Market Analysis of Bancor Protocol

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Smart Contract and Bancor

- Distributed System
  - Block Chain, e.g. BitCoin
- Smart Contract, implementing the idea of block chain, tries to supersede the function of real-world financial institution.
  - Imagine 100 years ago, you savd $100 dollars in bank told the bank to pay you today.
- Bancor Protocol is one of the Smart Contract programs.

Bancor Protocol,

Boon for market or Fraud

- What is Bancor Protocol？

- Single Equation, twenty lines of code, > $150M crowd funding (break the record)

$$P = \frac{B}{S \times \mathrm{CRR}}$$

```
function buy(IERC20Token _reserveToken, uint256 _depositAmount, uint256 _minReturn)
    public
    changingAllowed
    greaterThanZero(_minReturn)
    returns (uint256 amount)
{
    amount = getPurchaseReturn(_reserveToken, _depositAmount);
    assert(amount != 0 && amount >= _minReturn); // ensure the trade gives something in return and meets the minimum reques

    // update virtual balance if relevant
    Reserve storage reserve = reserves[_reserveToken];
    if (reserve.isVirtualBalanceEnabled)
        reserve.virtualBalance = safeAdd(reserve.virtualBalance, _depositAmount);

    assert(_reserveToken.transferFrom(msg.sender, this, _depositAmount)); // transfer _depositAmount funds from the caller
    token.issue(msg.sender, amount); // issue new funds to the caller in the smart token

    // calculate the new price using the simple price formula
    // price = reserve balance / (supply * CRR)
    // CRR is represented in ppm, so multiplying by 1000000
    uint256 reserveAmount = safeMul(getReserveBalance(_reserveToken), MAX_CRR);
    uint256 tokenAmount = safeMul(token.totalSupply(), reserve.ratio);
    Change(_reserveToken, token, msg.sender, _depositAmount, amount, reserveAmount, tokenAmount);
    return amount;
}
```

Quick Introduction of Bancor Protocol

What Bancor protocol actually does is to take advantage of price fluctuation to ensure the stability of reserve balance – more specifically, the stability of reserve balance's ratio to all reserve.

$$P = \frac{B}{S \times \mathrm{CRR}}$$

E.g.
People buy Smart Tokens →
Price of Smart Tokens grows, balance of Reserve Tokens accumulates with a constant ratio →
Normally, people hesitate to buy while eager to sell →
Price of Smart Tokens decreases, balance of Reserve Tokens decreases

Ditto for sell Smart Tokens.

Flawed Design of Bancor Protocol

(1) One thoughtlessness stems from **the frequent price fluctuation advo- cated by Bancor protocol**, which might obstruct transactions in the market.

(2) The second flaw of Bancor protocol is **that it neglects the potential abnormal marketing behaviors of customers**, which might bleed market’s reserve.

(3) Bancor protocol aims to solve **“Double Coincidence of Wants” problem, which actually might not be a problem in real-world market** as no previous study evidence this problem’s existence.

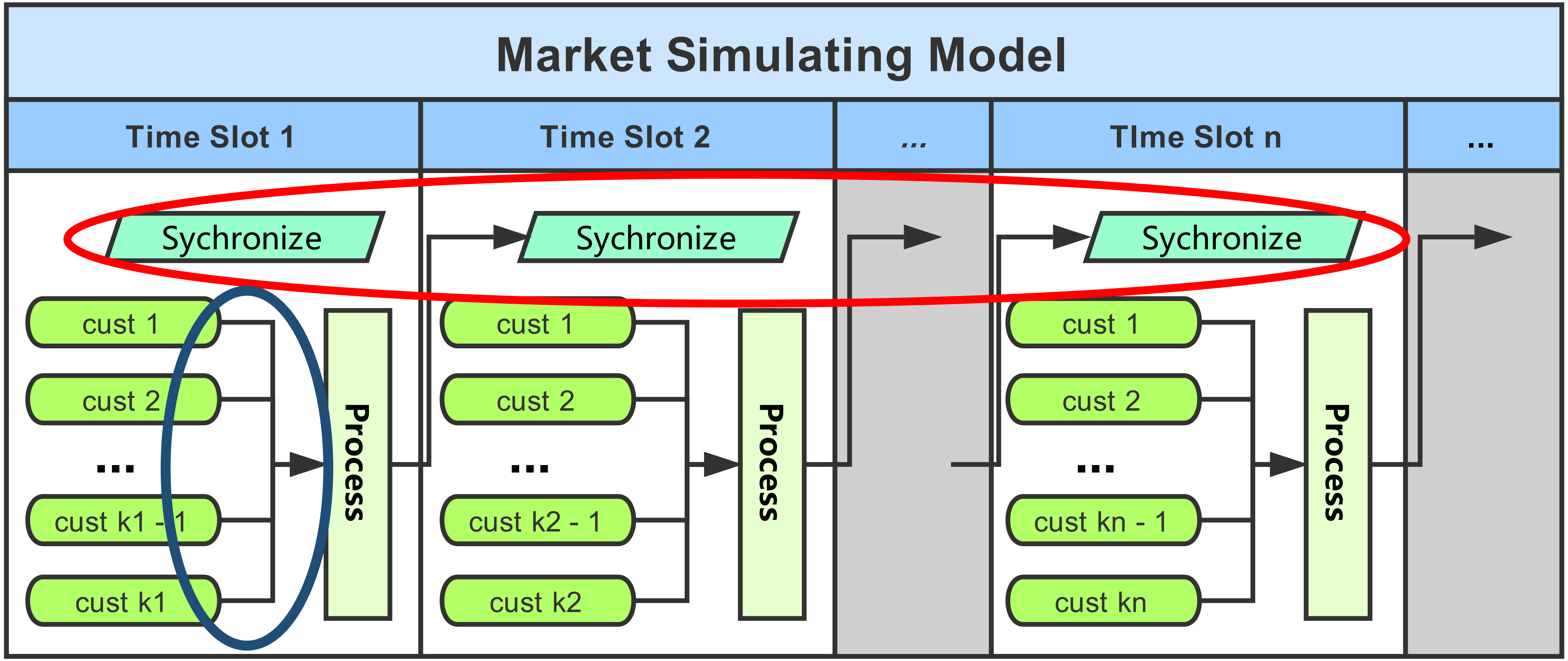
Bancor is flawed

(1) **The problem of "Double Coincidence of Wants" Bancor wants to solve might not exist in real world**. Even assuming this problem does exist, Bancor protocol fails to ensure its superiority compared with normal market.

(2) **The price of smart token, i.e. currency in Bancor protocol could fluctuate significantly**, especially when customers generate close valuations of smart token, which might generate destructive effect on market.

(3) **Bancor protocol cannot fully process multiple transaction orders that are launched simultaneously**, especially when the market size is small.

Simulating Details


Market Simulating Model
Time Slot 1
Time Slot 2
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Sychronize
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Process
cust 1
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Process
cust 1
cust 2
...
cust kn - 1
cust kn
Process

Classic Market Rules

3 stipulations in our simulating:

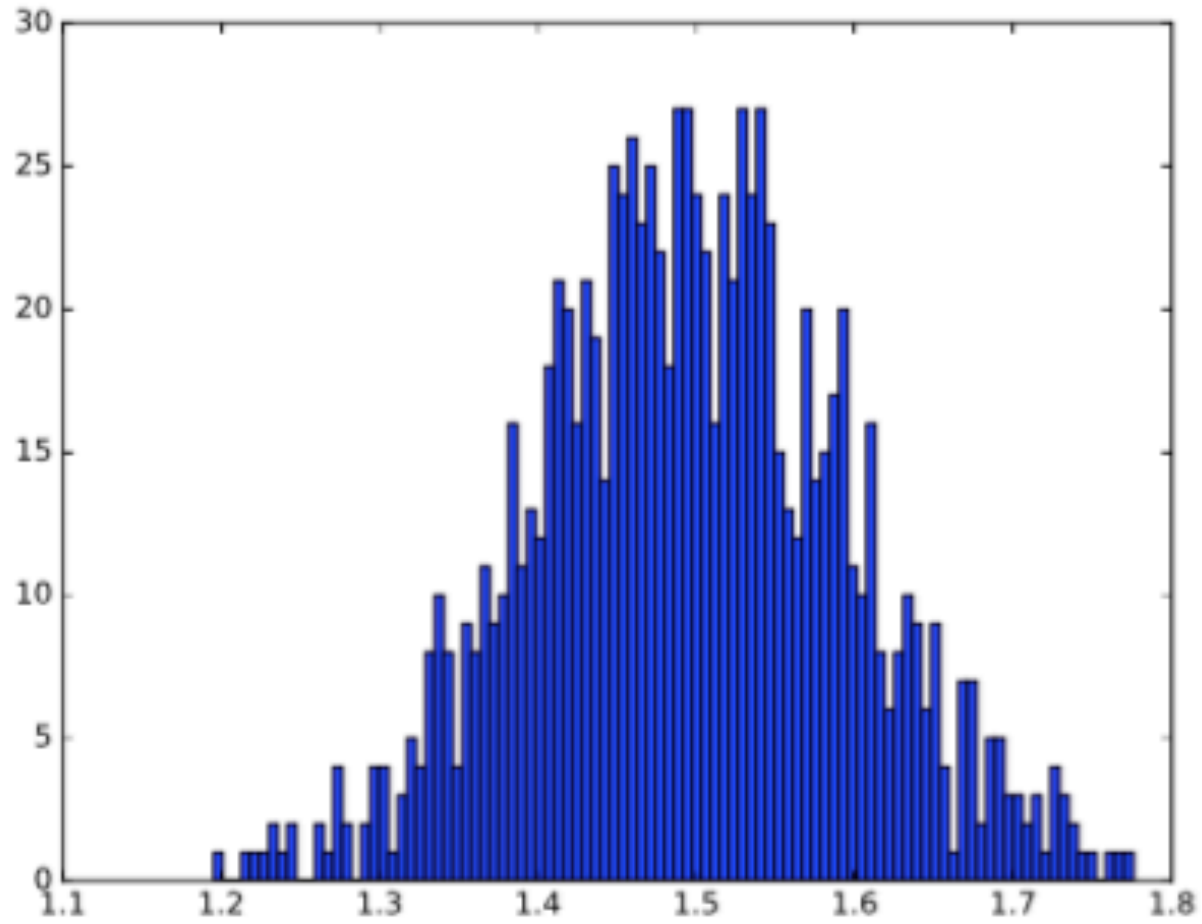
(1) **One time one order**: for simplicity, we set that one customer at one certain time slot, can only launch one order in the market.

(2) **Gaussian-like distributed number of customers:** the number of customers approaching market is Gaussian-like distributed with their valuations of commodities' price (smart tokens in Bancor Market).

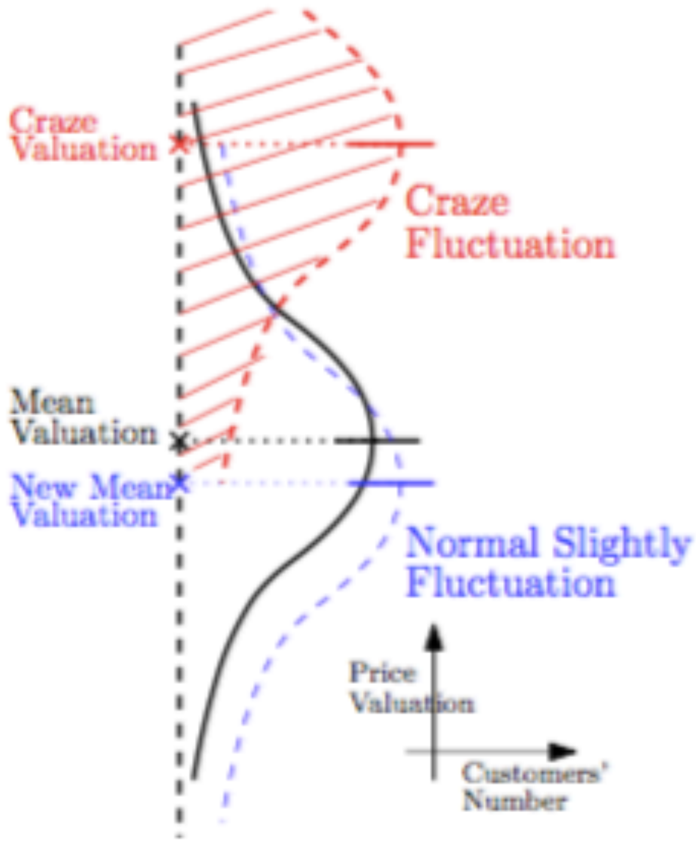
(3) **All-in Policy:** In each time slot, the customer launch buy order or sell order using all of his reserve tokens or smart tokens.

Gaussian Distribution & Market Craze Simulating:

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-(x-\mu)^2/(2\sigma^2)},$$



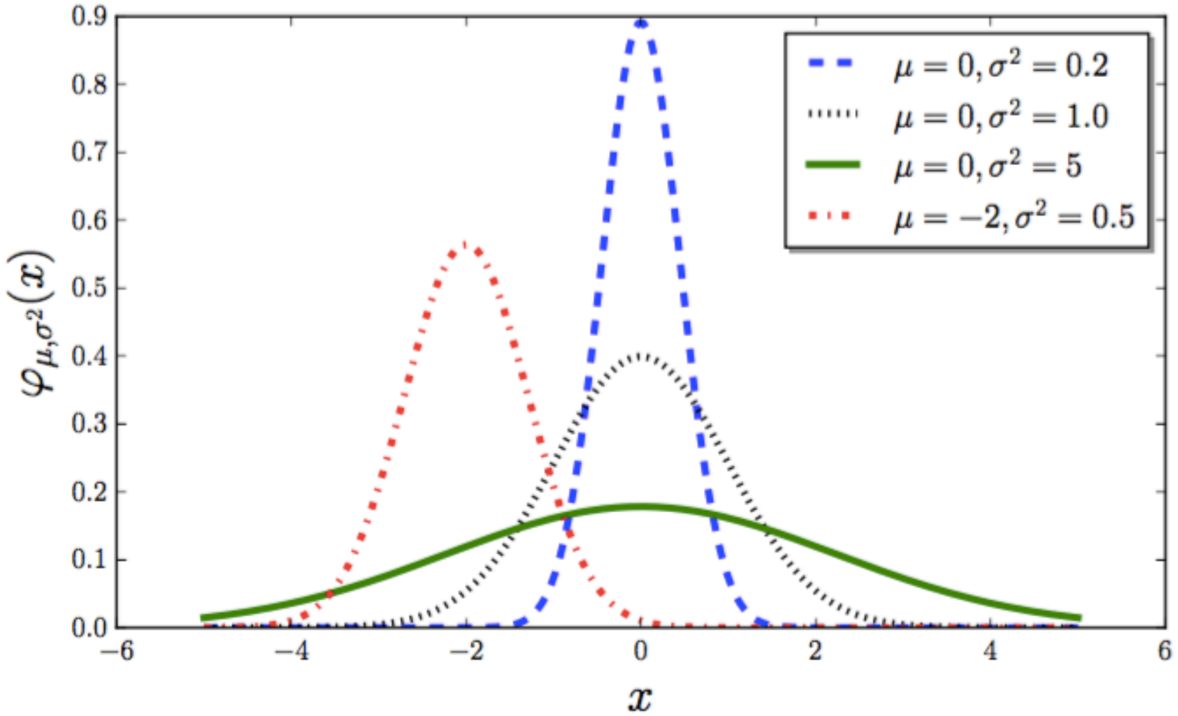
(a) Gaussian-like Distributed Customers' Number



(b) Craze Simulating

Parameters for Simulating Experiments :

Parameters	Definations
N_c	Number of customers who make deals in market
T	Time interval between market crazes, measured by count of time slots
R	Valuation bouncing range parameter of market craze
σ_0	Variable in Gaussian function for generating customer number's distribution



The curve becomes smoother, i.e., has lower steepness with the growth of sigma; while in contrast, the peak of Gaussian curve is steeper when sigma being smaller.

Analysis of Experimental Result

Indexes for Measuring Market Performance:

(1) Price-oriented Indexes: Under most circumstances, a healthy market is supposed to possess currency with considerably stable price.

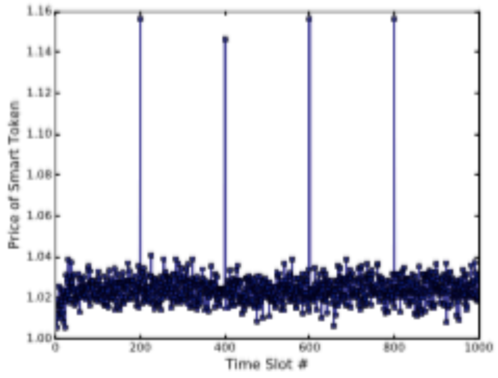
Price Slipping Ratio: The ratio of the number of time slots in which price drops at a certain rate to the number of all time slots.

(2) Transaction-oriented Indexes: To see whether Bancor protocol efficiently handle the problem of “Double Coincidence of Wants” and largely improve the market‘s liquidity.

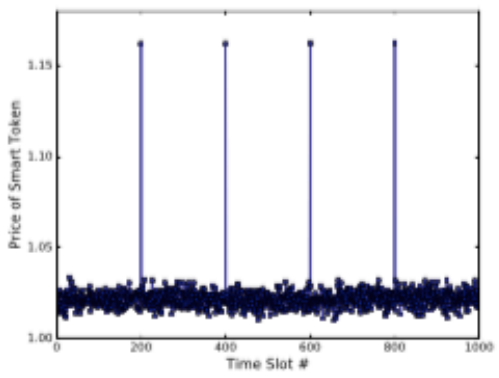
Total Transactions’ Number: Launched transactions’ Number in total.

Transactions’ Cancel Ratio: Simulator requires that in every new time slot, the customer has to cancel the old transaction order if it has not been finished. Here we record the cancel ratio.

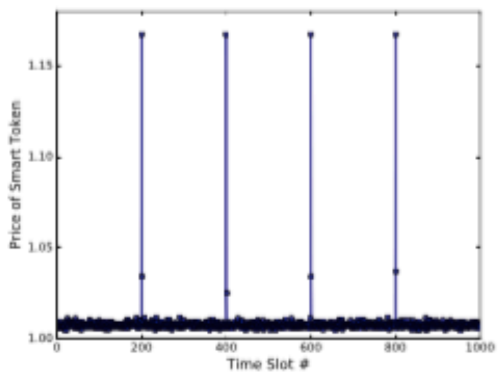
1. Analysis Based on Price



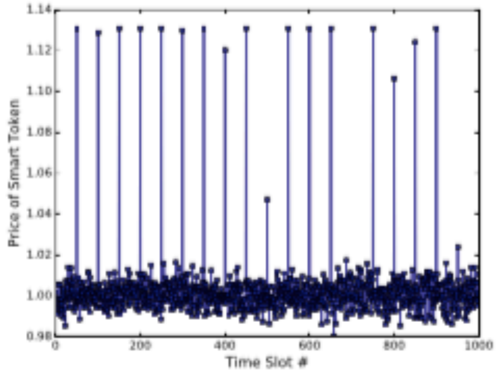
(a) $T = 200, \sigma_0 = 1, N_c = 500$



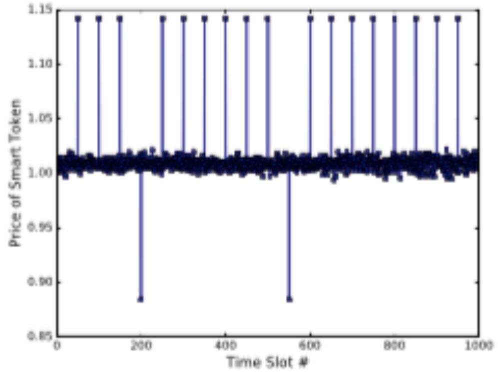
(b) $T = 200, \sigma_0 = 0.1, N_c = 500$



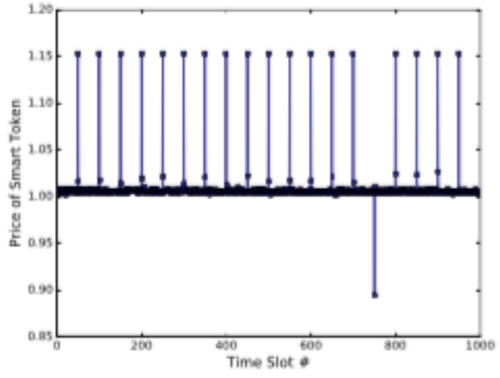
(c) $T = 200, \sigma_0 = 0.01, N_c = 500$



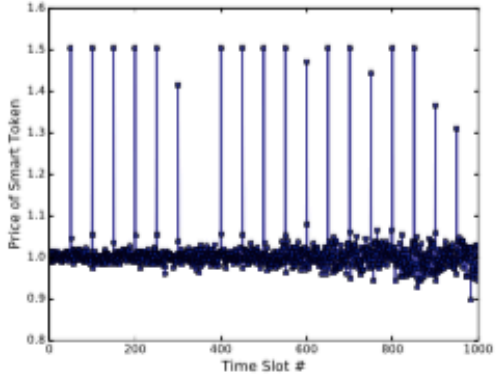
(d) $T = 50, \sigma_0 = 1, N_c = 500$



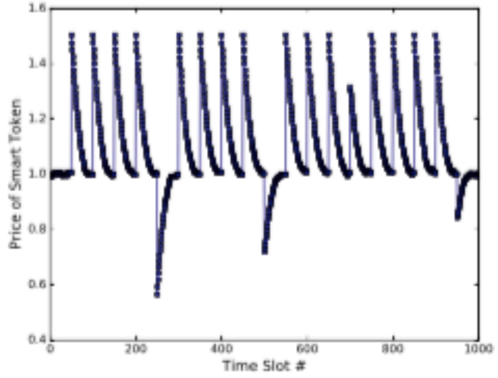
(e) $T = 50, \sigma_0 = 0.1, N_c = 500$



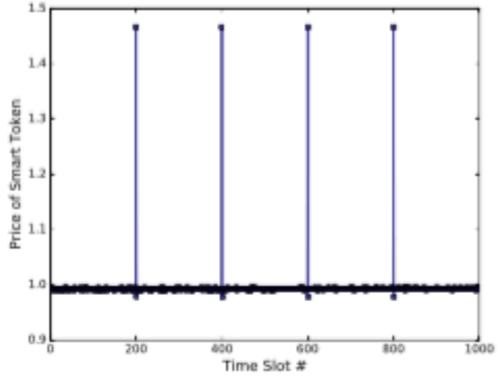
(f) $T = 50, \sigma_0 = 0.01, N_c = 500$



(g) $T = 50, \sigma_0 = 1, N_c = 2000$

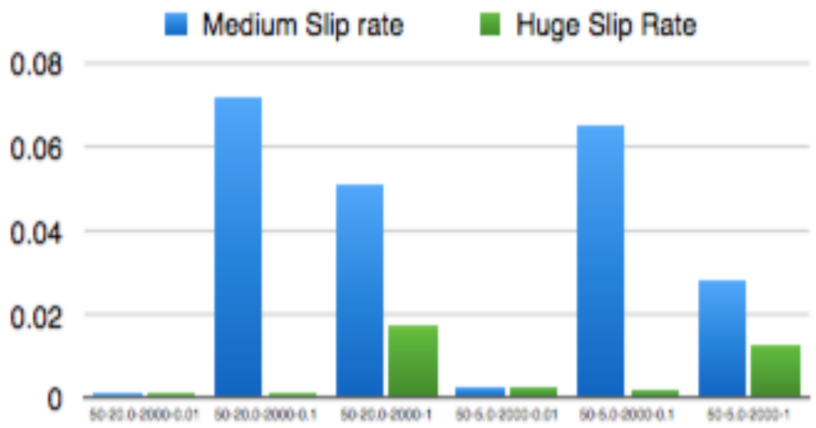


(h) $T = 50, \sigma_0 = 0.01, N_c = 2000$

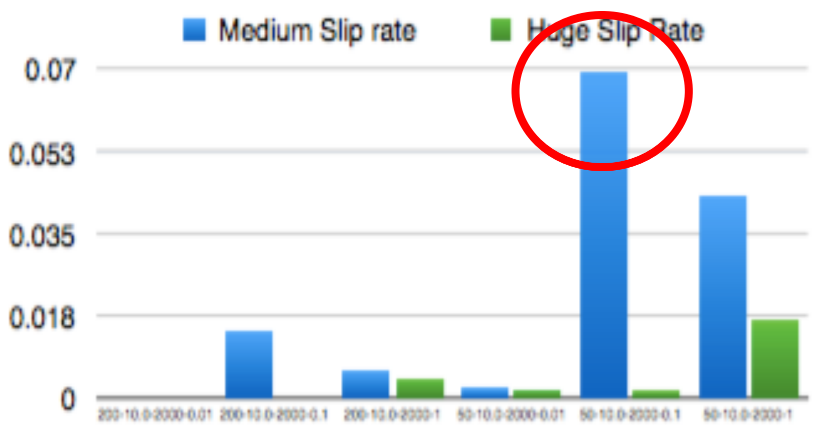


(i) $T = 200, \sigma_0 = 0.01, N_c = 2000$

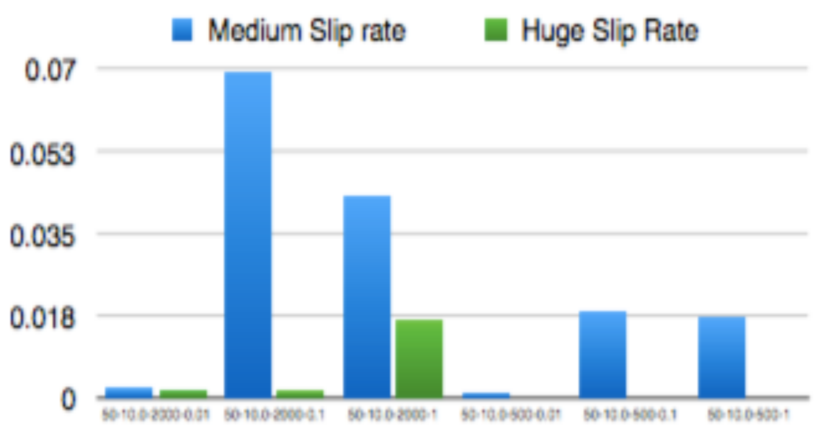
medium slip: 5%, huge slip: 20%



(a) $R = 20$ vs. $R = 5$



(b) $T = 200$ vs. $T = 50$

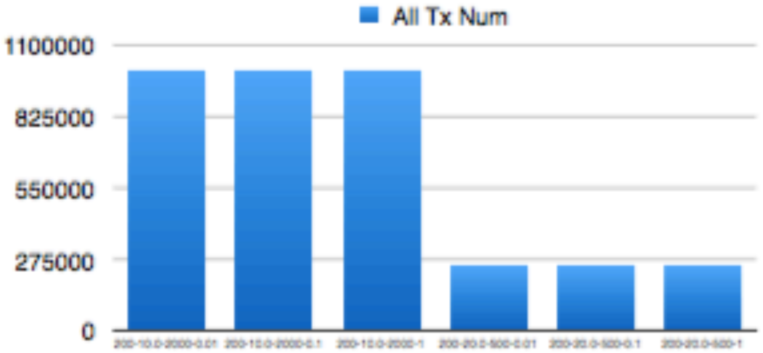


(c) $N_c = 2000$ vs. $N_c = 500$

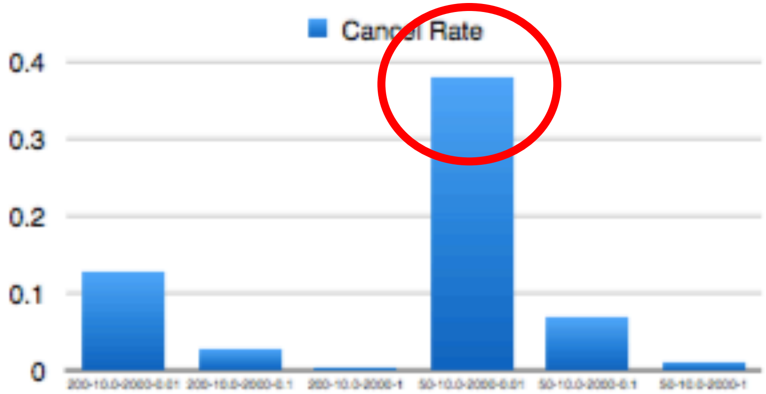
When market crazes emerge considerably frequently and the market owns a large size, the price slipping ratio can be quite high, e.g. almost 7%, which means **the price can actually fluctuate quite significantly in Bancor market**. This might lead many negative effects.

2. Analysis Based on Transaction

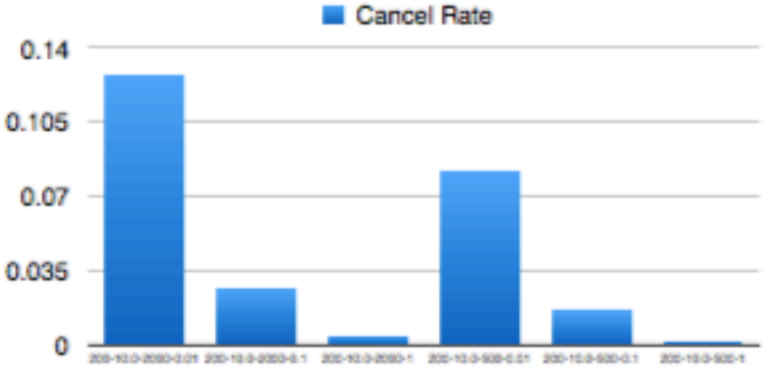
Bancor Market



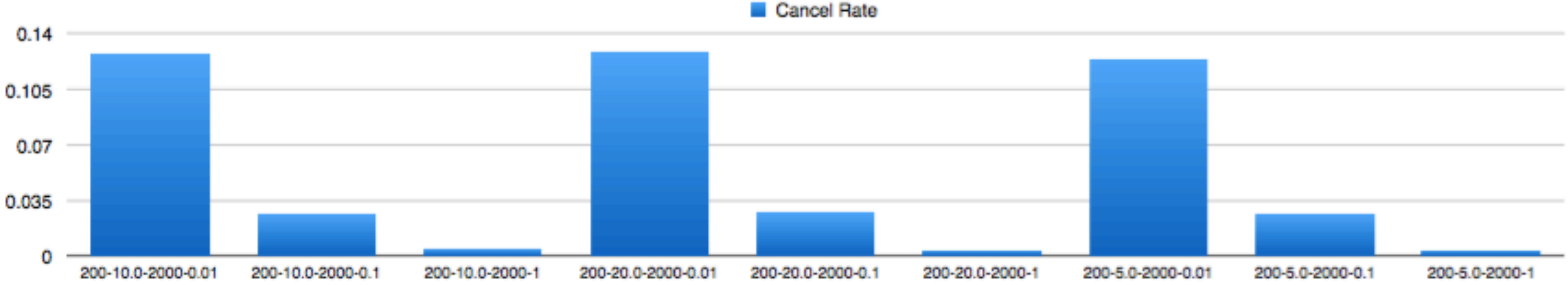
(a) Transaction Numbers



(b) $T = 200$ vs. $T = 50$



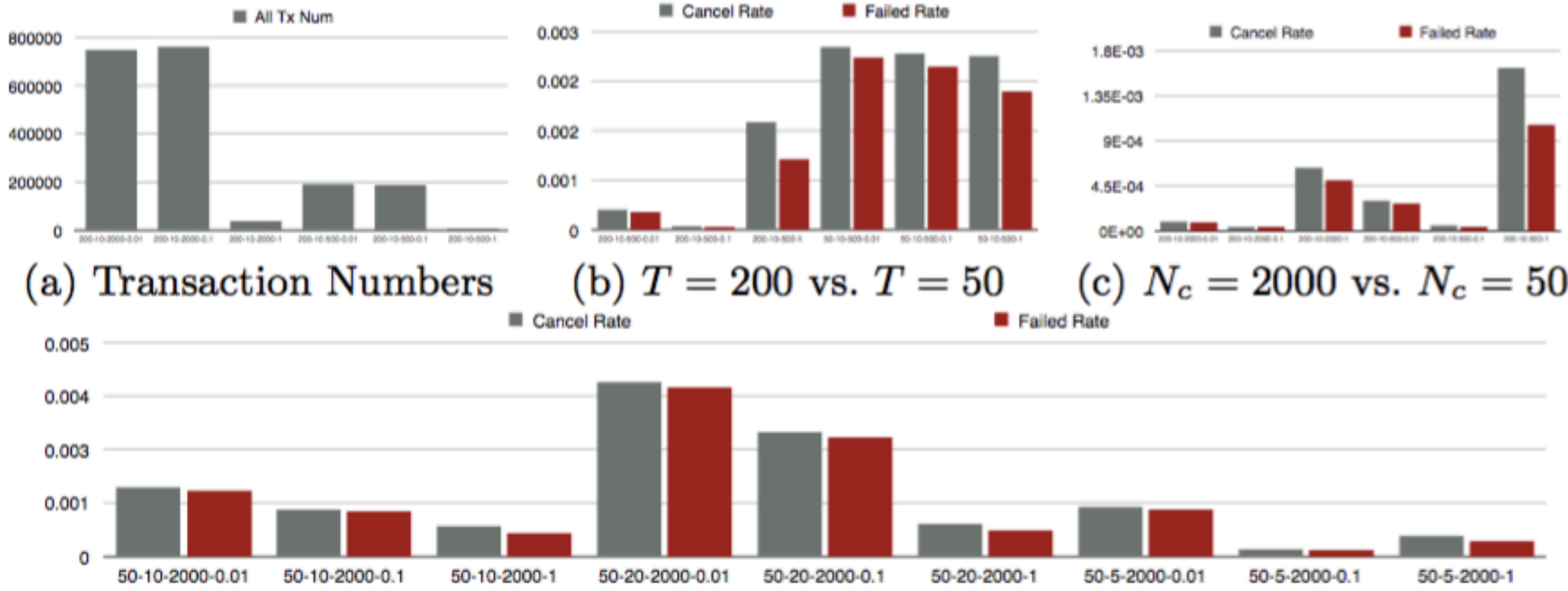
(c) $N_c = 2000$ vs. $N_c = 500$



(d) $R = 20$ vs. $R = 5$ vs. $R = 10$

By plots above, we learn that with the small Nc, i.e., small market size which actually represents the current status of most virtual current markets, and small σ0, i.e., the closer valuation between customers, **the failure transaction orders can even take over more than 35% in Bancor market, which is actually intolerable in real world.**

Classic Market

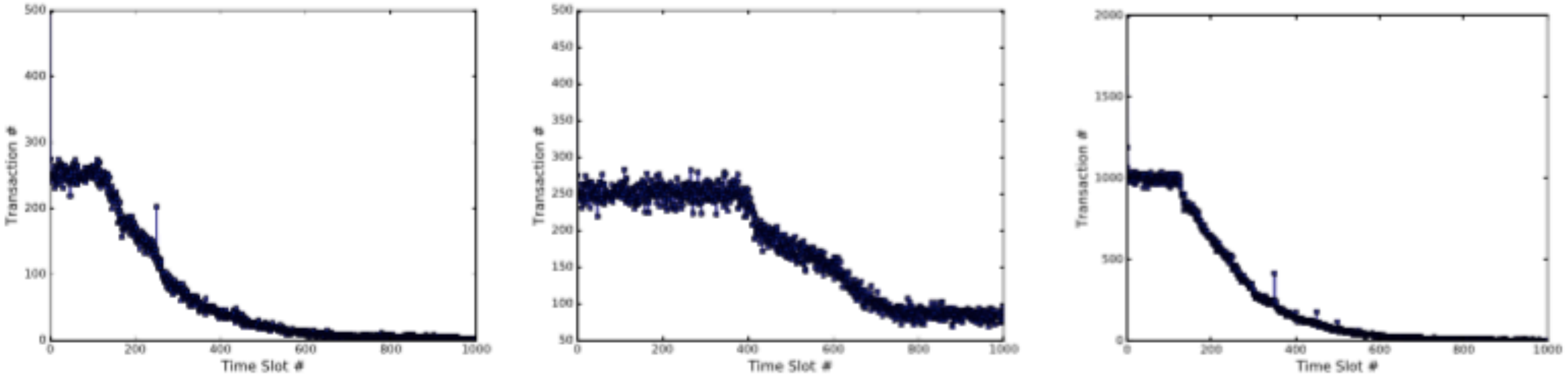


(a) Transaction Numbers (b) $T = 200$ vs. $T = 50$ (c) $N_c = 2000$ vs. $N_c = 500$

(d) $R = 20$ vs. $R = 10$ vs. $R = 5$

Lower the sigma is, (closer prices of valuations customers make)
higher the canceled transaction ratio is in Bancor Market;
while lower the canceled transaction ration is in Classic Market.

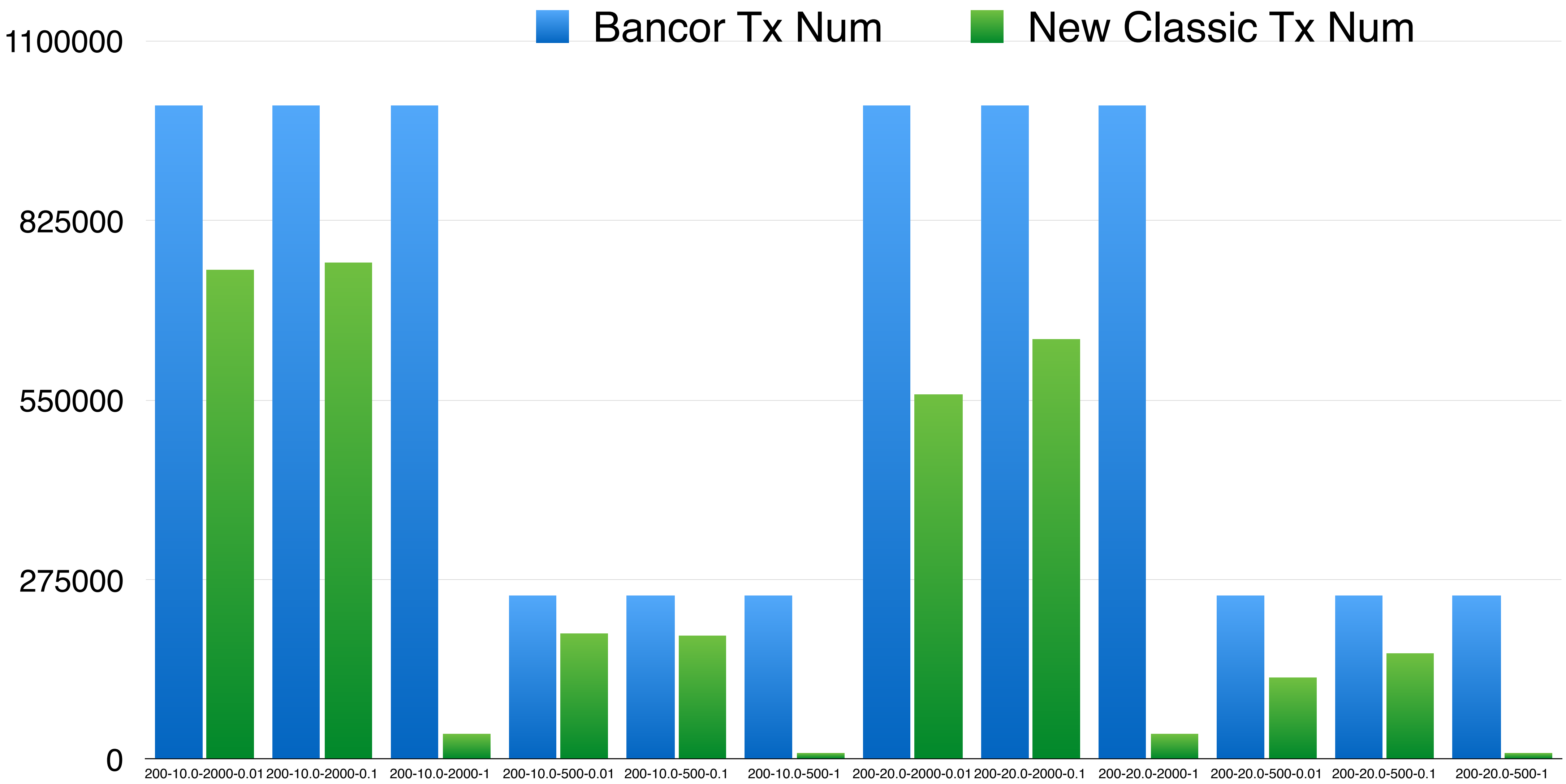
Fig. 10. This figure helps to explain why σ_0 impacts transactions' cancel or failed rate in Bancor and classic market.



(a) $T = 50, N_c = 500$ (b) $T = 200, N_c = 500$ (d) $T = 50, N_c = 2000$

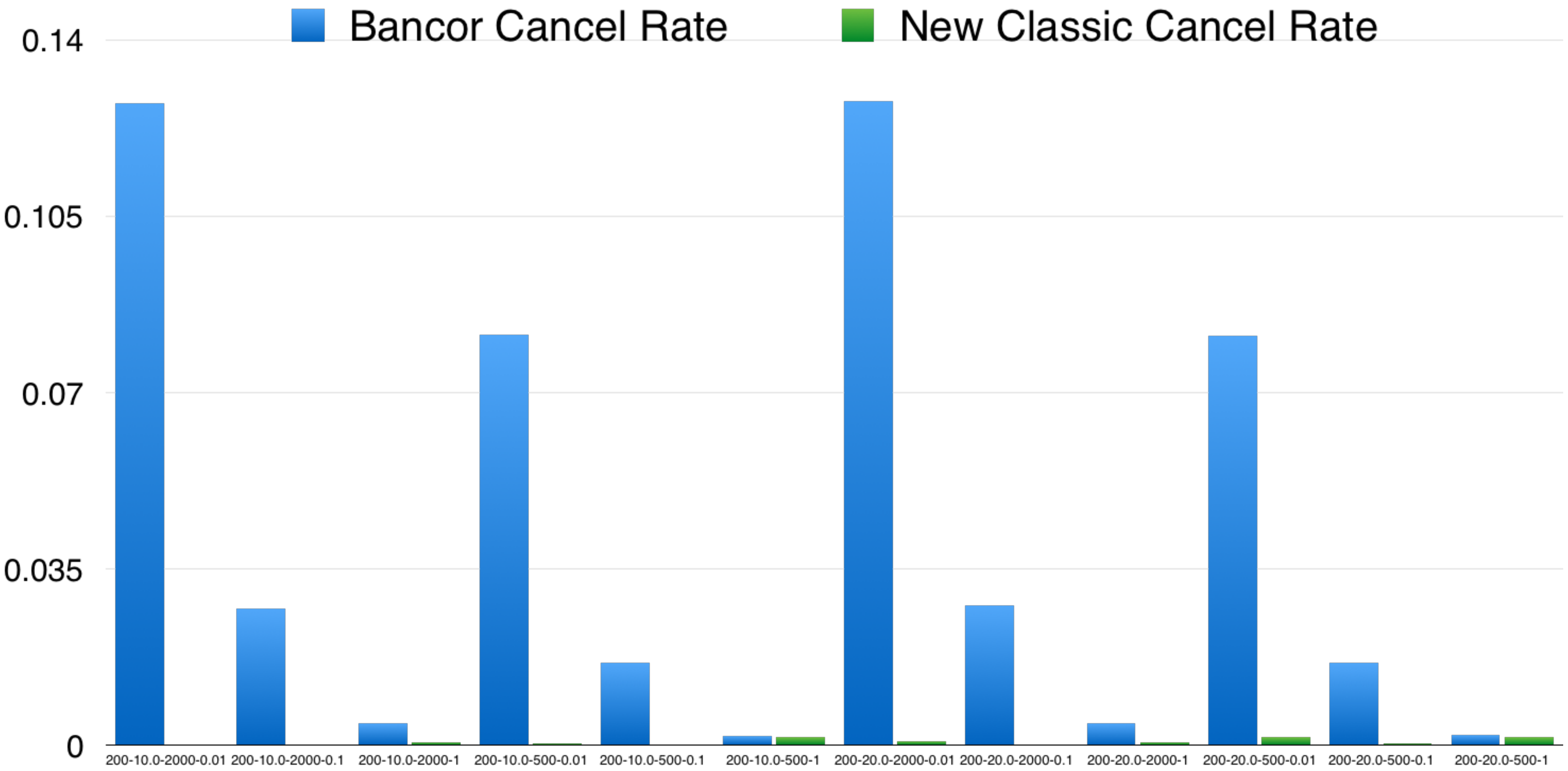
Fig. 9. This figure shows the launched transactions' number in Classic market in 1000 time slots with $R = 10$ and $\sigma_0 = 0.01$.

The low total Tx number and high cancel rate in Classic Market This is because under all-in policy in classic market, some customers quickly **run out their assets** as they generate low valuation to sell and generate high valuation to buy with all they own.



Transaction's Number decreases.

Reason: Some customers run out their money and cannot launch orders.



Bancor performs much worse all the time!

“Double coincidence…” might not exist nor be better solved by Bancor.

Tx based: Bancor Market vs. Classic Market

(1) The market craze actually positively accelerates the processing of transaction orders both for Bancor and classic market.

(2) The increase of market size helps Bancor market and classic market dealing with transaction orders much more smoothly.

(3) Bancor protocol has much higher transaction cancel rate than classic market.

Bancor is flawed

(1) **The problem of "Double Coincidence of Wants" Bancor wants to solve might not exist in real world.** Even assuming this problem does exist, Bancor protocol fails to ensure its superiority compared with normal market.

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Thanks!