can change distribution schedule, eligibility criteria, and any other mutable fund rules. Eligibility of a fund can be configured to trigger based on many criteria. For example, a fund may specify that only people who are vaccinated for COVID-19 are eligible to receive funds. This type of interaction requires off-chain validation that may be integrated into the onchain ecosystem via oracle solutions.
- The FUND_DISTRIBUTE contract triggers fund distribution, either manually or programmatically. Prior to distribution, the contract rechecks the rules of the fund, reconciles recipient list against current eligibility criteria, and finally assigns predetermined number of tokens to each member on the recipient list.

Fund rules are flexible by nature, allowing donors to best direct their money to the causes most aligned with their respective values. They can choose and enforce eligibility criteria to a fund based on the geography of recipients, income levels, spending history patterns, among many other parameters as long as the condition is sourced and provided by a trusted oracle. An example of a useful fund rule in a government-backed stimulus funds is a trigger that returns funds if they are not spent after a set period of time. Such a rule encourages individual spending, increasing money velocity and decreasing the risk of hyperinflation. This implementation allows for the enforcement of stimulus packages that are predictably spent, increasing aggregate spending without needing to wait for banks to create credit. Fund rule flexibility ensures that donors feel confident that their funds will truly go where they intended them to, and that funds can adapt based on changing needs for both existing and potential future funds.

Recipient Spending

The protocol allows two types of spend tracking: checking of fund rules in real-time and spend provenance.

Every time a recipient spends from one of their fund allocations, they invoke the SPEND_FUNDS contract in real-time. The SPEND_FUNDS contract is the most widely used contract in the protocol. The contract imposes a set of spending rules specified in the fund rules, then validates the spend transaction based on valid recipient addresses and account balances. Participating businesses on the platform register their products on the Maneki protocol so the contract can deterministically track and enforce spending. The Maneki protocol enforces a protocol-wide product categorization data standard to facilitate spend tracking, similar to a more robust version of Merchant Category Codes (MCC) used by banks and credit card providers today. As such, SPEND_FUNDS contracts confirm that funds are spent as donors intended, while addressing recipient needs.

The second part of spend tracking leverages blockchain's immutable nature to provide spend provenance insights at a fund, individual, and business level. Spend data on the blockchain can be indexed to provide aggregate spending data and money flows to fund creators to improve future fund rule changes, identify distribution errors, and provide protocol-wide reputation for all entities. Each entity's spending data are cryptographically secured and private, accessible only with permission from the entity. In other words, entities have the right to explicitly grant funds to certain spending data or personal information.

5 Use Cases

The general architecture of the Maneki protocol aims to enable the identification of better fund management systems. To this end, we explore several fund use cases that can benefit from the protocol today.

5.1 Government Stimulus Funding

One of the key failures of the Payment Protection Program (PPP) is the vague and non-enforceable language around protecting employee wages due to unforeseen supply shocks, the primary reason for the fund's existence. As a direct result, many corporations receive billions of dollars in taxpayer money in the form of loans and grants, only to lay off their employees shortly after. Through this distribution system alone, millions of working class Americans are defrauded while executives enrich themselves at an unprecedented time of crisis. While these actions of a few are ethically deplorable, it is the money distribution design that is fundamentally flawed, allowing for poorly regulated access to these funds.

A fund built on top of Maneki protocol would ensure that stimulus funds are tracked, businesses are spending the money based on loan and grant stipulations, and individuals are receiving the money from employers. Every interaction would be regulated and enforced by smart contract execution. Throughout the fund lifecycle, the government is able to analyze the efficiency of fund deployment

to change the fund's rules to optimize fund allocation for the future, all based on historical fund performance. Individuals will also be able to receive a larger share of the stimulus spending, decreasing income inequality and encouraging domestic spending as a whole.

5.2 Unemployment Insurance

Similar to PPP, unemployment insurance administered today suffers from distribution errors and collection fraud. In 2015, the US Department of Labor estimated a loss of $3.5B in unemployment insurance at an error rate of 10.7% [7]. A state-administered fund distribution application built on Maneki could provide clear provenance insurance collection and work history of any individual, giving the state department a clear understanding of the fund distribution lifecycle. Smart contract execution serves not only to prevent funds from collection fraud, but can also be used to protect against the common issue of people misunderstanding the rules and terms of unemployment insurance collection. Furthermore, the state may derive spending insights based on an individual's employment history, if permissioned by the individual, to assist in finding employment. For example, if John Doe has not found a job within 2 months, an agent can be dispatched to offer job search assistance. Similar applications can be built to power government funded programs like TANF or SNAP (i.e., food stamp program), where funds can be distributed to a predetermined set of individuals who qualify, and spending rules are attached to each fund allocation.

5.3 Donation and Fundraising Platforms

As Maneki's general structure allows it to be deployed on any type of payment blockchain with smart contract capabilities, donation and fundraising applications powered by Maneki smart contracts pose an interesting alternative for people looking to donate money outside of traditional nonprofits. For example, a donation platform can utilize Maneki smart contracts built on top of Diem (formerly known as Libra) to source capital for user-proposed causes. Donors on the platform can create funds for specific causes and invite others to donate, with the added benefits of recipient spending enforcement and transparent insights on fund usage. These funds provide a way for any individual or group to raise, distribute, and track money spent for any purpose, using a transparent and trustworthy set of smart contracts. As a result, recipients benefit from broader access to capital and a fairer system of fund distribution while donors ensure the security of their funds.

5.4 Managing Keynesian Supply Shocks

As government funds created on smart contracts have access to aggregated information across many different programs, they allow for the creation of intertemporal rules between economic sectors to alleviate the demand imbalances created

by Keynesian supply shocks. Preset conditions triggered by smart contracts can automatically execute the interest rate changes or employer-side tax rates by sector, allowing monetary policies to be deployed in a targeted fashion. In this scenario, agents create contracts on the Maneki platform that correct asymmetries in demand between sectors by either easing or tightening conditions based on the health of a particular sector. For instance, the technology industry has benefited greatly since the onset of pandemic-driven shutdowns, while the restaurant sector is in fallout. By lowering interest rates or payroll taxes for only the affected industries, fund creators can perform macroeconomic policies that are better informed on a per sector basis, resulting in less fund leakage and higher efficiency.

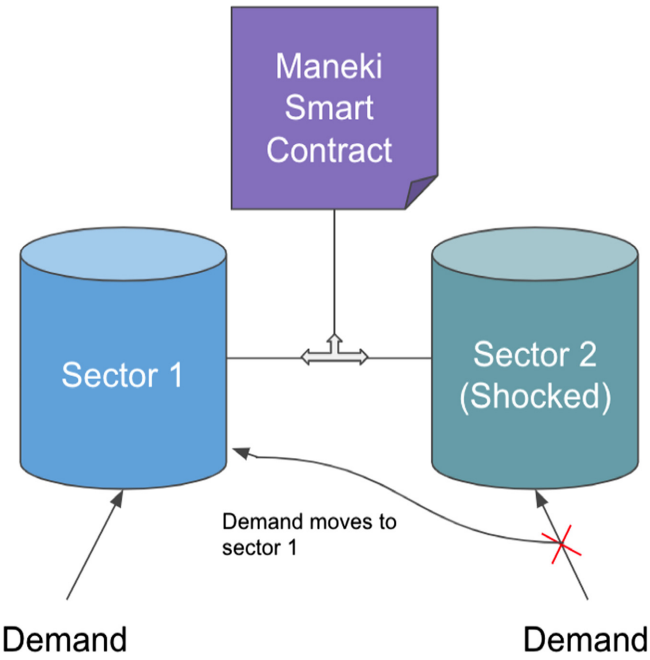

Fig. 2. Maneki contract alleviating sector imbalances. A detailed simulation and analysis of the recovery dynamics will appear in the full paper. Imagine Sector 1 represents college education sector and Sector 2 k-12 education sector: two sectors one thriving under impersonal interaction and the other suffering from a lack of in-person interaction. A pandemic induced supply shock to Sector 2 may lead to a partial demand for the Sector 1 infrastructure to be used by Sector 2, and covered by donations from Sector 1 governed by Maneki Smart contracts.

A realistic simulation will appear in the full paper showing how a Maneki smart contract can help alleviate Keynesian Supply Shocks [1].

Other forms of macroeconomic policies can be deployed and monitored more effectively through the use of smart contracts. For instance, a widely-known correlation between REPO and market volatility can be modeled on the Maneki protocol to create a micro lending structure that automatically eases FED lending conditions based on liquidity conditions between sectors. While we primarily tackle ineffective government spending in this paper, the customizability and adaptability of the protocol allows for the creation and growth of an infinite number of incentive structures (Fig. 2).

6 Conclusion

Modern monetary policies derived from Keynesian economics amplifies the wage gap separating the ends of the income distribution. The attempts of federal stimulus bills fall short in execution and size, including directing spending towards the most in need. A smart contract system that distributes funds directly to communities and individual payments while incentivizing good spending behavior would alleviate the K-Shape recovery that current monetary policies are creating. By utilizing mechanism and incentive designs, our model directs spending to help stimulate the economies of small communities and struggling businesses. The usage of smart contracts removes the many inefficiencies in current bureaucratic solutions and allows for more transparency, trust, and incentives to help one's community in times of need.

Appendix: Linear Regression Charts

(See Figs. 3, 4, 5, 6, 7, 8 and 9)

Type	Name	Description
Predictor	Interest Rate	Interest rate is one of the key levers used by the Federal Reserve to enact monetary policies to stimulate the economy.
Predictor	Balance Sheet	Balance sheet is the size of asset purchases, used by the Federal Reserve to prop up the economy when enacting Quantitative Easing policies (QE)
Response	Consumer Price Index	Consumer Price Index (CPI) is a measure of inflation in the economy. When the Federal Reserve increases its balance sheet or decreases interest rates, we expect to see an increase in CPI.
Response	Delinquency Rates on Commercial and Industrial Loans	Delinquency rates refer to the percentage of loans in the United States that are late or close to default. This is a measure of the health of businesses in the United States that are behind on their payments or close to insolvency.
Response	Unemployment Rate	The percentage of people who are unemployed in the United States. This is the actual unemployment rate as opposed to full employment, which is the target unemployment rate of the US government, normally around 4-5%.

Fig. 3. Predictor and response variables

Balance Sheet vs CPI	We expect a high positive correlation between the Balance Sheet and CPI. We reject the null hypothesis at Significance F-level of 0.05.
Balance Sheet vs Unemployment	We expect a high negative correlation between the Balance Sheet and Unemployment. We reject the null hypothesis at Significance F-level of 0.05.
Balance Sheet vs Delinquency	We expect a high negative correlation between the balance sheet and Delinquency Rates. We reject the null hypothesis at Significance F-level of 0.05.
Interest Rate vs CPI	We expect a high negative correlation between Interest Rate and CPI. We reject the null hypothesis at Significance F-level of 0.05.
Interest Rate vs Unemployment	We expect a high positive correlation between Interest Rate and Unemployment. We reject the null hypothesis at Significance F-level of 0.05.
Interest Rate vs Delinquency	We expect a high positive correlation between Interest Rate and Delinquency Rates. We reject the null hypothesis at Significance F-level of 0.05.

Fig. 4. Response expectations

Regression Statistics			*Coefficients*	*Standard Error*	*t Stat*	*P-value*
Multiple R	0.59135009	Intercept	7.04869811	0.13682247	51.5171096	8.411E-135
R Square	0.34969493	FEDFUNDS	-0.6179169	0.05340038	-11.571396	4.5865E-25
Adjusted R Square	0.34708326					
Standard Error	1.60390145					
Observations	251					

This regression analysis shows a strong negative relationship between interest rates and unemployment, with an adjusted r-squared value of ~0.35 and a coefficient p-value of ~0.0. This is similar to the balance sheet vs unemployment regression as it indicates that increased interest rates actually lowers unemployment, contrary to Federal Reserve monetary policies. This analysis shows that the negative correlation is statistically significant, and provides a strong argument against Keynesian monetary policies of increased subdued interests rates.

Fig. 5. Interest rate vs unemployment

Regression Statistics			*Coefficients*	*Standard Error*	*t Stat*	*P-value*
Multiple R	0.91682028	Intercept	190.039543	1.13180502	167.908376	1.408E-242
R Square	0.84055942	WALCL	1.2125E-05	3.4819E-07	34.8215979	1.1398E-93
Adjusted R Square	0.8398662					
Standard Error	8.78536508					
Observations	232					

Our regression shows a very strong correlation between balance sheet and CPI with an adjusted r-squared value of ~.84. The p-value of ~0.0 is extremely low, providing strong evidence that balance sheet movement has a strong positive correlation with inflation at any reasonable confidence level, including a=0.05. This behavior is expected.

Fig. 6. Balance sheet vs CPI

Regression Statistics			*Coefficients*	*Standard Error*	*t Stat*	*P-value*
Multiple R	0.43537084	Intercept	2.41887675	0.17685809	13.676936	2.1603E-23
R Square	0.18954777	WALCL	-2.47E-07	5.4758E-08	-4.5108175	2.0085E-05
Adjusted R Square	0.18023223					
Standard Error	0.84550997					
Observations	89					

This regression shows a semi-strong negative relationship between balance sheet expansion and delinquency rates, with an adjusted r-squared value of ~0.18. This is close to our benchmark for a large correlation of 0.2, and the coefficient's p-value of ~0.0 indicates the relationship to be statistically significant. This observed relationship reflects our initial hypothesis for the regression pair.

Fig. 7. Balance sheet vs delinquencies

Regression Statistics			*Coefficients*	*Standard Error*	*t Stat*	*P-value*
Multiple R	0.54376937	Intercept	230.114297	1.896123	121.360427	7.405E-223
R Square	0.29568513	FEDFUNDS	-7.5360675	0.73856313	-10.203688	1.2244E-20
Adjusted R Square	0.29284515	This regression shows a strong negative relationship between interest rates and inflation, with an adjusted r-squared value of ~0.3 and a coefficient p-value of ~0.0. This indicates that the regression is statistically significant. The strong negative correlation between the two variables is expected from our initial hypothesis as it is logical that lowered interest rates will lead to lower inflation with lowered velocity in the monetary system.				
Standard Error	22.1500697					
Observations	250					

Fig. 8. Interest rate vs CPI

Regression Statistics			*Coefficients*	*Standard Error*	*t Stat*	*P-value*
Multiple R	0.0298674	Intercept	1.95242207	0.1342553	14.5426072	1.0308E-26
R Square	0.00089206	FEDFUNDS	-0.0159864	0.0527157	-0.3032563	0.76230622
Adjusted R Square	-0.008808	This regression shows a very slight negative correlation between interest rates and delinquencies, with an adjusted r-squared value of ~-0.0 and a coefficient p-value of ~0.76. The correlation coefficient indicates that there is almost no relationship between the two variables.				
Standard Error	1.01587351					
Observations	105					

Fig. 9. Interest rate vs delinquencies

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