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Bitcoin's Fatal Flaw: The Limited Adoption Problem

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Brief Summary

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- Blockchain as payment infrastructure

- Bitcoin (proof-of-work) blockchain is not scalable
  - Limited adoption: the fraction of users who use the blockchain for payments vanishes as the number of users increases

- Permissioned blockchain is a viable alternative
  - But not for all consensus mechanisms, e.g.:
    - simple majority voting doesn't work
    - voting scaled by crypto-currency holdings does

Model (PoW): Users

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N users need to transact & choose:

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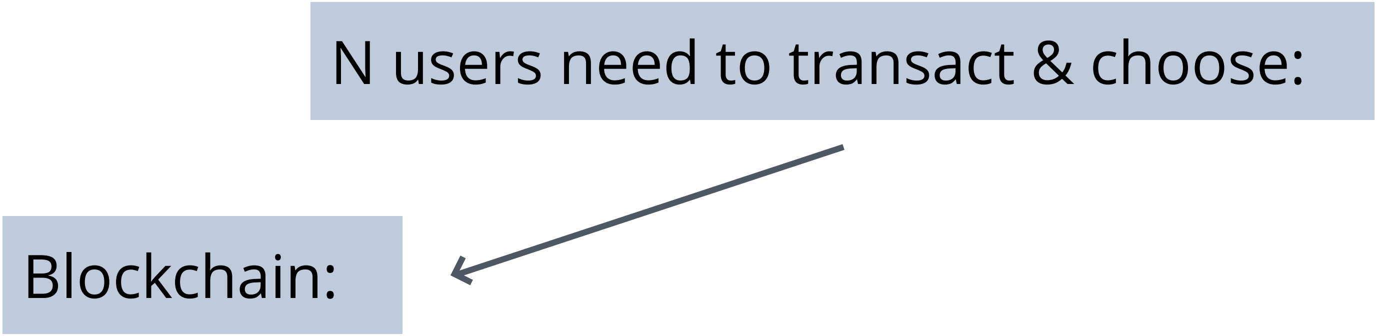

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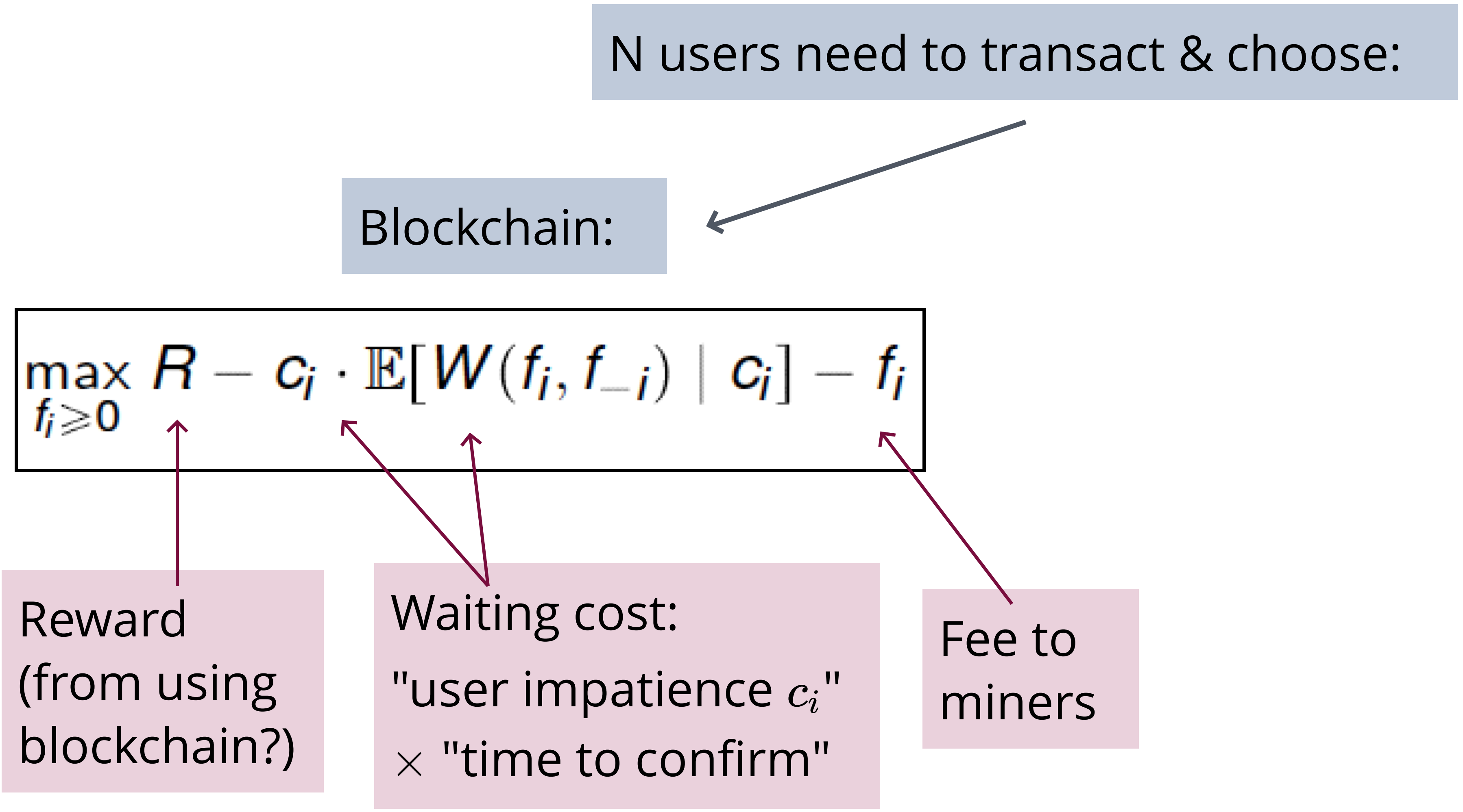

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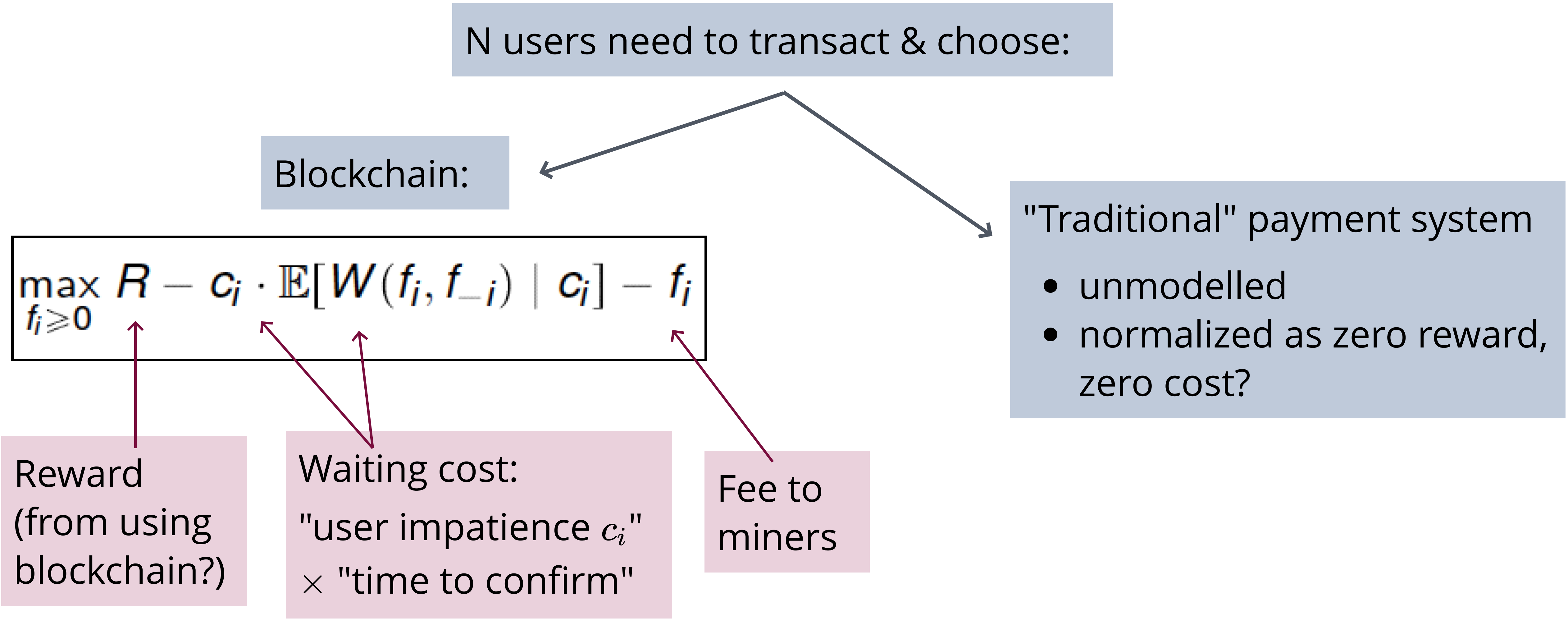

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"Traditional" payment system

- unmodelled
- normalized as zero reward, zero cost?

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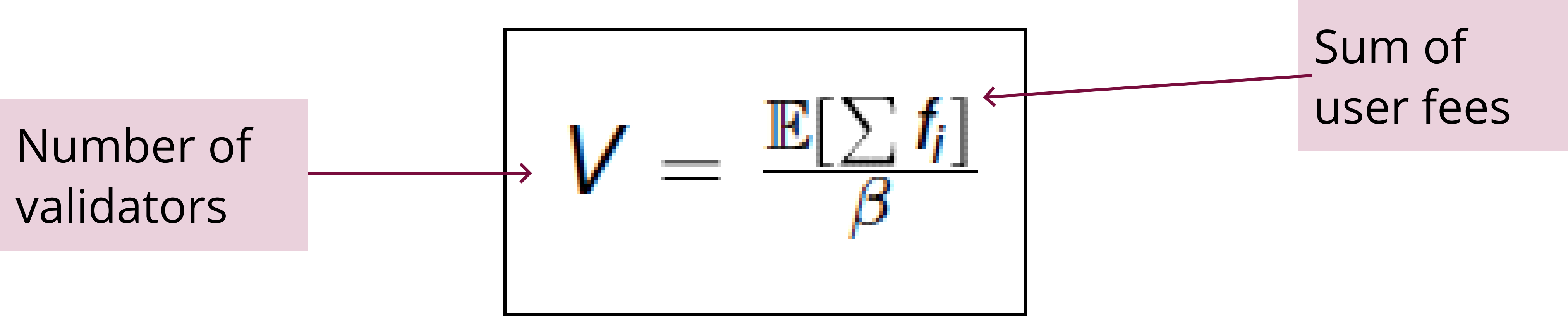

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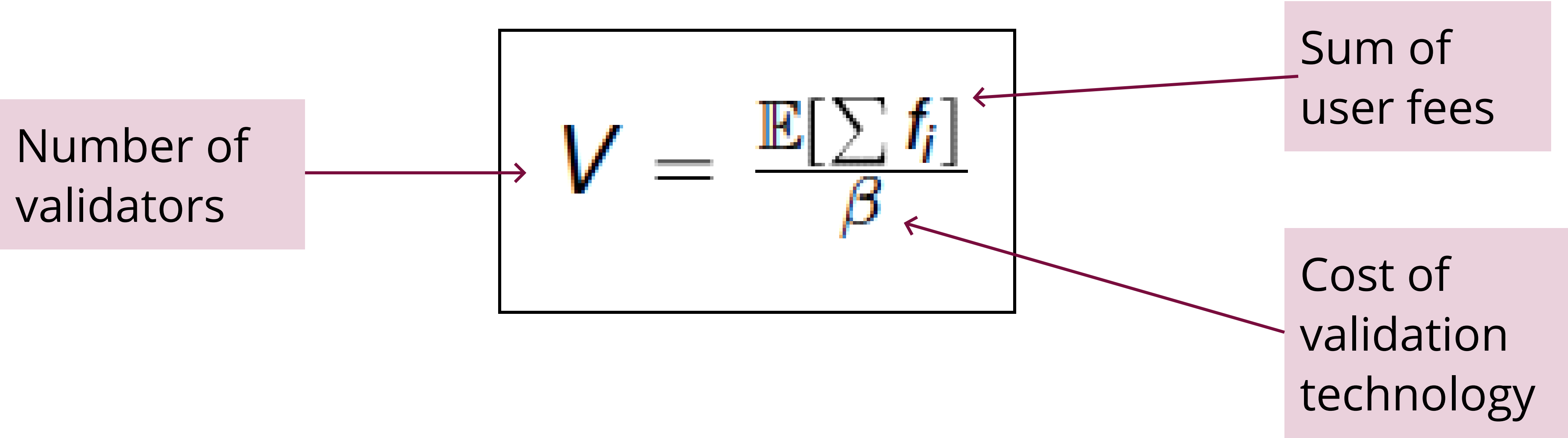

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Cost of validation technology

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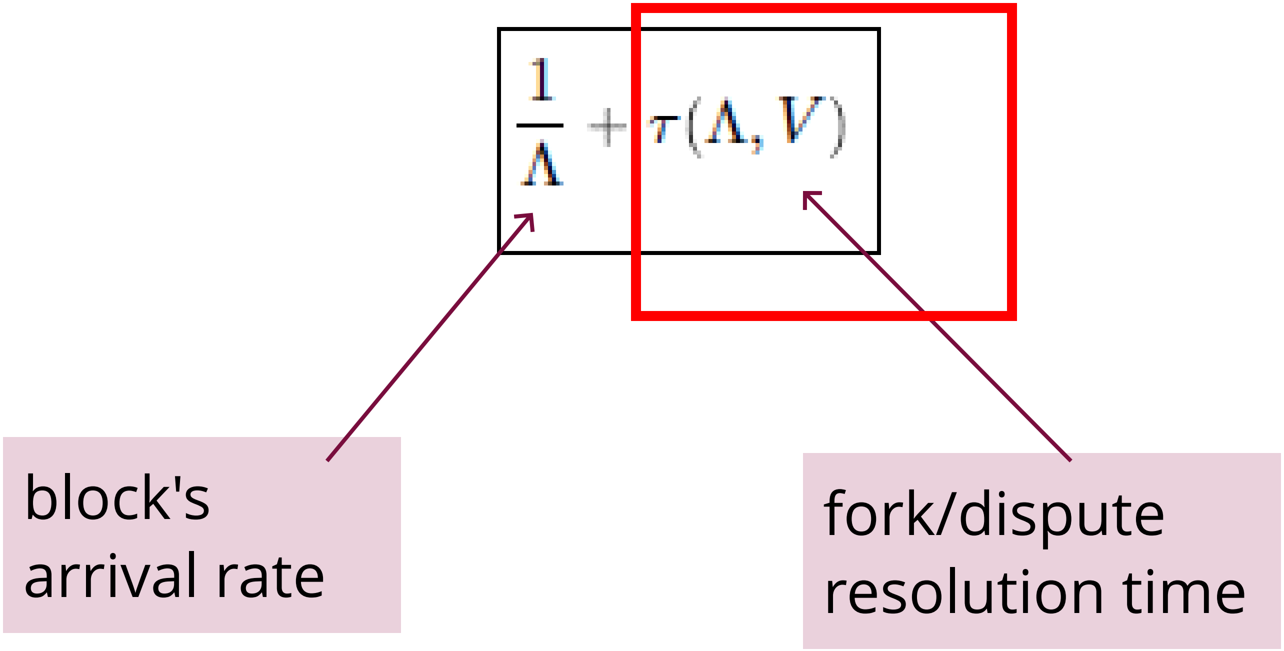

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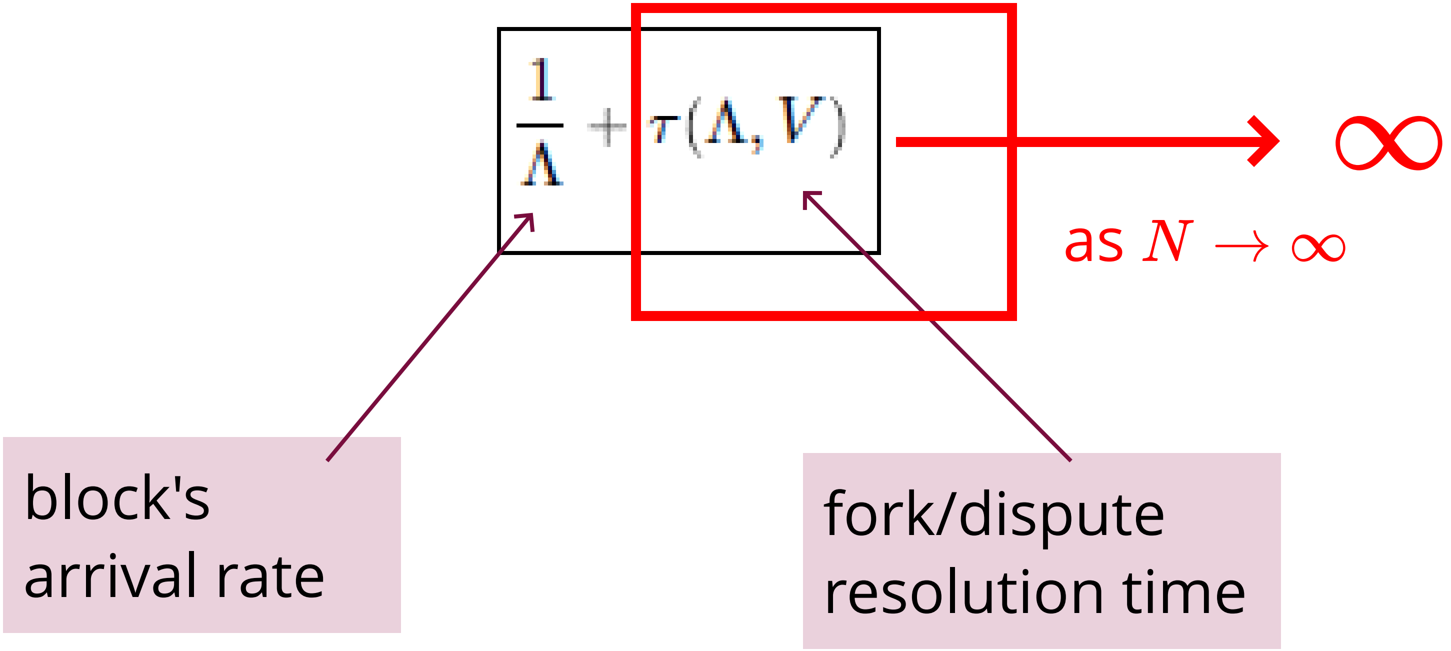

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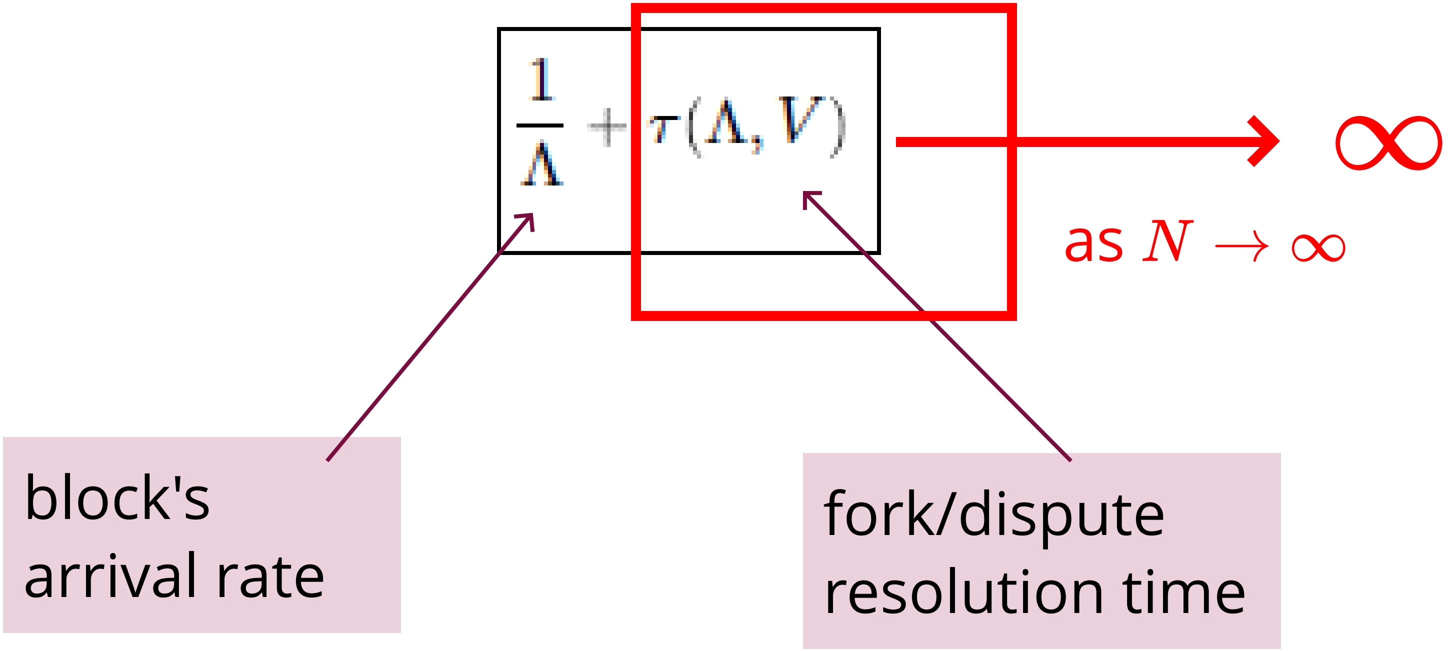

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$c^* \rightarrow 0$

"limited adoption"

Comments/Questions:

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Network delay/physical system limits

- $\to$ with $V = \infty$, time to agree/communicate explodes

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Lemma B.1 in Appendix B ....

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Comment 1: need more intuition for this:

- User i pays fee $f_i \propto (N-1)c_i^2$
- With $N \to \infty$, wait times explode & only super-patient users use blockchain ….
  - $\to \ c_i \approx 0$
- Fraction of blockchain users vanishes …
- What happens to fee per user?

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Comment 2:

- Confirmation times $\to \infty$
  $\Rightarrow$ fees are received with infinite delay
- Technology costs are incurred in real time!(?)
- Are validators infinitely patient? No capital constraints?
  - Is there a transversality condition?

Model 2: (Permissioned Blockchain)

Users:

- same as before

Validators:

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  - be malicious
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- Where does the reward come from?
- Seemingly should depend on the value of transactions and/or malicious users?

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This paper: 2.5 models

1. Proof-of-Work -- validators' incentives unmodelled
2. Permissioned -- coordination game among validators
    - with majority voting
    - with crypto-currency stake-weighted voting
        - → must introduce and value cryptocurrency

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No clear connection between #1 and #2

- Why move from decentralized proof-of-work to permissioned?
- Are there decentralized alternatives?
    - E.g., require minimum crypto-stake to become a validator?

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- E.g., with bitcoin: censorship-resistance, immutability ...
- But this disappears if blockchain is permissioned

Question: purpose of a blockchain in the model?

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Key differences (from the user perspective) b/n the permissioned blockchain vs. traditional payment system in the model?

- Central Bank Digital Currency?

Suggestion: better connections to existing literature

Various "impossibility triangles" have been discussed:

- The authors mention Buterin's: scalability, security, decentralization triangle
- This is also discussed in the academic literature, e.g.:
  - comp sci: Gilbert and Lynch (2002)
  - econ&finance: Abadi and Brunermeier (2018)
  - see Chen, Cong, Xiao (2019) for a survey

Suggestion: better connections to existing literature

- The paper:
  - co-existence of payment and currency systems
  - role for the value of cryptocurrency (for the voting weights)
  - users don't directly affect crypto-valuation

- Is this approach consistent with the predictions from the user-driven cryptocurrency valuation models, where value is affected by e.g.:
  - possible speculation
  - coordination among users
  - see Malinova (2019) for a survey

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