Tradfi and Defi

Anthony Lee Zhang

May 24, 2024

Lecture Overview

Brief intro to traditional finance

- What does finance do?
- Why is finance useful for society?
- What are some problems with traditional finance?
- Decentralized Finance
 - Some numbers
 - What problems could these solve?

Economics in One Slide

There is an island with 2 kinds of people:

- Banana farmers can only produce bananas
- Apple farmers can only produce apples

Every farmer would prefer to have both apples and bananas

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- In market equilibrium, farmers can trade p bananas for one apple
- Everyone is happier because they can eat both bananas and apples

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- Solution: a market emerges for trading risky food for safe food
- Farmers form a venture-capital group which pays the hunter.io startup to hunt meat
- Everyone is happier: if hunters succeed, everyone gets meat. If they fail, hunters don't starve

Markets for Time and Risk

- Financial markets allow people to trade time and risk
- This allows people to consume time/risk bundles different from what they started with

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See The Market for Promises





- Households (savings)
- Firms (savings)
- Govts (SWFs)











Finance in the USA



FIGURE 2. FINANCE INCOME AND INTERMEDIATED ASSETS OVER GDP

Notes: Both series are expressed as a share of GDP, excluding defense spending. Finance income is the domestic income of the finance and insurance industries, i.e., aggregate income minus net exports. It is available from 1880 to 2012. Intermediated assets include debt and equity issued by nonfinancial firms, household debt, and various assets providing liquidity services. Data range for intermediated assets is 1886–2012.

Source: Philippon (2015), Has the US finance industry become less efficient? On the theory and measurement of financial intermediation

The Traditional Financial System

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- The purpose of the system is to enable agents to smooth consumption and share risk
 - Essential functions for a society!
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- But not all is good with tradfi:
 - Complexity
 - Rents
 - Justice
 - Access

ISDA_®

International Swaps and Derivatives Association, Inc.

2002 MASTER AGREEMENT

dated as of

and

have entered and/or anticipate entering into one or more transactions (each a "Transaction") that are or will be governed by this 2002 Master Agreement, which includes the schedule (the "Schedule"), and the documents and other confirming evidence (each a "Confirmation") exchanged between the parties or otherwise effective for the purpose of confirming or evidencing those Transactions. This 2002 Master Agreement and the Schedule are together referred to as this "Master Agreement".

Accordingly, the parties agree as follows:-



International Swaps and Derivatives Association, Inc.

2002 MASTER AGREEMENT

dated as of October 8, 2022





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Anthony owes Anup 100 times the S&P 500 closing price on November 8, 2022



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1. Interpretation

(a) Definitions. The terms defined in Section 14 and elsewhere in this Master Agreement will have the meanings therein specified for the purpose of this Master Agreement.

(b) Incontistency. In the event of any inconsistency between the provisions of this Schedule and the other provisions of this Master Agreement, the Schedule will prevail. In the event of any inconsistency between the provisions of any Confirmation and this Master Agreement, such Confirmation will prevail for the purpose of the relevant Transscritori.

(c) Single Agreement. All Transactions are entered into in reliance on the fact that this Master Agreement and all Confirmations form a single agreement between the parties (collectively referred to as this "Agreement"), and the parties would not otherwise enter into any Transactions.

- 2. Obligations
- (a) General Conditions.

 Each party will make each payment or delivery specified in each Confirmation to be made by it, subject to the other provisions of this Agreement.

(ii) Paynets under this Agreement will be made on the due due for value on that due in the place of the kecount specified in the relevant confirmation or otherwise paramate to this Agreement, in frequent transformable fands and in the manner customary for paynets in the required currency. Where settlement is by delivery (that is, whoft than by appearement, node delivery will be made for receipt the made for a settlement of the due due in the due due to the due due in the due due in the elevator in due to average the due to the due due in the due due in the elevator in the approximation or elevator in the apprecent.

(iii) Each obligation of each party under Section 2(a)(i) is subject to (1) the condition precedent that no Event of Default or Potential Event of Default with respect to the other party has occurred and is continuing, (2) the condition precedent that so Early Termination Dufe in respect of the relevant Transaction has occurred or been effectively designated and (3) each other condition specified in this Agreement to be a condition precedent for the purpose of this Section 2(a)(ii).

(b) Change of Account. Either party may change is account for receiving a payment or delivery by giving notice to the other party at last fiber local Basiness Days prior to the Scheludel Settement Date for the payment or delivery to which such change applies unless such other party gives timely notice of a reasonable objection to such change.

- (c) Netting of Payments. If on any date amounts would otherwise be payable:-
 - (i) in the same currency; and
 - (ii) in respect of the same Transaction,

by each party to the other, then, on such date, each party's obligation to make payment of any such amount will be automatically satisfied and discharged and, if the aggregate amount that would otherwise have been payable by one party exceeds the aggregate amount that would otherwise thave been payable by the other party, replaced by an obligation upon the party by which the larger aggregate amount would have been payable to pay to the other party each excess of the larger aggregate amount two the smaller aggregate amount.

The parties may cloci an respect of two or more Transactions that a net amount and payment obligation will be download in respect of all amounts paylols on these ands in the same currency in respect of these Transactions, regarding of the other and amounts paylors of the same data in the same currency in respect of these Transactions, its same and the Multiple Transactions. It is an effect of the same and the same and

(d) Deduction or Withholding for Tax.

(i) Gross-Cp, All payments under this Agreement will be made without any deduction or withholding for or on account of any Tax unless such deduction or withholding is required by any applicable law, as modified by the practice of any relevant governmental revenue authority, then in effect. If a party is so required to deduct or withhold in that party ("YV) will—

promptly notify the other party ("Y") of such requirement;

(2) pay to the relevant authorities the full amount required to be deducted or withheld (including the full amount required to be deducted or withheld from any additional amount paid by X to Y under this Section 2(d)) promptly upon the earlier of determining that such deduction or withhelding is required or receiving notice that such amount has been assessed against Y;

(3) promptly forward to Y an official receipt (or a certified copy), or other documentation reasonably acceptable to Y, evidencing such payment to such authorities; and

(iii) approximate and the set of the set

in each case by the date specified in the Schedule or such Confirmation or, if none is specified, as soon as reasonably practicable.

(b) Maintain Authorizations. It will use all reasonable efforts to maintain in fail force and effect all consents of any governmental or other authorize that are required to be obtained by it with respect to this Agreement or any Credit Support Document to which it is a party and will use all reasonable efforts to obtain any that may become necessary in the future.

(c) Comply With Laws. It will comply in all material respects with all applicable laws and orders to which it may be subject if failure so to comply would materially impair its ability to perform its obligations under this Agreement or any Credit Support Document to which it is a party.

(d) Tax Agreement. It will give notice of any failure of a representation made by it under Section 3(f) to be accurate and true promptly upon learning of such failure.

(c) Payment of Shamp Taxs. Subject to Section 11, 1t will pay any Shamp Tax levid or imposed upon it or in respect of its excerning to a juridicistion in which it is incorporated, exganized, managed and controlled or considered to have its sea, or where an Office forwagh which it is acting for the paymose of this Agreement by a juridicistion in which it is located ("Sham Tax Juridicistion"), and will identify the other party against any Shamp Tax levid or imposed upon the other party or in respect of the other party action target on the share the party a submark Tax. Larvisidient which more than the submark and the party action target of this Agreement by a Juridicistic n"), and the Juridicistic n"), and and the Juridicistic n"), and

5. Events of Default and Termination Events

(a) Events of Default. The occurrence at any time with respect to a party or, if applicable, any Credit Support Provider of such party or any Specified Entity of such party of any of the following events constitutes (subject to Sections 5(c) and 6(c)(w)) an event of default (m "Event of Default") with respect to such party.—

(i) Failure to Pay or Deliver. Failure by the party to make, when due, any payment under this Agreement or dedivery under Scenitor (24)(i) or 99(b)((2)) or (4) required to be made by it if such failure is not remedied on or before the first Local Business Day in the case of any such payment or the first Local Delivery Day in the case of any such delivery after, in each case, notice of such failure is given to the party;

(ii) Breach of Agreement; Repudiation of Agreement.

(1) Failure by the party to comply with or perform any agreement or obligation (oder than an obligation to make any payment under this Agreement or delivery under Section 2(a)(i) or 9(h)(i)(2) or (4) or (1) or (4) or (1) or (4) or (1) or (4) or (1) or (4))(1) or (4)(1) or

(2) the party disaffirms, disclaims, repudiates or rejects, in whole or in part, or challenges the validity of, this Master Agreement, any Confirmation executed and delivered by that party or any

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14. Definitions

As used in this Agreement:---

"Additional Representation" has the meaning specified in Section 3.

"Additional Termination Event" has the meaning specified in Section 5(b).

"Affected Party" has the meaning specified in Section 5(b).

/dfliate means, subject to the Schedule, in relation to any person, any entity controlled, directly or indirectly, hub the person, are unity that controls, directly or indirectly, the person are verify directly or indirectly and control with the person. For this purpose, "control" of any entity or person means ownership of a majority of the voing power of the entity or person.

"Agreement" has the meaning specified in Section 1(c).

"Applicable Close-out Rate" means:-

(a) in respect of the determination of an Unpaid Amount:---

 in respect of obligations payable or deliverable (or which would have been but for Section 2(a)(iii)) by a Defaulting Party, the Default Rate;

in respect of obligations payable or deliverable (or which would have been but for Section 2(a)(iii)) by a Non-defaulting Party, the Non-default Rate;

in respect of obligations deferred pursuant to Section 5(d), if there is no Defaulting Party and for so long as the deferral period continues, the Applicable Deferral Rate; and

(iv) in all other cases following the occurrence of a Termination Event (except where interest accrues pursuant to clause (iii) above), the Applicable Deferral Rate; and

(b) in respect of an Early Termination Amount:-

 for the period from (and including) the relevant Early Termination Date to (but excluding) the date (determined in accordance with Section 6(d)(ii)) on which that amount is payable:—

(1) if the Early Termination Amount is payable by a Defaulting Party, the Default Rate;

(2) if the Early Termination Amount is payable by a Non-defaulting Party, the Non-default Rate; and

(3) in all other cases, the Applicable Deferral Rate; and

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The '	Cross-Default" provisions of Section 5(a)(vi) [will][will not]* apply to Party A [will[will not]* apply to Party B
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[~ 5]N	erited indenteeness" [will have the meaning specified in Section 14 of this Agreement. [[means
"The	whald Amount" means
The •	Credit Event Upon Merger" provisions of Section 5(b)(v) [will][will not]* apply to Party A
	[will][will not] ⁺ apply to Party B
The *	Automatic Early Termination" provision of Section 6(a) [will][will not]* apply to Party A [will][will not]* apply to Party B
"Ter	mination Currency" [will have the meaning specified in Section 14 of this Agreement.][means
	den 1. Wenneder den 1999 van 1990 van die 1991 van die 1991 van die 1991 van die 1991 van die 1992 van 1993 van
Term For t	inned Termination Event [will[will not]" apply. [The following will constitute an Addit ination Event—
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For the For the Formation	Intend Termination Event [will[will not]" apply. [The following will constitute as Addit institute Termination Event, the Affected Party or Affected Parties will be

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^{•••} Include if Additional Termination Event will apply.

N.B.: the following representations may need modification if either party is a Multibranch Party.

Rents

PAYMENT NETWORK	AVERAGE CREDIT CARD PROCESSING FEES
Visa	1.29% + \$0.05 to 3.29% + \$0.10
Mastercard	1.39% + \$0.05 to 3.29% + \$0.10
Discover	1.58% + \$0.05 to 3.28% + \$0.10
American Express	1.5% + \$0.10 to 3.15% + \$0.10

Sources: Visa USA Interchange Reimbursement Fees published on April 23, 2022, Mastercard 2022–2023 U.S. Region Interchange Programs and Rates, Weils Fargo Merchant Services Payment Network Pass-Through Fee Schedule, and Wells Fargo Payment Network Qualification Matrix effective April 22, 2022.

Venmo will fix this!

Venmo will fix this!

venmo

We're reaching out to let you know that as of July 1, 2024, transaction fees for receiving payments tagged by the sender as a goods and services purchase will change to 2.99% per transaction.

This change won't affect fees for receiving payments into business or charity profiles, which remain at 1.9% + \$0.10 for Venmo-to-Venmo transactions. View our fees. Eligible goods and services payments are covered by Venmo Purchase Protection.

If you have questions, get in touch with us.

Thank you for choosing Venmo.

Justice?

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HORE > NEVS

Canada says it will freeze the bank accounts of 'Freedom Convoy' truckers who continue their anti-vaccine mandate blockades

Hattewitch Feb 16, 2022, 9:33 PM



Deputy Prime Minister Chrystia Freeland said banks are obligated to flag, freeze, or suspend accounts financing the "illegal becauses." Else GashirlEUTERS

- Canada says it will freeze the bank accounts of truckers who continue to form "Freedom Convoys."
- On Monday, Prime Minister Justin Trudeau declared a national emergency to combat the protests.
- Canadian truckers have been protesting vaccine mandates for weeks by blocking streets and bridges.

Source 1 and source 2

Justice?

Prohibited Activities

You may not use the PayPal service for activities that:

- 1. violate any law, statute, ordinance or regulation.
- 2. relate to immunition involving (a) narcoince, strenish, carcinia controlled abstinacies or other potentisk flag presents in this to isoniume aroles (b), do day invitad post, d), productisk flag presents in this to isoniume aroles (b), do day invitad post, (b) the prevention of that, s: visible, rescale or obsolic including digital and invitad post, (b) the prevention of that, s: visible, rescale or obsolic including digital and interfaces that is discretized by the financial explosion of a critera (g) indicates that is discretized by the strength of the prevention of the indicates of the indication of the strength of the strength of the indicates of the indication of the strength of the strength of the strength of the laws of any particulation, (i) certain sexually oriented materials is a strives, (i) weapsoor a chira's explained that or applicable law.
- relate to transactions that (a) show the personal information of third parties in violation of applicable law, (b) support personal or pours ischemes, matrix programs, other "get rich quick" schemes or certain null-level marketing programs, (c) are associated with purchases of annullises or lottery contracts, hyaway systems, off-shore banking or transactions to finance or refinance debts funded by a credit card, (d) are of the sale of certain intems before the seller has

control or possession of the item, (c) are by payment processors to collect payments on behalf of merchanks, (i) are associated with the sale of traveler's checks or money orders, (g) involve currency exchanges or check cashing businesses, (h) involve certain creatif requir, debt stellment services, credit transactions or insurance activities, or (i) involve offering or receiving payments for the purpose of bribery or corroration.

- involve the sales of products or services identified by government agencies to have a high likelihood of being fraudulent.
- 5. involve the sending posing, or publication of any messages, costen, or matrixin that, in PayPa's and discretion, (a) are harding denotes, harming or harding the sending of the sending of the sending of the activities (c) Paysics or provide likely and use, (a) depice or promote violance, control activity, control, well-known (c) depices, pownets, or incide any discretional activity, control, well-known (c) depices, pownets, or incide activities of protected groups or of individual or groups based on potential discretional activity, control, well-known (c) depices and the sending of the sense selfory or variable (c) depices and the protection of the sense selfory or variables, (c) are fundamental potential properties and (b) do infinge the provise, on the level and protection protection of the sense selfory or variables (c) do not match the protection of the sense selfory or variables (c) do not match the protection of the sense selfory or variables (c) do not match the protection of the sense selfory or variables (c) do not match the sense match or variables (c) do not selfory or variables (c) do not do not sense (c) do not sense (c) do not sense (c) or variables (c) do not sense (c) or variables (c) do not sense (c) or variables (c) do not sense (c) do no
- relate to transactions involving any activity that requires pre-approval without having obtained said approval.

Source 1 and source 2

Tiniest bit of personal opinion

I am in favor of discouraging offensive wars, but know the financial system to be a very blunt instrument for expressing society's preferences. In particular, while the global financial system and the governments giving them instructions have not actually banned the usage of oligarchs' wealth prior to now, they have already given many ordinary Russians (and *ordinary Ukranians*!) severe difficulties doing things we expect to be utterly routine for law-abiding members of society.

Without divulging any professional confidences, in the wake of the 2014 invasion of the Crimean Peninsula many U.S. banks decided to stop serving customers with Ukrainian passports. No one explicitly made the decision "Your nation got invaded, so you should have less access to financial systems *holf a world away*. This is a natural and just outcome in a democratic society."

It flowed indirectly through "The Crimea now poses a heightened risk of money laundering", "We lack the ability to discriminate between the Crimea and the rest of Ukraine", "We care a lot more about not facilitating money laundering than we do about our infinitesimal Ukraine business so Ukraine is going on the High Risk Country list", "Sorry, you have citizenship from the High Risk Country list, accordingly I'm not allowed to open this account for you. This is a commercial decision of the bank and will not be reversed."

Source: Bits About Money on international transfers

Other Issues with Tradfi

- "Walled garden" industrial organization
- Rusty pipes, lack of composability
- Crashes, fragility, systemic risk
- Privacy?

- Traditional financial system plays major role in society, but has a number of flaws
- Can defi potentially help fix these flaws?

Defi is very successful!



Source

But still small overall...

DeFi TVL data is as of 5/12/2022

DeFi would represent the 31st largest US bank by total assets under management



Decentralized Finance: The Vision

Simple,

- Low-cost and competitive,
- Just and non-discretionary,
- Accessible,
- etc. etc....

Defi Contracts...

Product 🗸 Solutions 🗸 Open S	ource v Pricing Search				
Uniswap Labs Web3 infrastructure and products A: 12k followers					
📮 v3-core (Public)	Julic Public				
3 3 Core smart contracts of Uniswap v3	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>				
● TypeScript 😭 3k 😵 1.5k	● TypeScript				
📮 interface (Public)	📮 v3-sdk Public				
An open source interface for the Uniswap protocol	ℜ An SDK for building applications on top of Uniswap V3				
● TypeScript	● TypeScript 🛱 400 😵 268				
📮 v2-core (Public)	v2-periphery Public				
Core smart contracts of Uniswap V2	Peripheral smart contracts for interacting with Uniswap V2				
● TypeScript 🙀 2.1k 😵 2.3k	● Solidity 🛱 832 😵 1.3k				

Defi Contracts...

Ç	Product ~ Solutions ~ Open So	urce ~ Pricing	
Uniswap / v3-core	e Public		
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	13 tags		Go to file Code -
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	📄 .github	feat: add stale config (#571)	3 months ago
	audits	add tob audit	2 years ago
	Contracts	Dual license under GPL or BUSL (#557)	5 months ago
	🖿 test	change how we get wallets for testing against external nodes	16 months ago
	gitattributes	add prettier	3 years ago
	🗋 .gitignore	big test infra upgrade (hardhat + typechain)	2 years ago
	.prettierrc	add prettier	3 years ago
	solhint.json	prettier + solhint	2 years ago
	🗅 .yarnrc	ignore scripts	2 years ago
	LICENSE	add LICENSE and make associated changes (#433)	2 years ago
	C README.md	Dual license under GPL or BUSL (#557)	5 months ago
	bug-bounty.md	add tob audit	2 years ago
	C echidna.config.yml	more robust price math testing + add incomplete pair echidna test	(#98) 2 years ago

Defi Contracts...

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4	import "./fullMath.sol';	
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	/// @title Computes the result of a swap within ticks	
8	/// protice Contains methods for computing the result of a swap within a single tick price range, i.e., a single tick-	
2	litery septeth (
10	/// profice Computes the result of swapping some amount in, or amount out, given the parameters of the swap	
	/// plev The fee, plus the amount is, will never exceed the amount remaining if the sump's 'amountSpecified' is positive	
2	/// gparam sprtRatLaCurrentING The current sprt price of the pool	
13	/// gparam sprtRatiaTarge1306 The price that cannot be exceeded, from which the direction of the swap is inferred	
14	/// gparam liquidity The usable liquidity	
15	/// gparam amountRemaining Now much input or cutput amount is remaining to be sumpped in/out	
16	/// gparam feePips The fee taken from the input amount, expressed in hundredths of a hip	
	/// greture cartBatLoBoottNH The price after camping the ansatt injust, not to exceed the price target	
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Decentralized Finance

Next few lectures, we'll talk about defi applications, focusing on:

- Automated Market Makers
- Stablecoins
- Lending Protocols
- Tokenomics
- Financial Institutions around Crypto

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- What new weaknesses are introduced?
- What kinds of promises that couldn't be made, now can be made, thanks to blockchain technology?