

Terra Stability Mechanism Deep Dive



Nicholas Platias
Head of Research

EXECUTIVE SUMMARY



Terra is a blockchain payment network for the growing Asian eCommerce market. It rebuilds the payments stack on the blockchain to deliver unparalleled efficiency to partners and value to customers.

PRODUCT HIGHLIGHTS

Massive eCommerce alliance with \$25 billion in GMV and 45 million users to push initial adoption

Comprehensive, end-to-end payment solution tailored for the needs of the growing Asian eCommerce market

Discounts on every transaction, funded by economic growth in its underlying digital currency

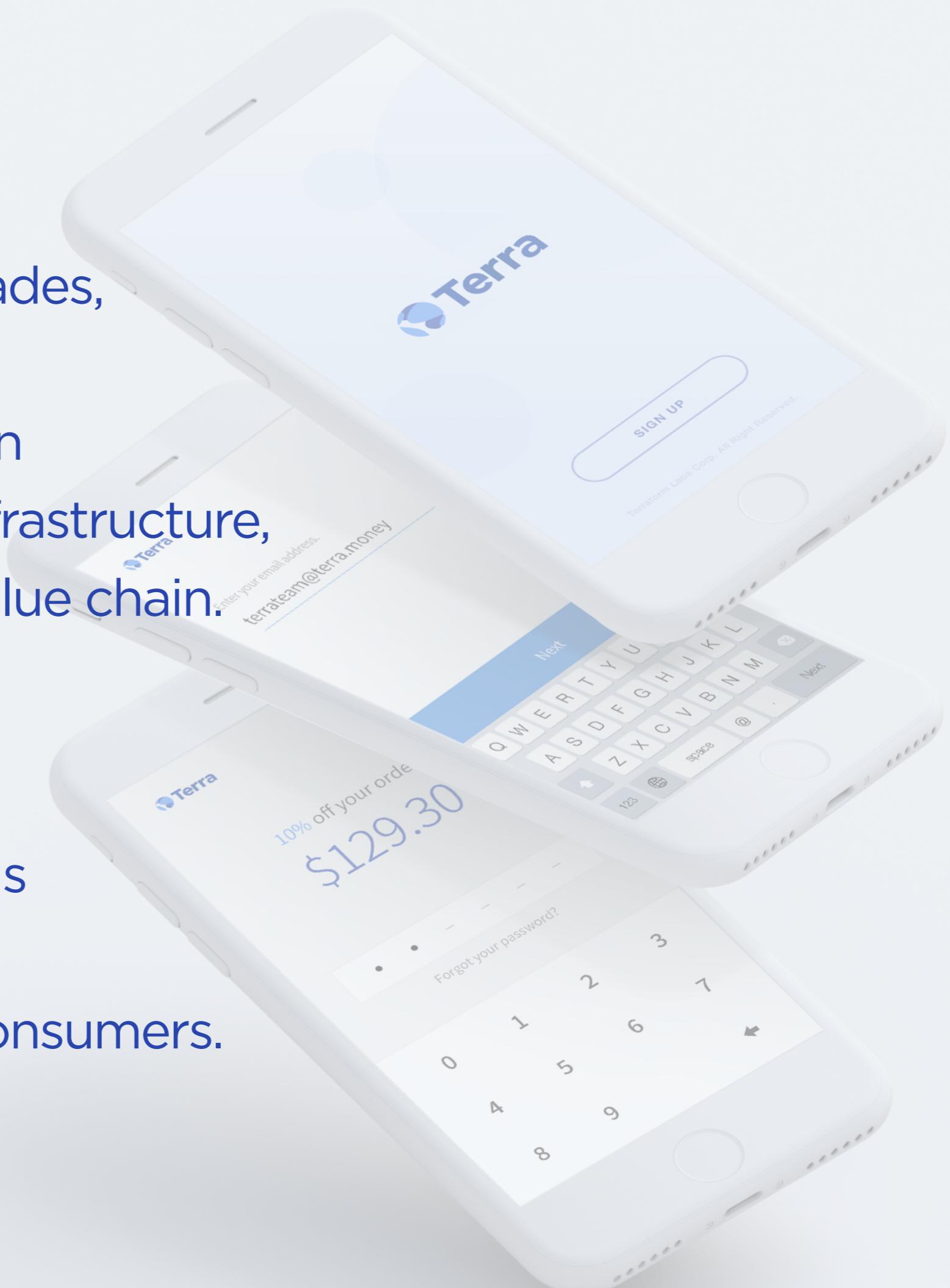
Lower transaction fees by circumventing existing payment networks

While digital payments have been around for decades, the core payment stack has not evolved in years.

Digital payments are still locally confined, reliant on unnecessary middlemen, and built on outdated infrastructure, creating inefficiencies for all stakeholders in the value chain.

Our answer is Terra

the next-generation payment network that rebuilds the payment stack on the blockchain to provide unprecedented benefits to both merchants and consumers.



PRODUCT HIGHLIGHTS

**Asia's top eCommerce companies
are joining Terra in search
of a better payment solution**

Terra Genesis Alliance

15 partners at genesis

\$25 billion in collective GMV

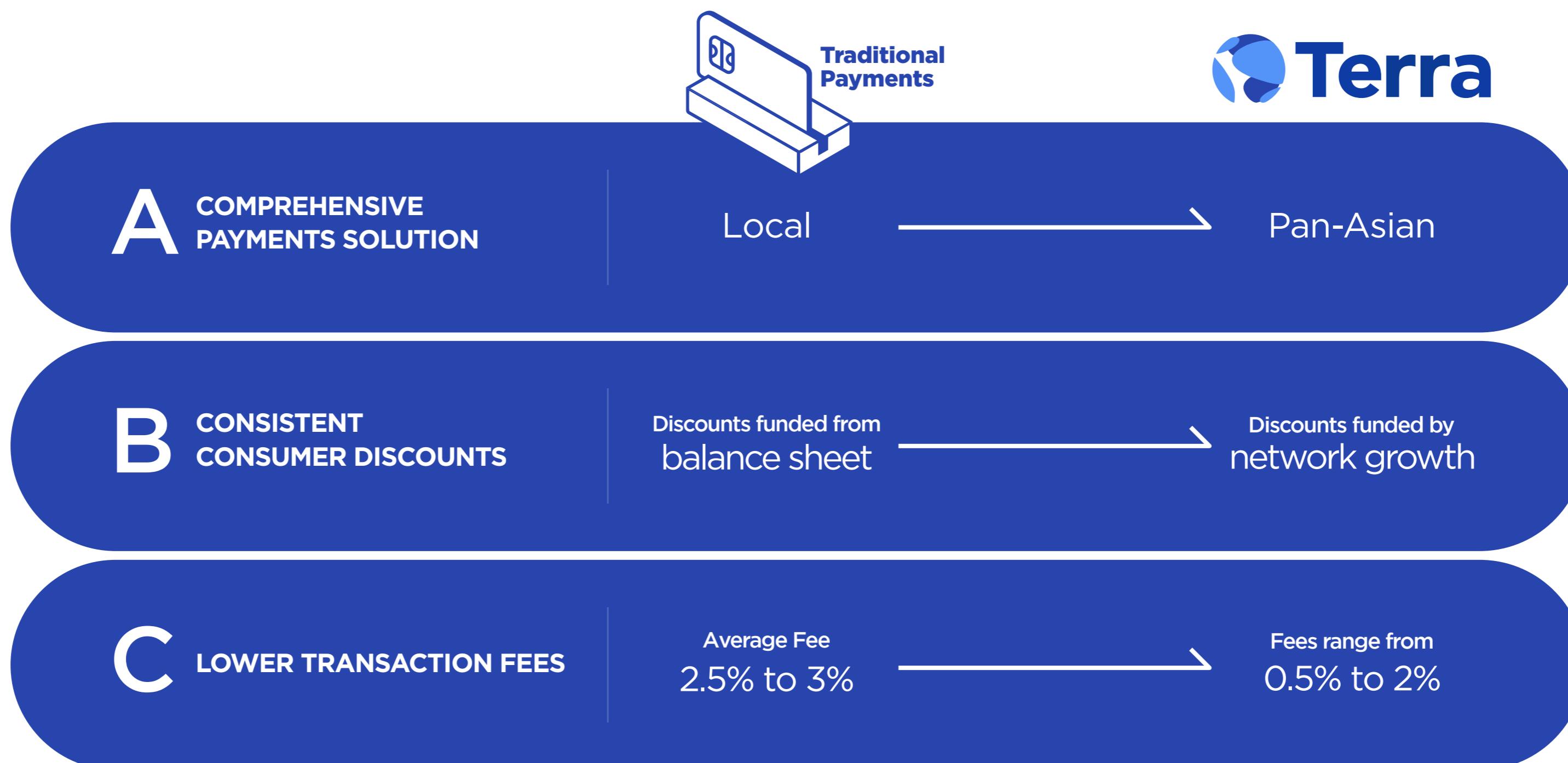
45 million global users

No	Name	Industry	GMV (bn)	Region
01	Ebates	eCommerce Affiliate	\$8	SEA
02	Carousell	C2C Marketplace	\$5	SEA
03	TMON	eCommerce	\$3.5	Korea
04	Woowa	Food Delivery	\$3.5	Korea
05	Qoo10	eCommerce	\$1	SEA
06	Galleria	Department Store	\$1	Korea
07	Yanolja	Accommodations	\$1	Korea
08	Musinsa	Fashion eCommerce	\$0.5	Korea
09	Megabox	Cinema	\$0.5	Korea
10	Tiki	eCommerce	\$0.5	Vietnam
11	Pomelo	Fashion eCommerce	\$0.25	Thailand
12	Idus	eCommerce	\$0.1	Korea
13	Zaksim	Library	\$0.1	Korea
14	Women's Talk	Cosmetics	< \$0.1	Korea
15	Althea	Cosmetics	< \$0.1	SEA

* Alliance Partners in order of transaction volume

A total of \$25 billion in GMV with more partners to come

Terra's irrefutable offer has struck home in the highly competitive Asia eCommerce market



Asia's digital payments market is extremely crowded with undifferentiated products

Alipay

WeChat Pay

SAMSUNG pay

Apple Pay

Rakuten Pay

N Pay

GO PAY

Grab Pay

PROMPT PAY

R A Z E R

fave PAY

AEON

UOB

LINE Pay

kakaopay

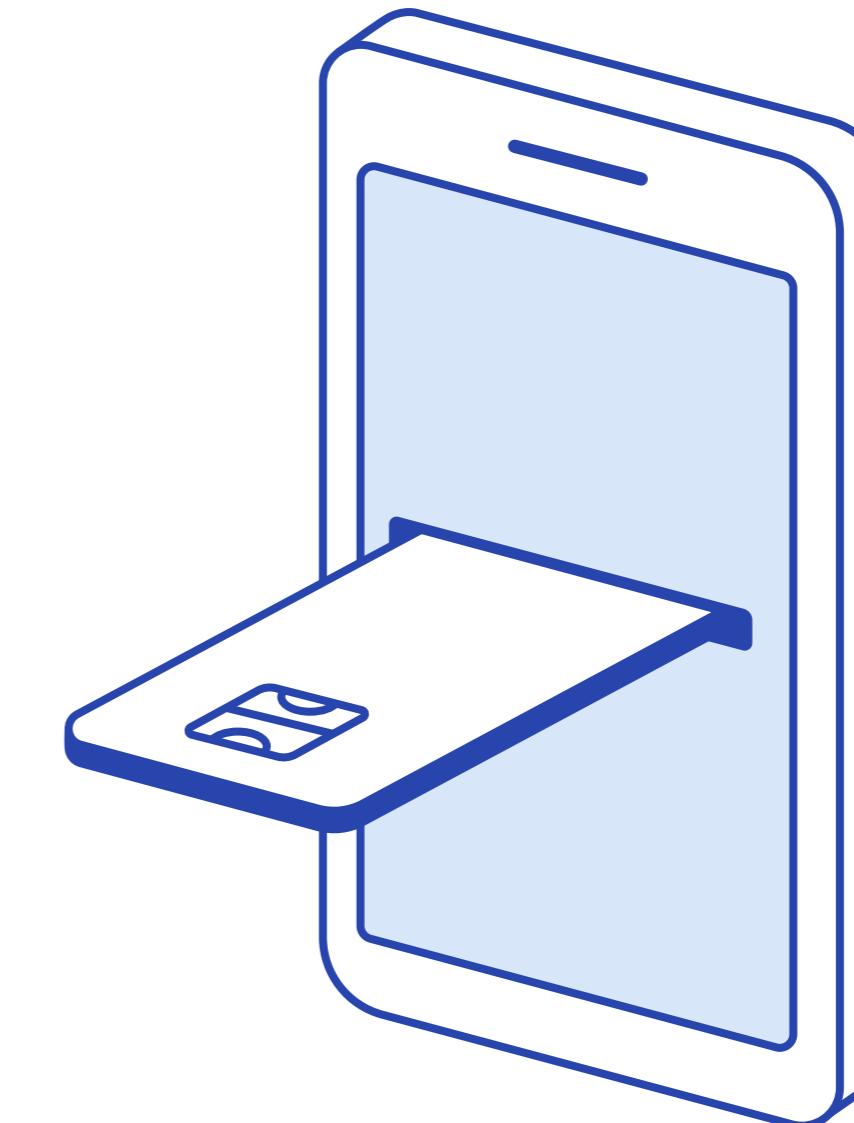
PAYCO

paytm

OVO

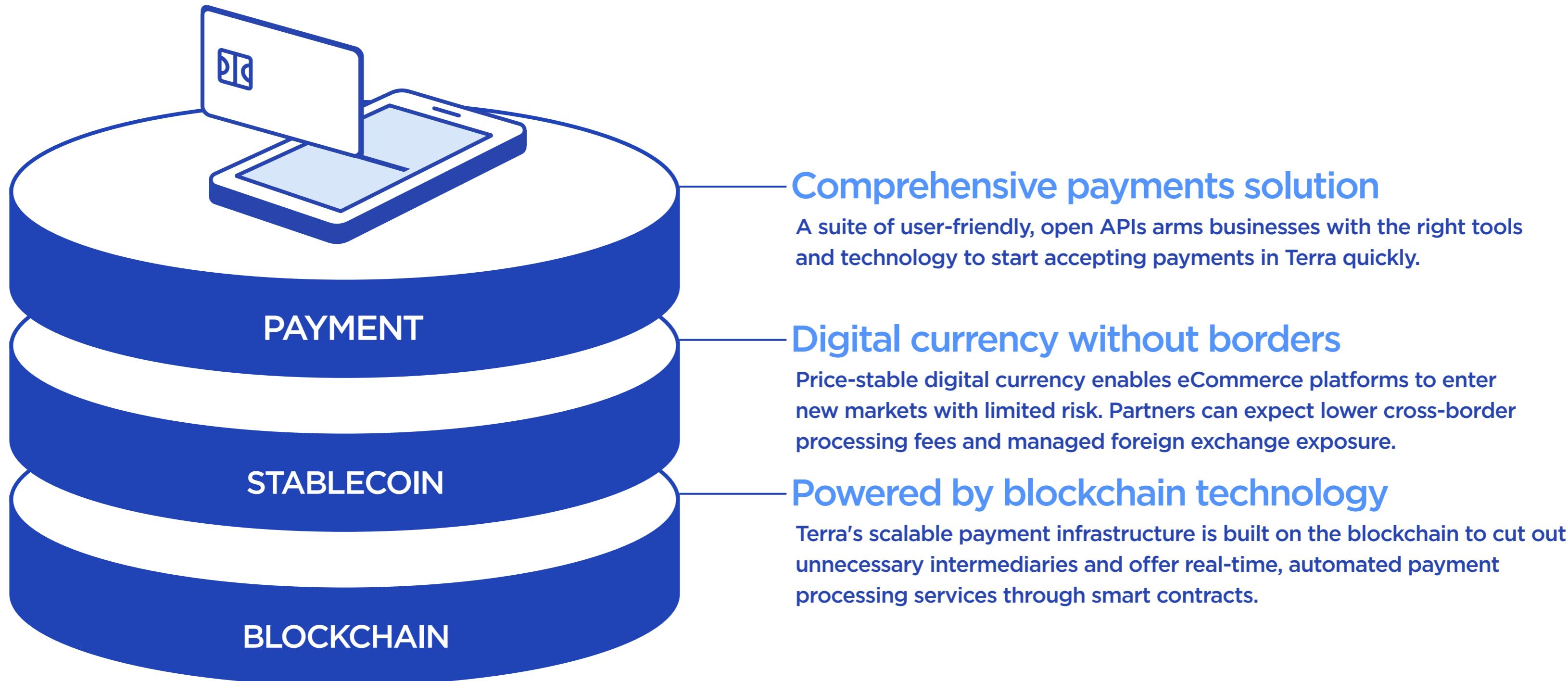
Dash

MobiKwik



Preferred payment methods vary significantly by country, and a fragmented payment landscape had led to more complexity for both merchants and consumers. Moreover, of the 45+ wallet companies in Asia, most operate without a clear revenue model or core product value, leading to high user acquisition and retention costs.

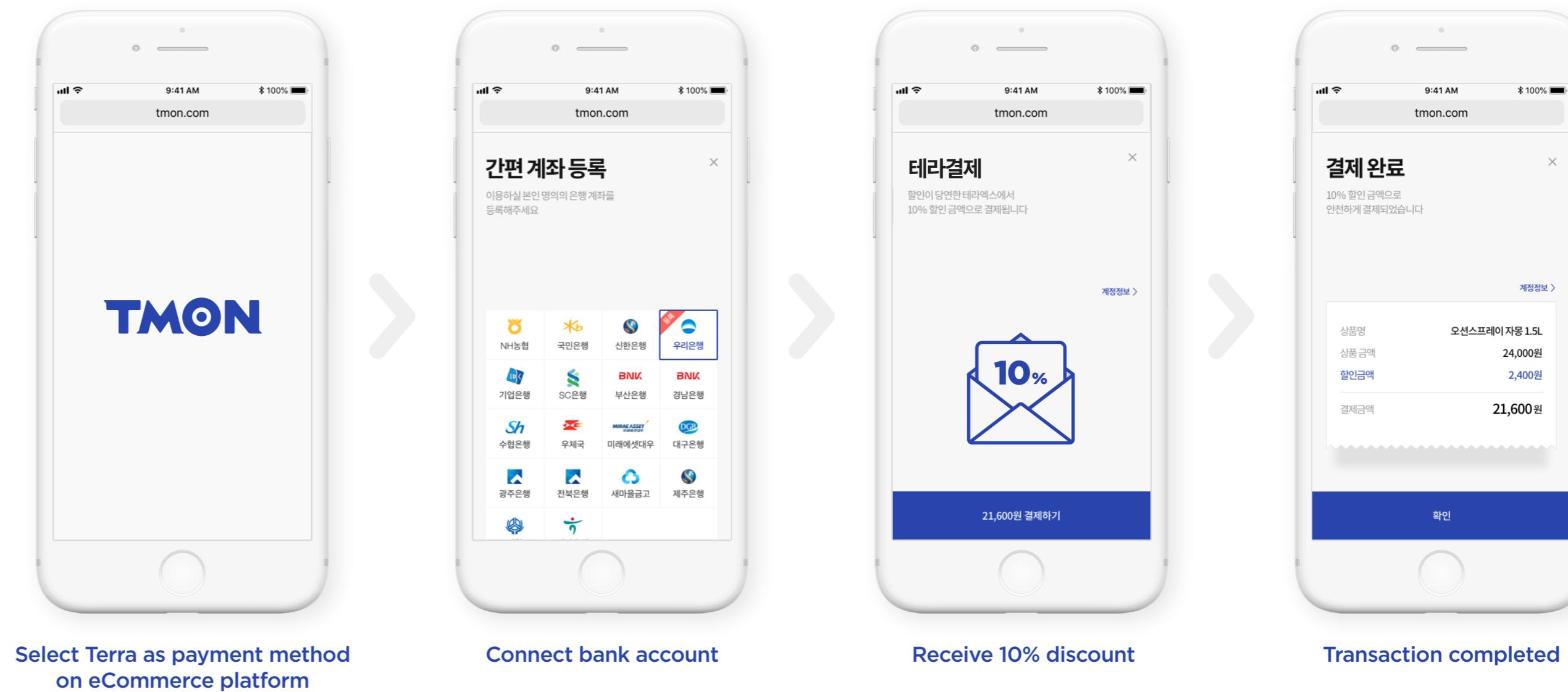
Terra is a comprehensive, end-to-end payments solution tailored for the growing Asian eCommerce market



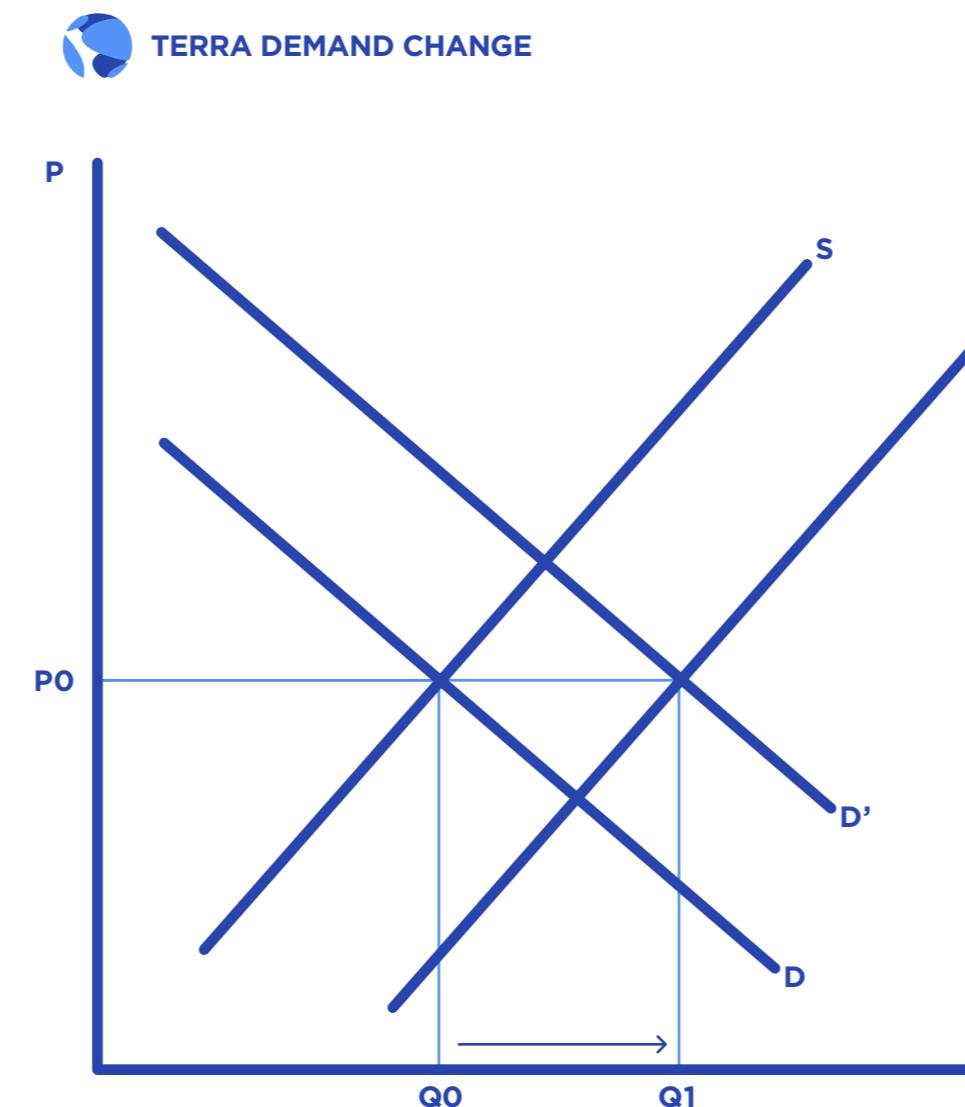
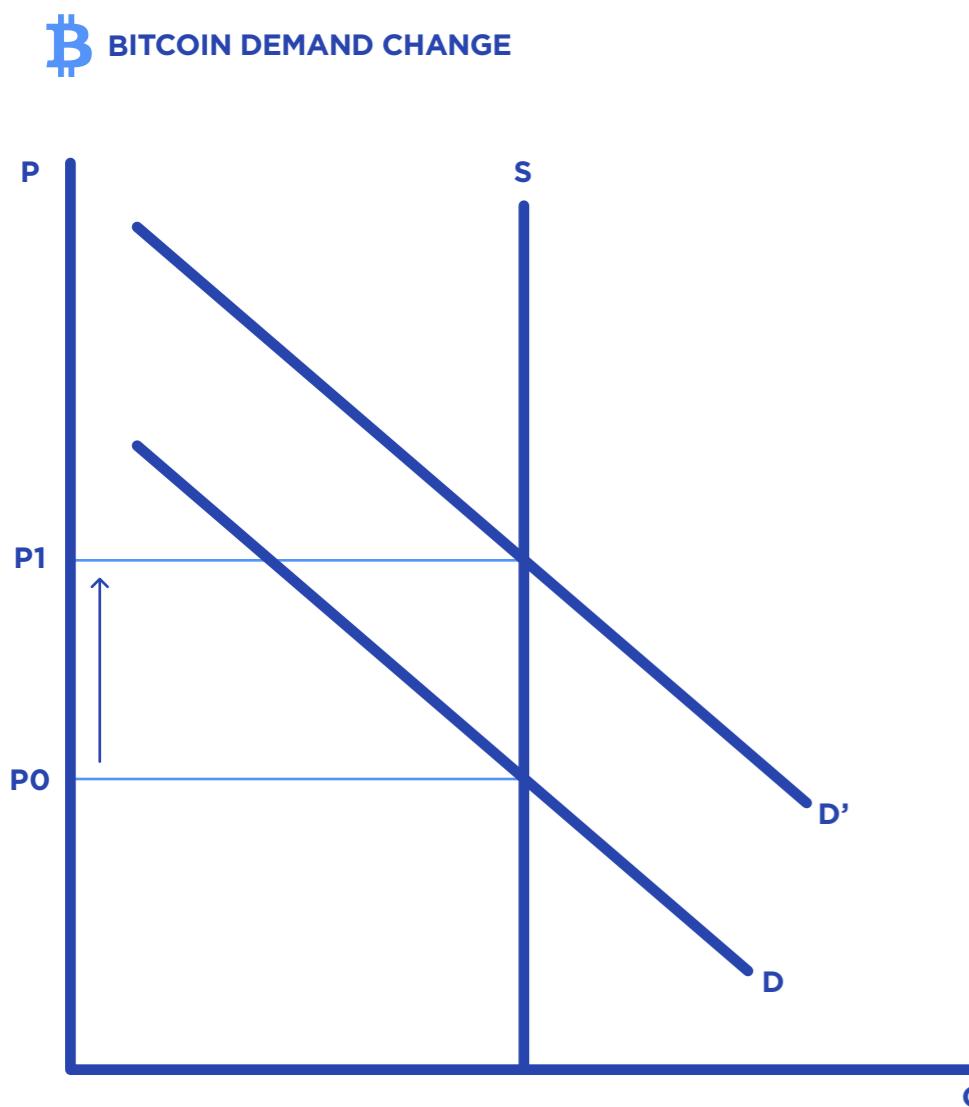
Terra has an unfair advantage over other payments players because it can provide ongoing discounts on every transaction

The value proposition to the end-user is simple

Enjoy the same checkout experience you've become accustomed to at a 5-10% discount for every transaction.



Terra maintains stability by algorithmically adjusting money supply

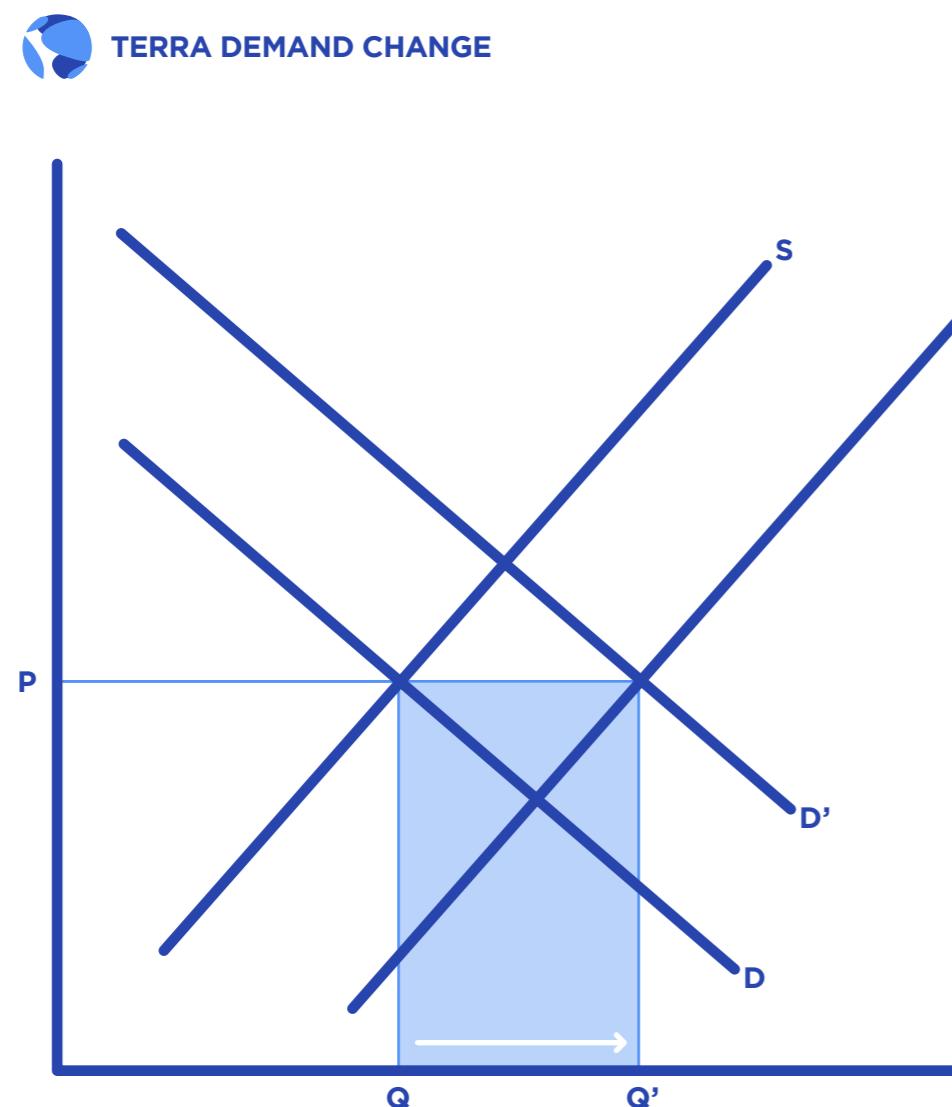


TERRA'S ALGORITHMIC MONETARY POLICY

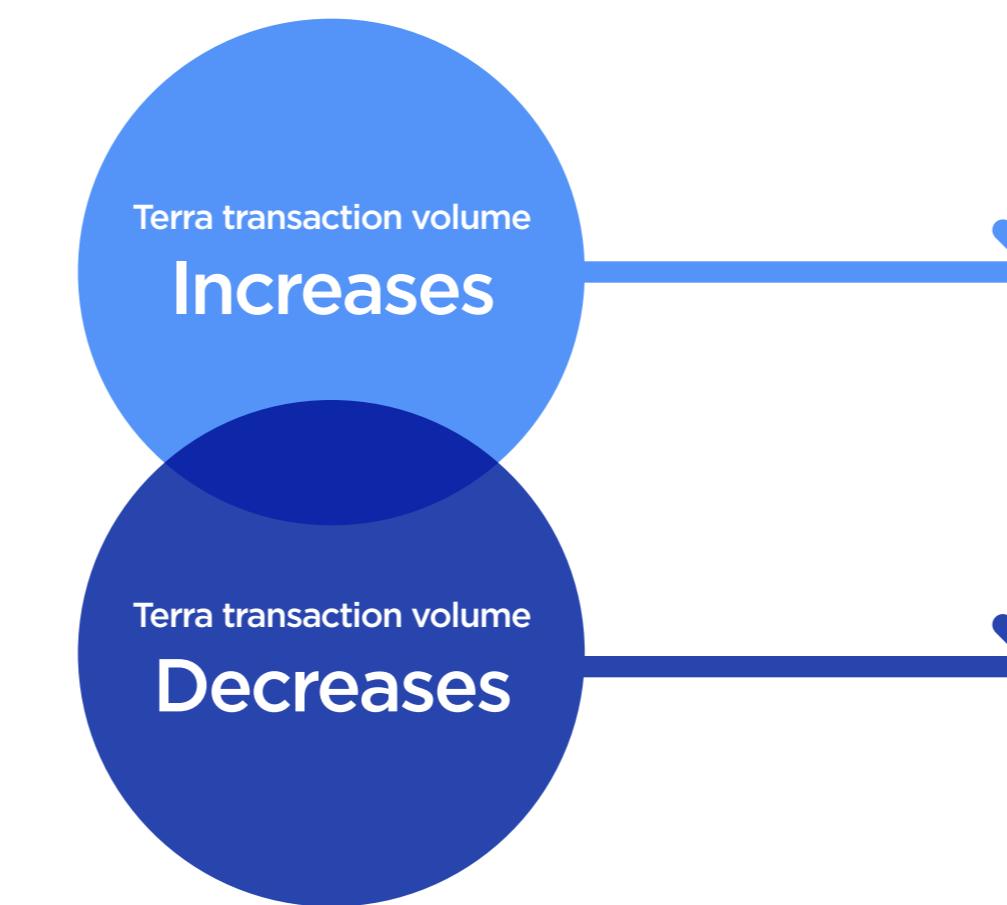
When the price of Terra goes up, the protocol prints Terra to bring the price back down.

When the price goes down, the system buys back Terra from the market using the stability reserve and burns them.

Terra's discount model is made possible by the unique token economics of its underlying digital currency



Terra's medium of payment is an algorithmic stablecoin. When transaction volume on eCommerce increases, the overall demand for the stablecoin also increases, and Terra must issue new money supply in order to maintain price stability.

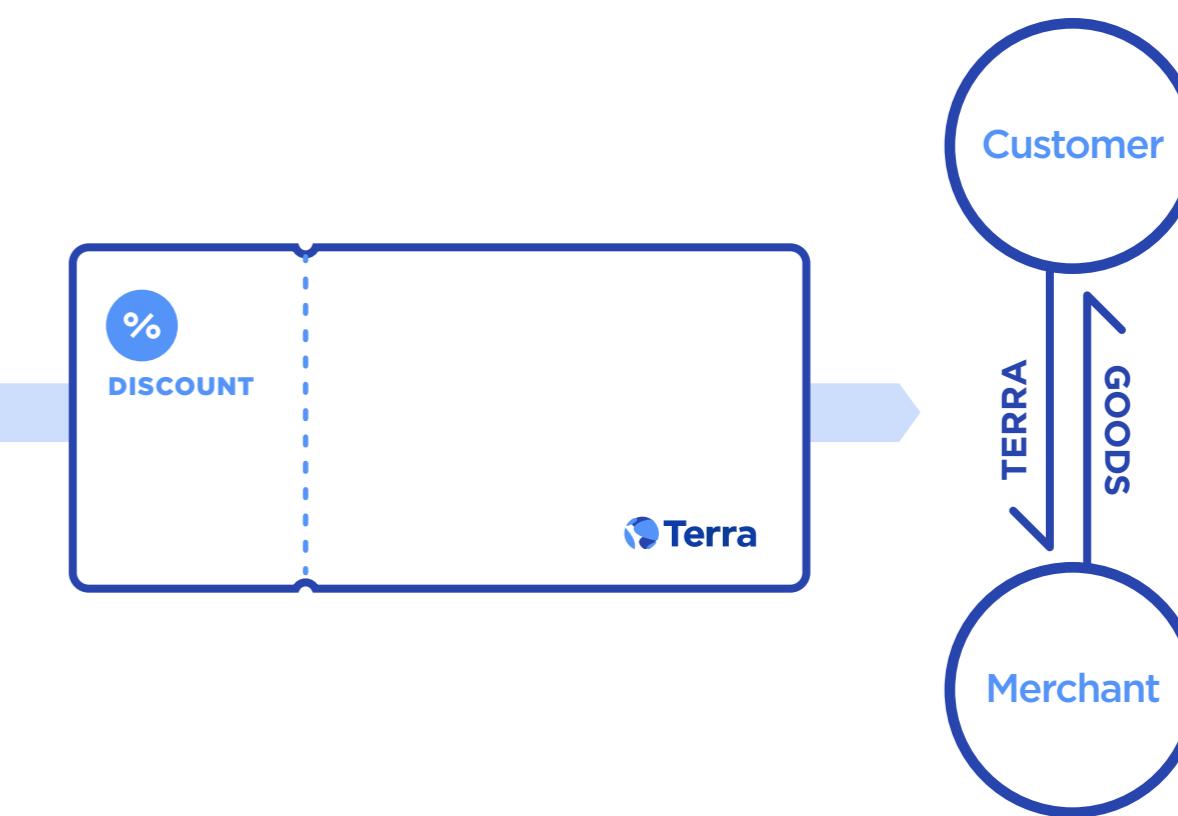
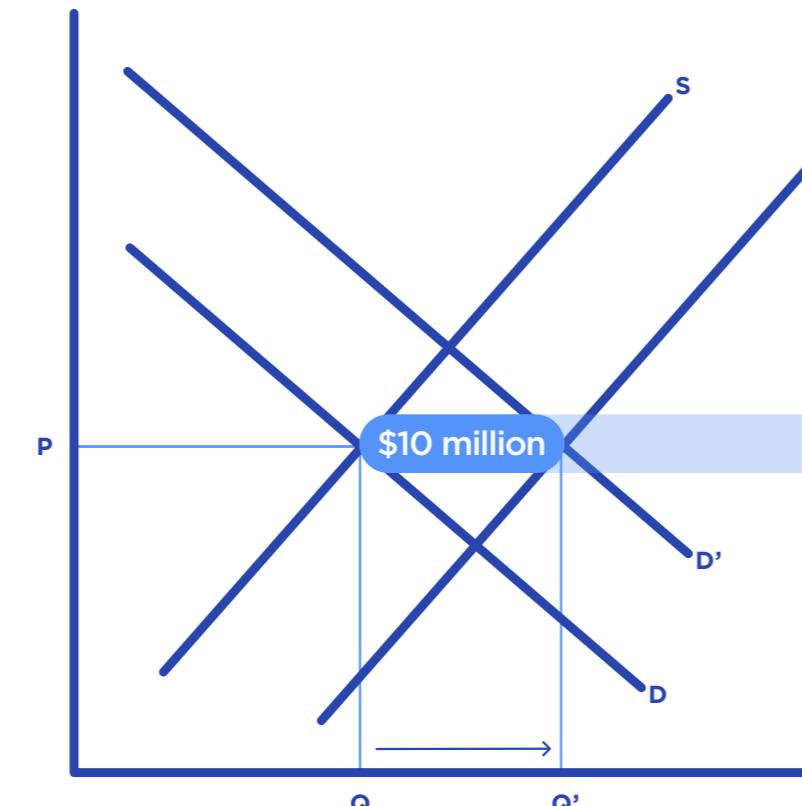
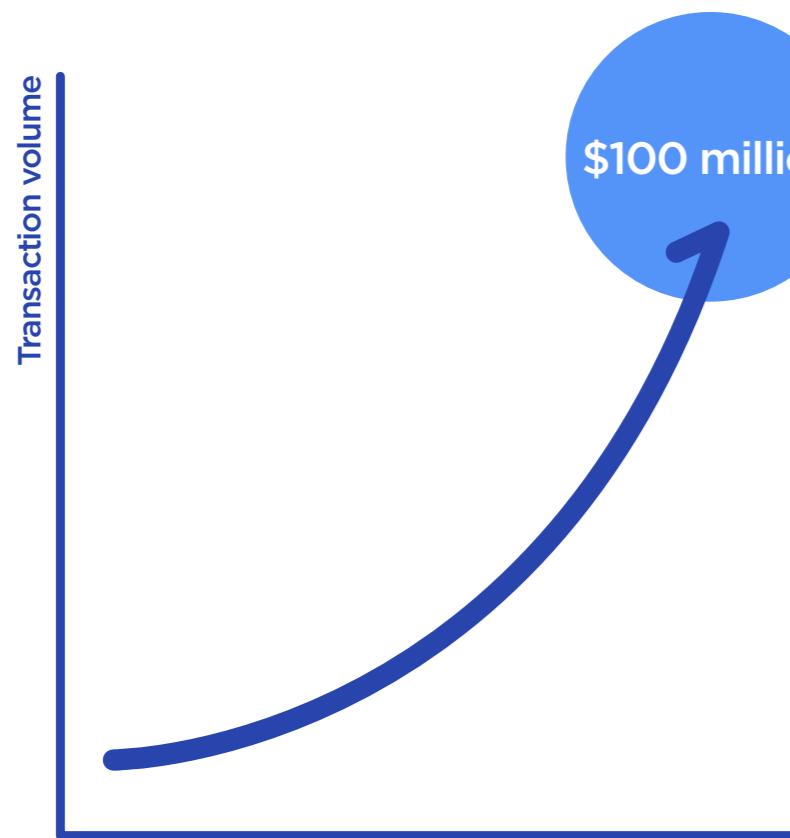


Terra issues more money supply

Terra buys back and burns excess money supply

Increased money supply of the digital currency is used to fund ongoing discounts

Illustrative Example



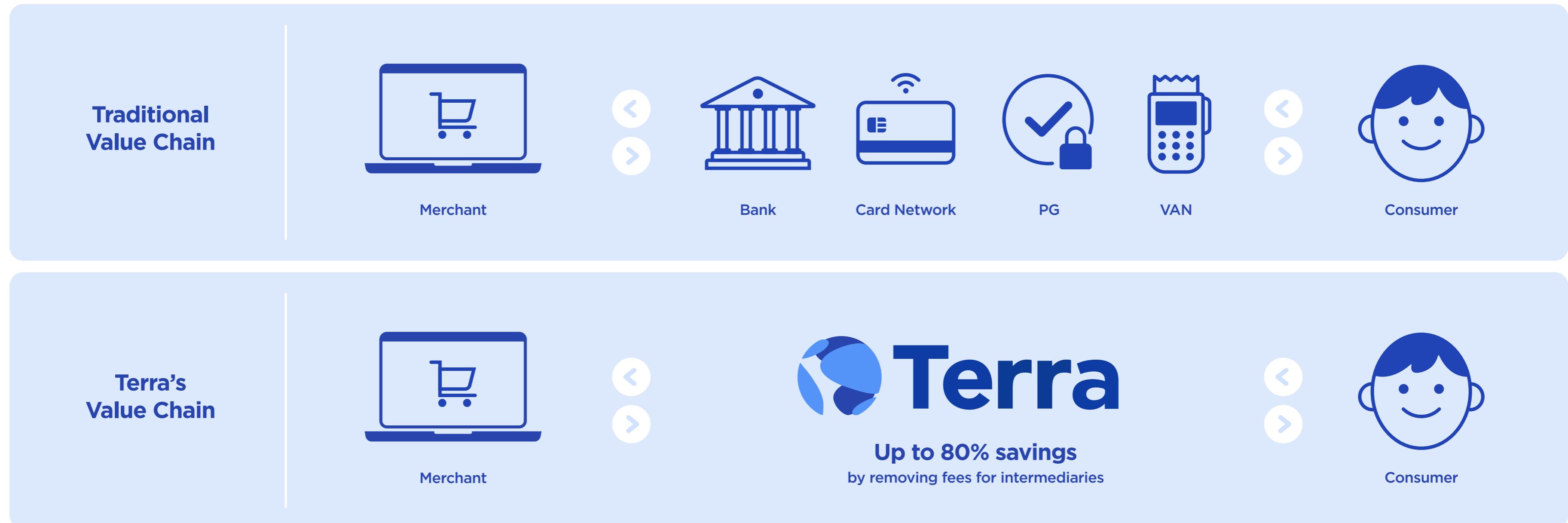
Terra's transaction volume increases by \$100 million through a newly added eCommerce partner.

To meet the increased transaction volume and demand, the protocol increases the supply of Terra by \$10 million.*

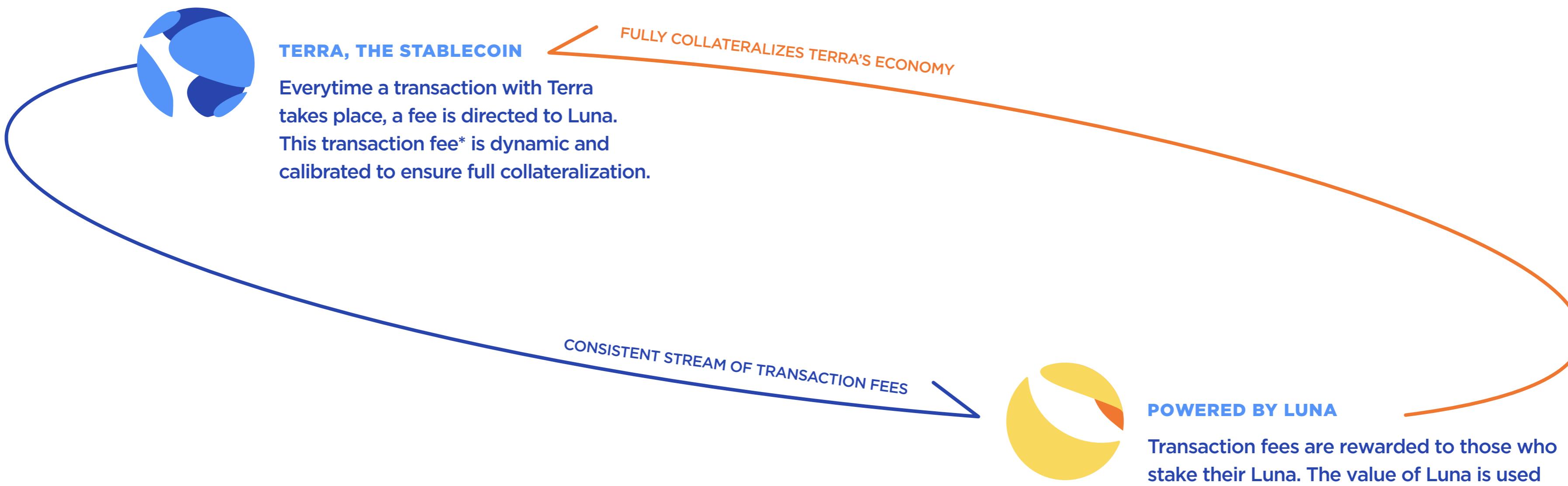
This growth in money supply is returned to users as discounts, serving as a strong incentive to use Terra instead of other payment options.

*Detailed explanation available on Terra's White Paper

Terra can significantly decrease transaction fees for merchants by cutting out unnecessary middlemen



The only transaction fee Terra charges is to fund Luna, the ecosystem's collateral token



* Algorithmically calibrated based on Dynamic Multiplication/Milestone-based Decrement (DMMD). More information available on Terra's White Paper.

Terra's growth story

However, most crypto projects pursue hype rather than traction and growth

BLOCKCHAIN COMPANIES

VS

TRADITIONAL STARTUPS

Whitepaper

Business plan

Token raise

Equity raise

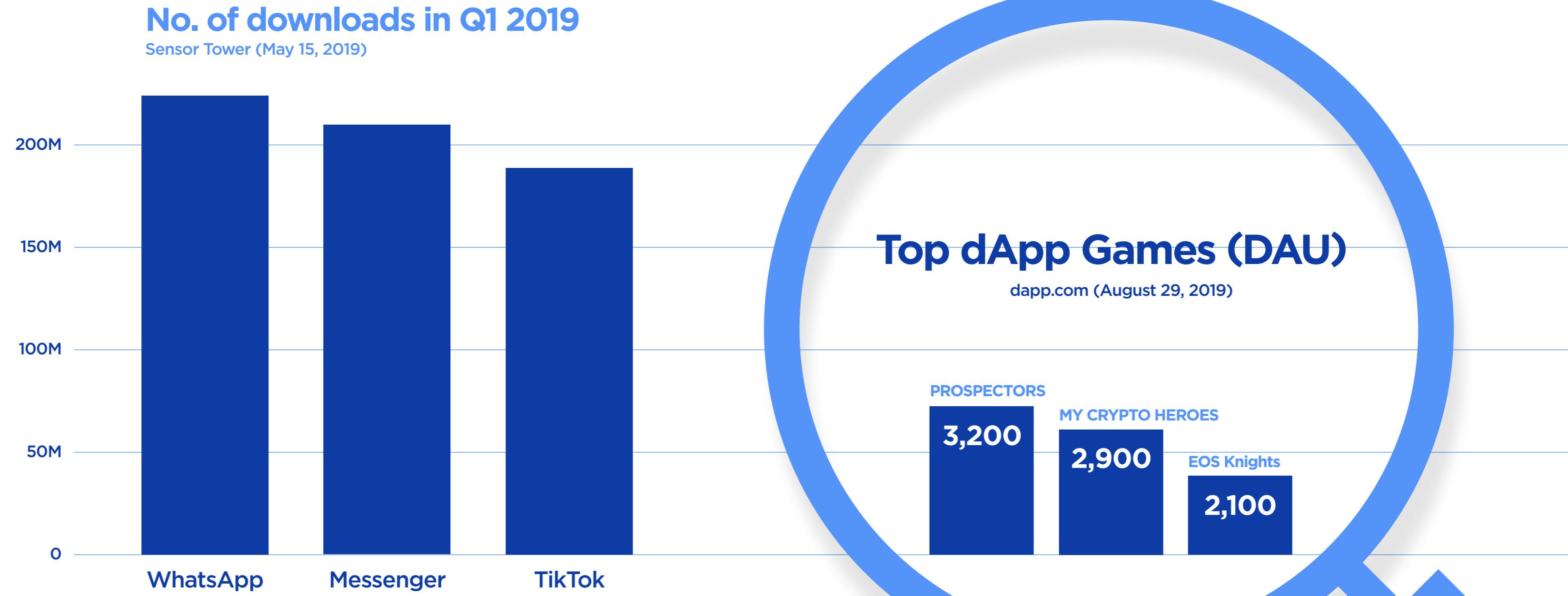
Decentralized ownership

Consolidation of voting power

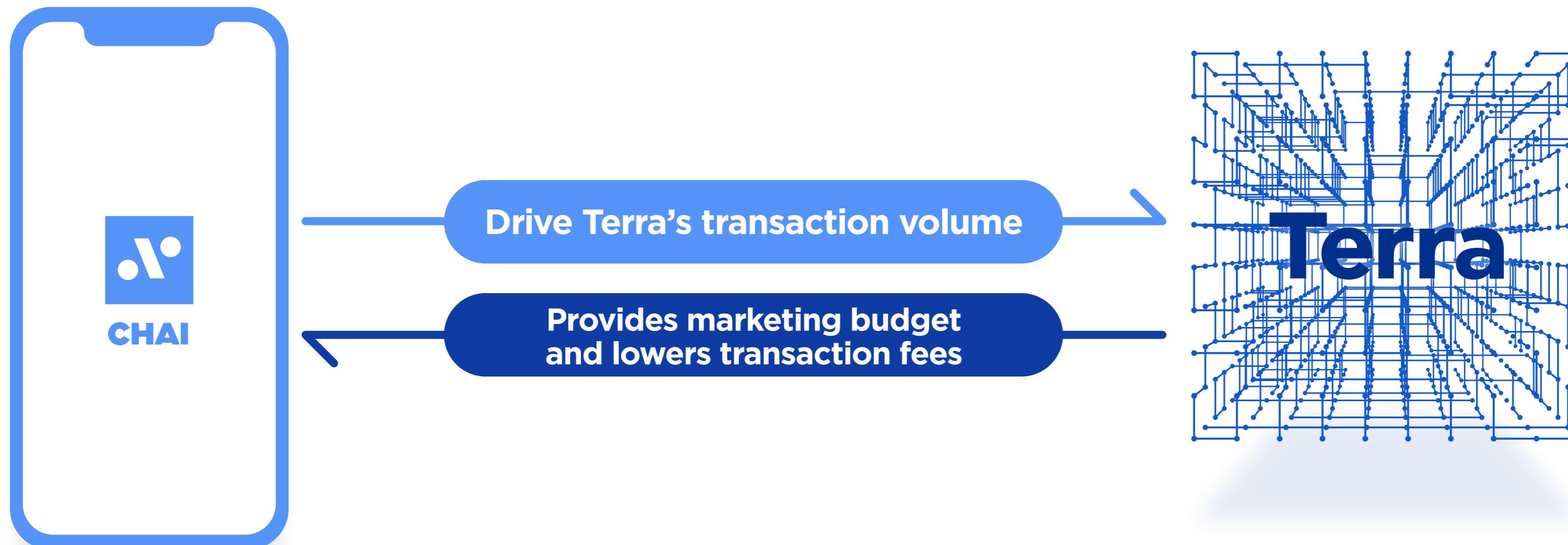
Token prices

Usership growth

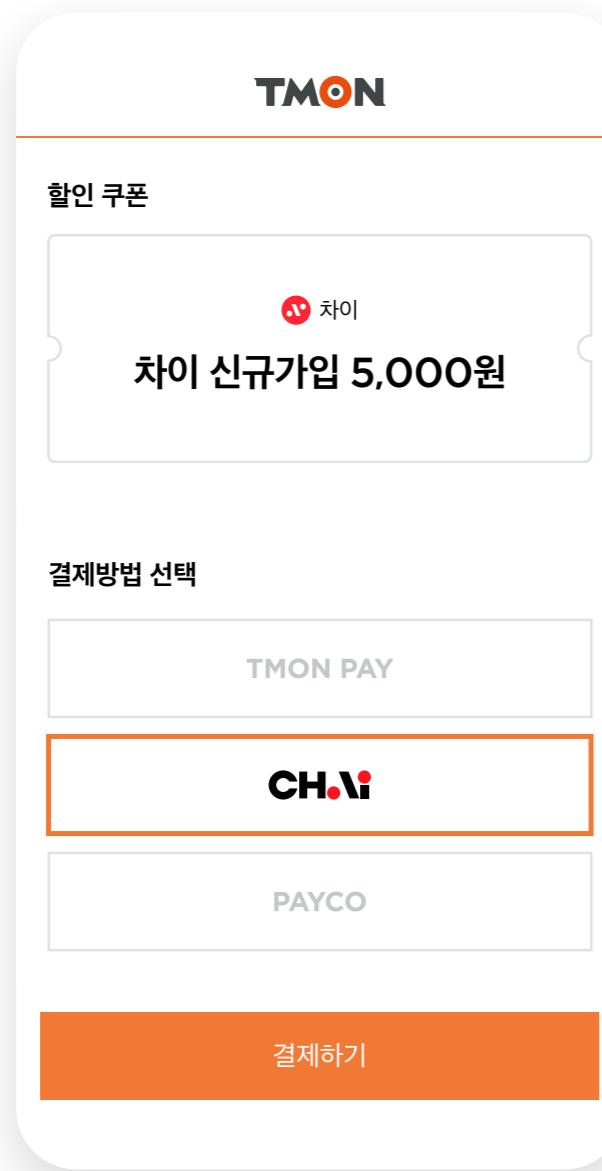
Perhaps because focus was never on user adoption, dApp traffic is absolutely abysmal



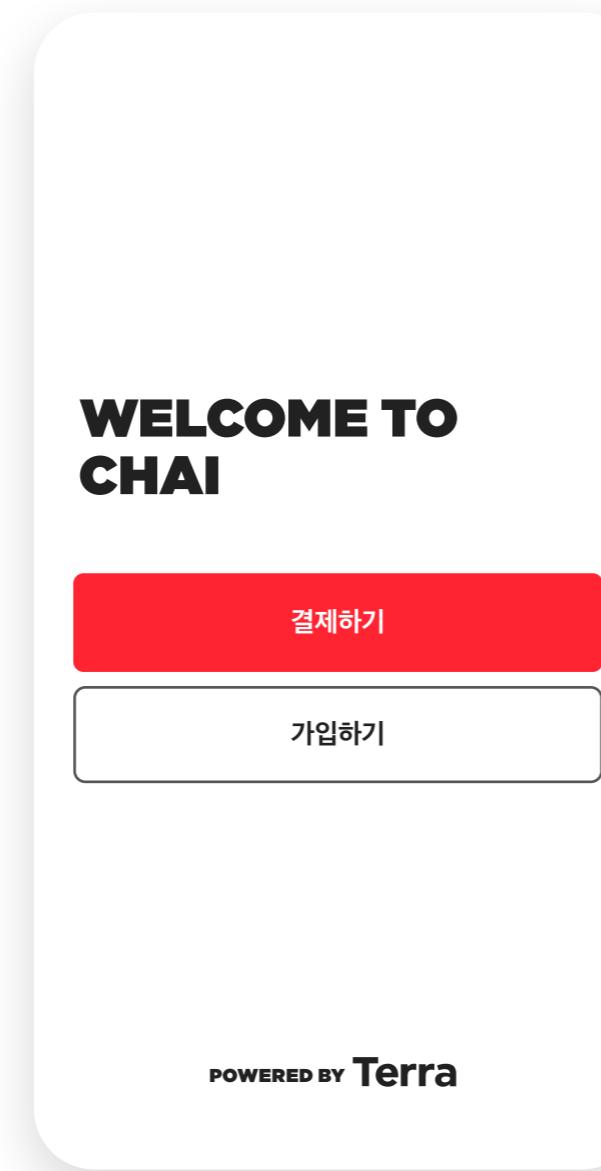
CHAI's unique value proposition is enabled by Terra's cutting-edge blockchain technology



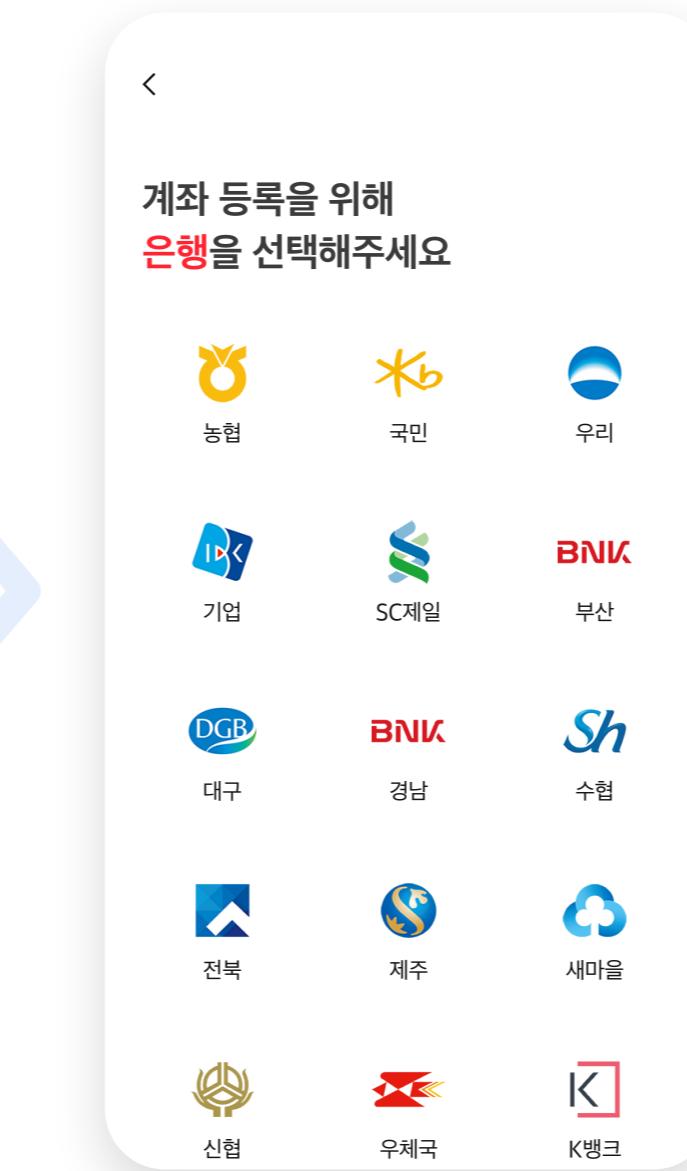
On the surface, Terra offers the same seamless UX as mainstream payment apps



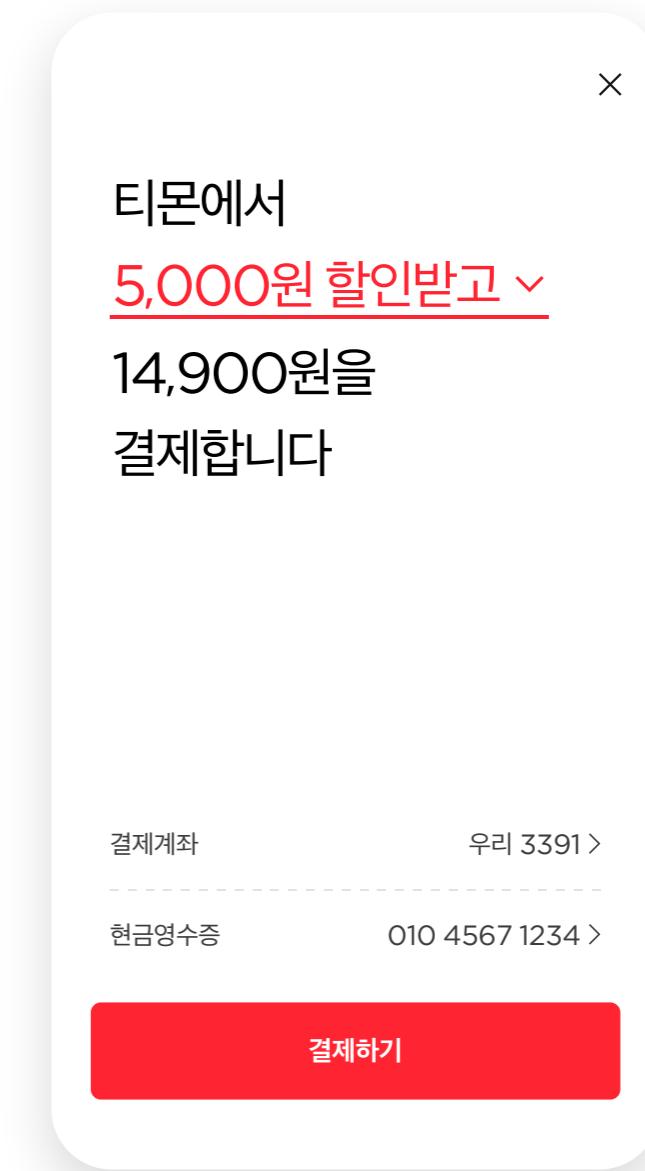
Choose CHAI



Sign Up



Connect Bank



Get Discount

CHAI's early traction has been explosive

430,000

USERS



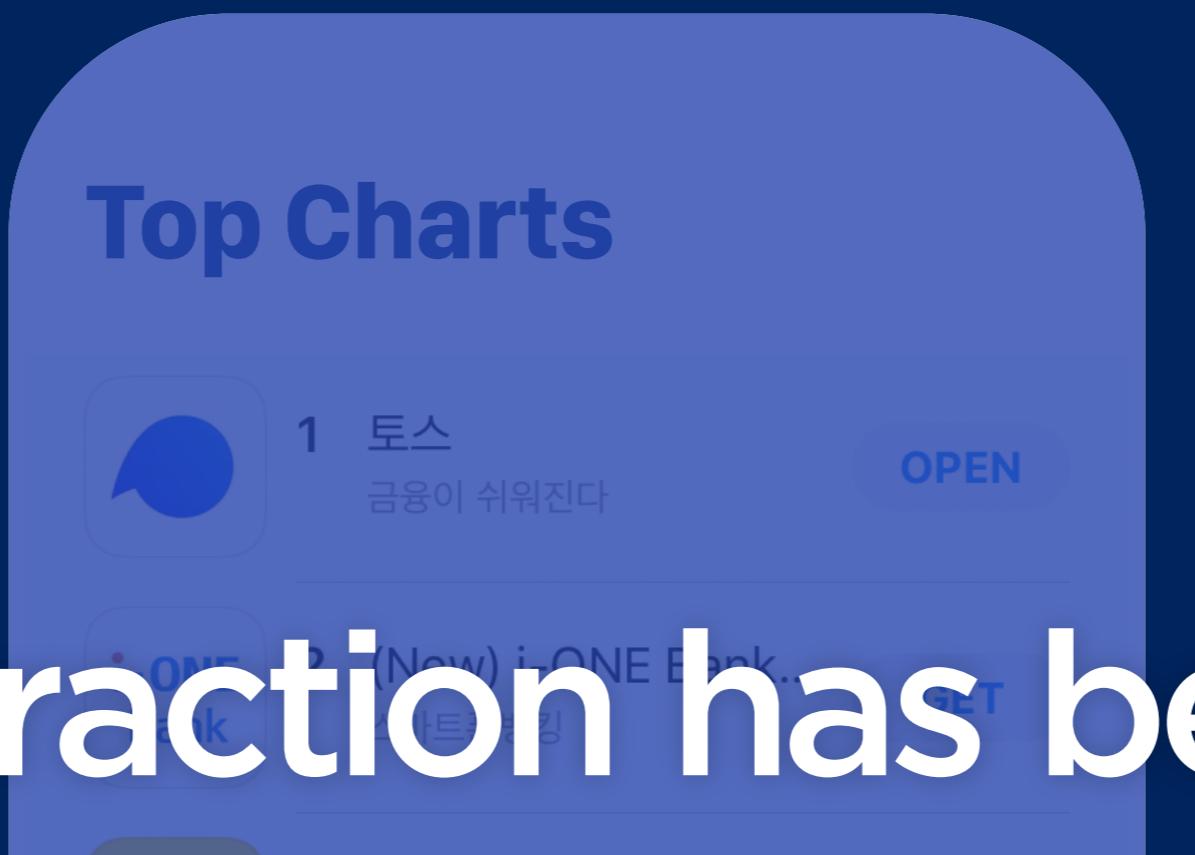
4 차이

결제마다 할인받는 간편결제

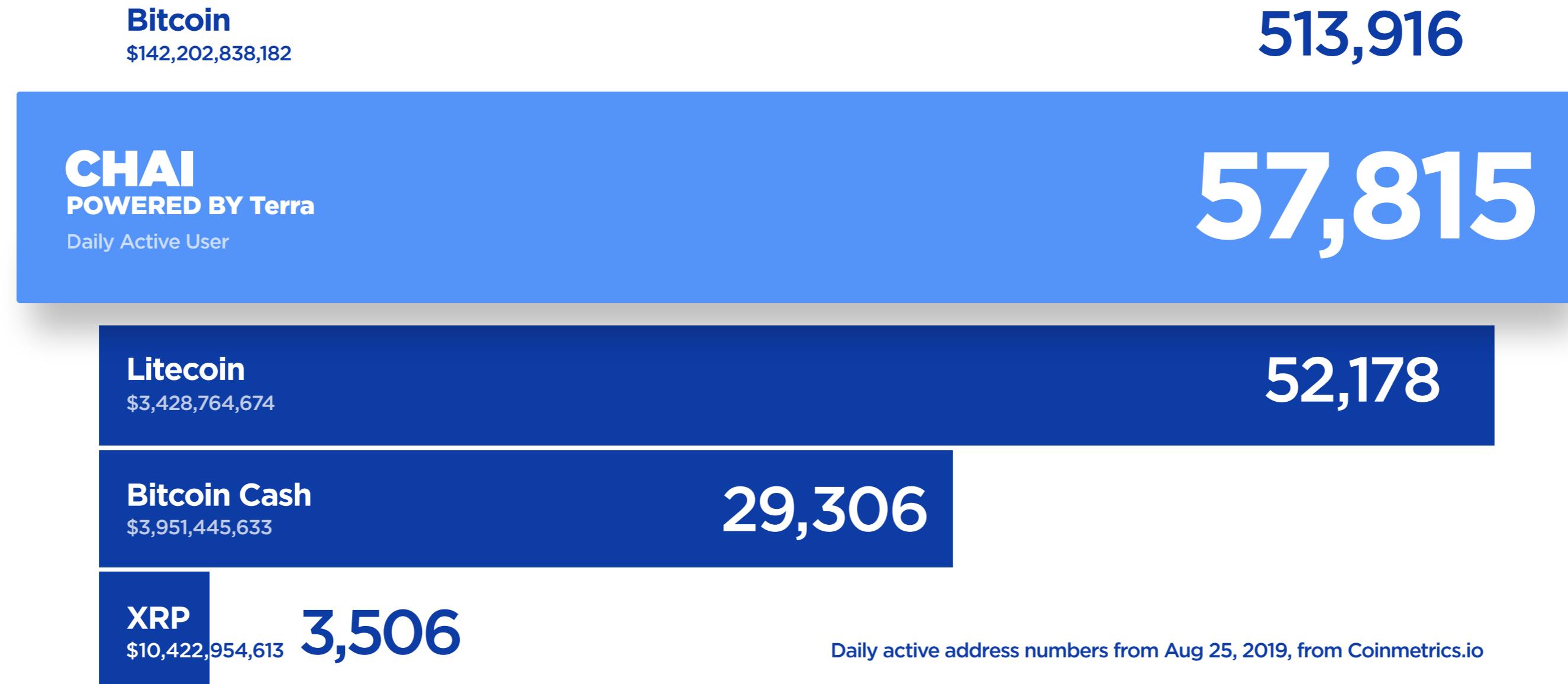
OPEN

1,994,584

TRANSACTIONS



In terms of daily active users, CHAI has already exceeded some of the most popular tokens



Terra Stability Mechanism Deep Dive



Nicholas Platias
Head of Research

Terra Chain

- Terra is an independent Tendermint-based blockchain (PoS)
- Built using the cosmos SDK
- Luna is the staking token, Terra is the stablecoin

Key Metrics

- \$2mm/day on-chain transactions
- 500K+ active addresses
- ~6 seconds block time
- 60+ validators

Terra Station: <https://station.terra.money>



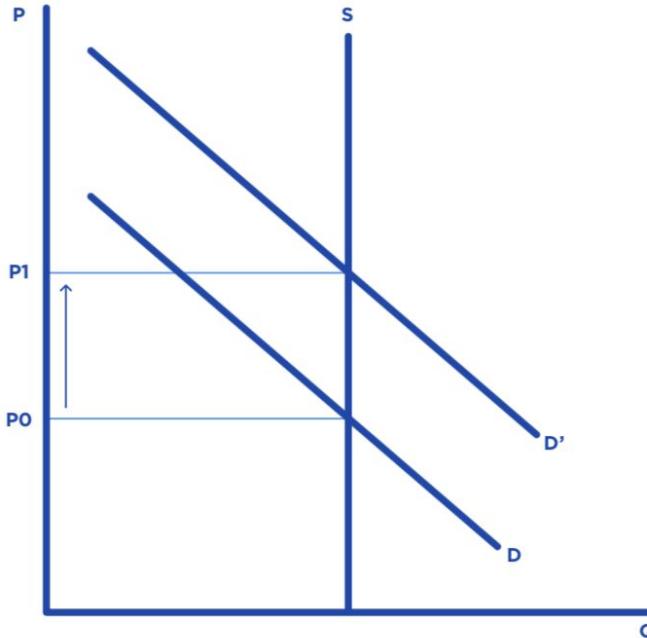
Terra is a family of stablecoins

- SDT <> SDR
- UST <> USD
- KRT <> KRW

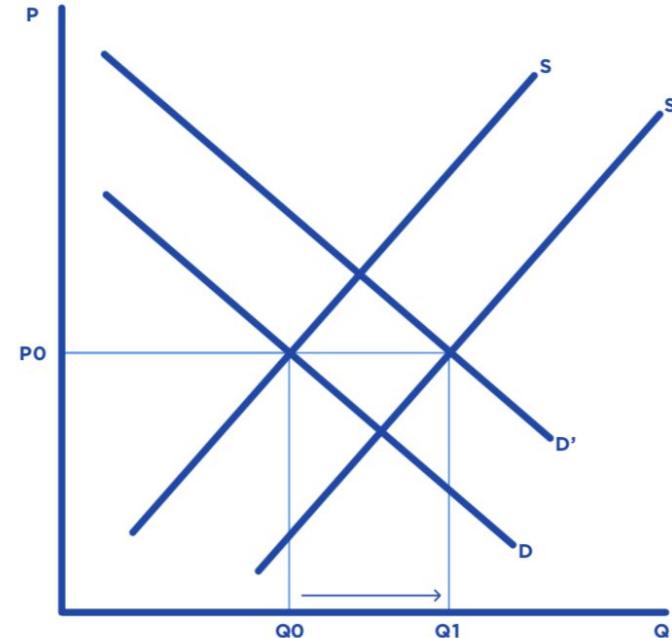
- Terras atomically swappable at market exchange rate (oracle)
- In what follows, I will be using the singular “Terra” for SDT

Terra Stability Mechanism

 BITCOIN DEMAND CHANGE



 TERRA DEMAND CHANGE



Terra Stability Mechanism

Three core components:

1. Swaps
2. Price Oracle
3. Stability Levers

We'll do an overview of each, then dive deeper into the swap algorithm.

Terra/Luna Swaps

The Terra Protocol acts as a market maker for Terra:

- Buy Terra at $1 - \varepsilon_1$ SDR
- Sell Terra at $1 + \varepsilon_2$ SDR

Exchange facilitated using Luna:

- To buy 1 Terra, the protocol **mints** and sells Luna worth $1 - \varepsilon_1$ SDR
 - By selling 1 Terra, the protocol **earns** Luna worth $1 + \varepsilon_2$ SDR
- *What are $\varepsilon_1, \varepsilon_2$??*
- *Is the spread symmetric ($\varepsilon_1 = \varepsilon_2$)?*
- *How do $\varepsilon_1, \varepsilon_2$ respond to swap imbalance (e.g. more Terra bought vs sold)*

Terra Price Oracle

How to determine how much Luna is worth 1 SDR? We need an **oracle** for Luna's price in SDR

Terra Price Oracle

Oracle Algorithm

- Validators vote a price with a weight that is equal to their Luna stake (every ~1 minute)
- Oracle determines the price as the **weighted median** of the votes
- Validators who vote within *either* 1std or 1% of the outcome are rewarded with a portion of fees, amortized over the next 7 days
- Validators who don't meet the above receive nothing (no penalty)

Key Security Guarantee

If at least 50% of the votes are within ϵ of the true price, the oracle price will be within ϵ of the true price

Terra Price Oracle

Manipulation Surface

- Manipulation of underlying market
- Malicious price feeds
- What if < 50% of votes are honest? How bad can it get?

Terra Stability Levers

- To buy Terra, the protocol **mints** Luna
- To sell Terra, the protocol **burns** Luna (partly)

What is going on here?

→ The supply of Luna is absorbing volatility in the demand for Terra

→ Staking rewards risk becoming *cyclical*:

- Expansion: tx fees increase, Luna supply decreases
- Contraction: tx fees decrease, Luna supply increases

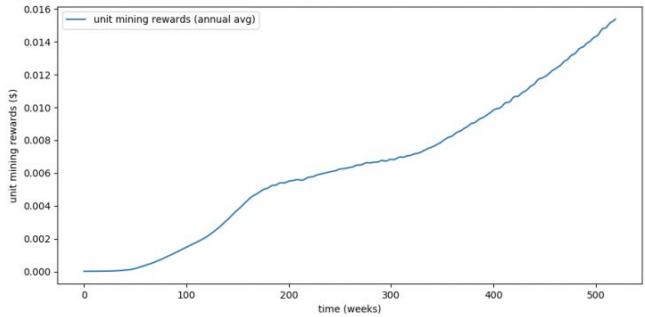
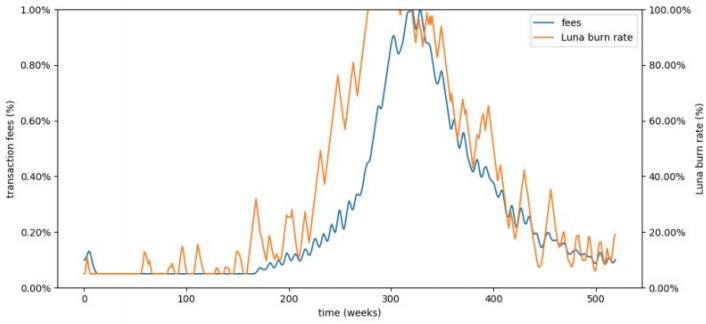
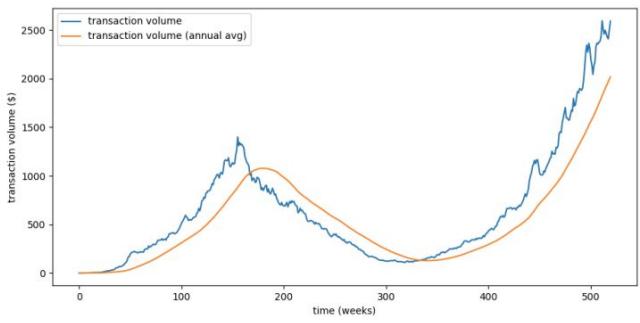
Terra Stability Levers

To prevent this, the protocol uses two levers to make staking rewards *countercyclical*:

- Tx fees
- Luna burn rate (what % of earned Luna does the protocol burn, vs allocate to growth e.g. promotions)

Objective: *unit staking rewards (per Luna) should grow at a steady rate, in line with growth of the Terra economy.*

For more formal treatment and stress test methodology/results, read
<https://agora.terra.money/t/stability-stress-test>



Deeper into Swaps: the Terra/Luna Market Maker

The Terra Protocol acts as a market maker for Terra:

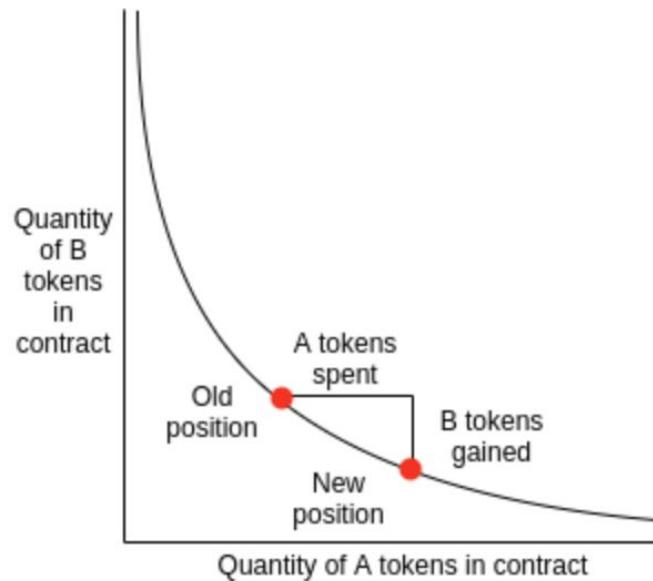
- Buy Terra at $1 - \varepsilon_1$ SDR
 - Sell Terra at $1 + \varepsilon_2$ SDR
-
- *What are $\varepsilon_1, \varepsilon_2$??*
 - *Is the spread symmetric ($\varepsilon_1 = \varepsilon_2$)?*
 - *How do $\varepsilon_1, \varepsilon_2$ respond to swap imbalances (e.g. more Terra bought vs sold)*

We implement swaps using a **constant-product market maker** for Terra/Luna \Rightarrow
Market maker dynamically quotes $\varepsilon_1, \varepsilon_2$ relative to Terra supply/demand

Background: Uniswap (Constant Product)

- No order book
- Market makers specify quantities, not price
- Quantities placed in pools
- Trades served using a constant product rule:

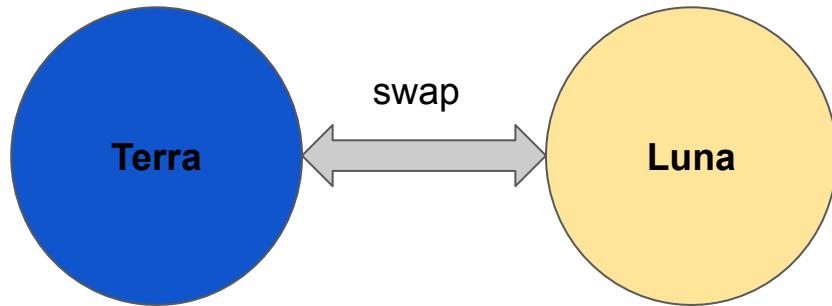
Size of Pool A * Size of Pool B == K



Why Uniswap?

- Simple
- Finite quantities, infinite liquidity!
- Mimics non-linear price impact of trades in traditional markets

Applying to Terra/Luna swaps



Initialization: offer Terra price at the peg (1 SDR)

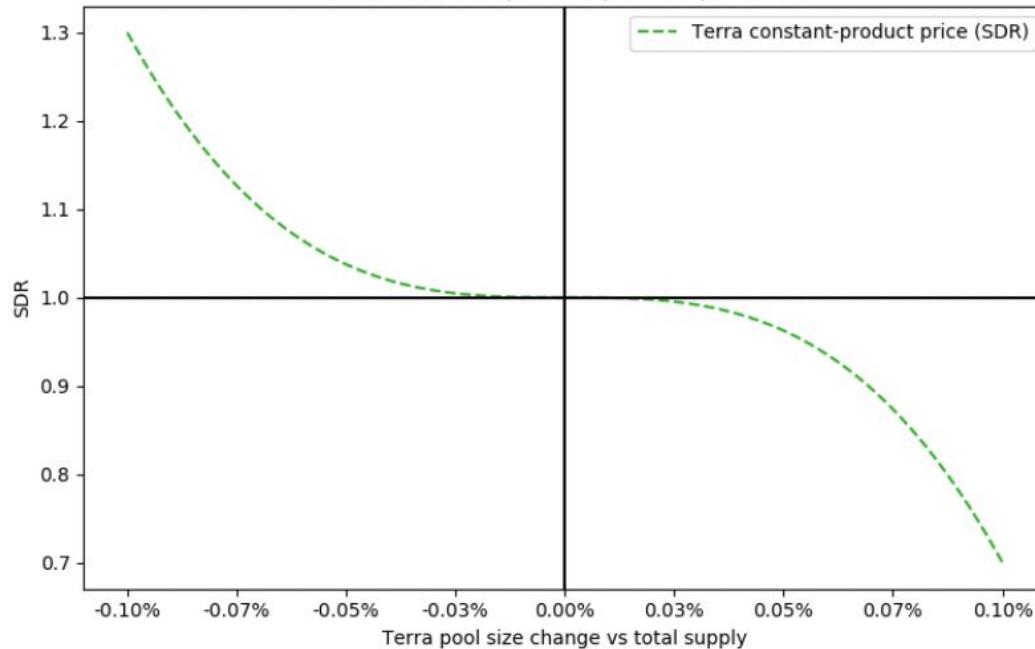
Constant Product Rule: Terra Pool * (SDR value of Luna pool) == K

Why SDR value of Luna pool? Terra swaps should be priced vs SDR, not vs Luna

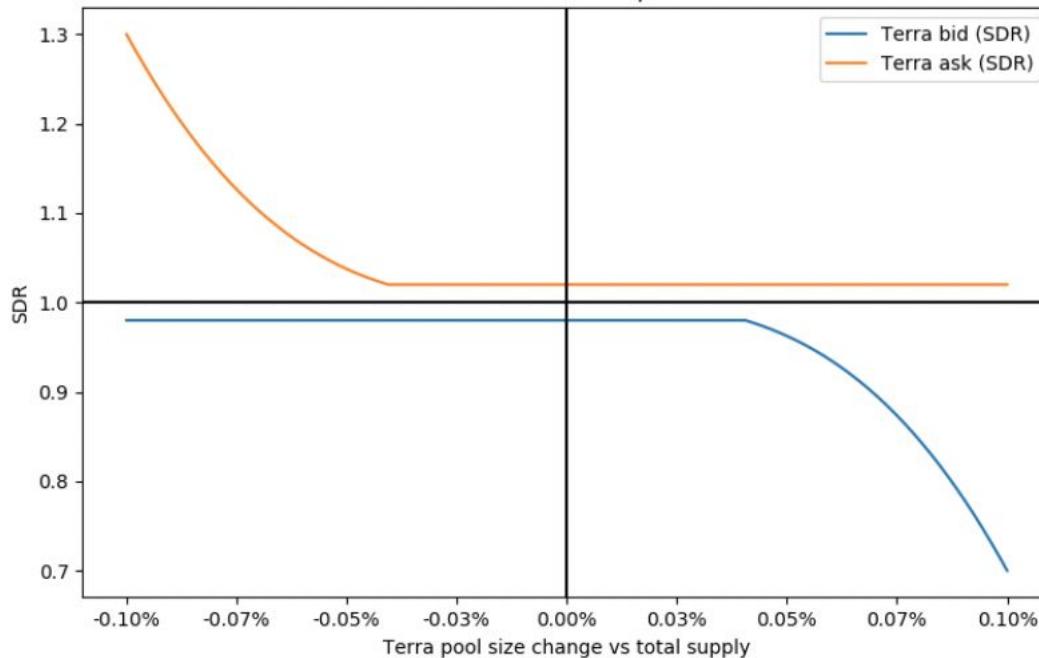
Modifications to market make a currency peg

1. Terra swaps should be priced vs the peg (SDR), not vs Luna → we need to adjust the size of the Luna pool whenever Luna/SDR price changes
2. We need to offer different marginal prices to buyers and sellers: $1 - \varepsilon_1$ vs $1 + \varepsilon_2$ (marginal prices are the same in uniswap)
3. We need a way to *replenish* liquidity -- otherwise trade imbalance in either direction can push ε_1 or ε_2 out of control

Terra constant-product price vs pool size



Terra bid and ask vs pool size



Read more at <https://agora.terra.money/t/oracle-revamp-proposal-for-columbus-3>

How you can get involved

Run a validator

- Join the growing network of 60+ validators to partake in Terra's rapid growth
- Simple steps at <https://docs.terra.money/guide/guide>

Contribute

Core

- Code: <https://github.com/terra-project/core>

Research

- Agora: <https://agora.terra.money/>
- Open Problems: <https://github.com/terra-project/research/wiki/Problems>
- Code: <https://github.com/terra-project/research>

We're hiring!

- Visit <https://terra.breezy.hr/>
- Come talk to us!

Thank you!