

Society Collapse through erroneous Annual Tax rates: Piketty Recipe

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Foreword

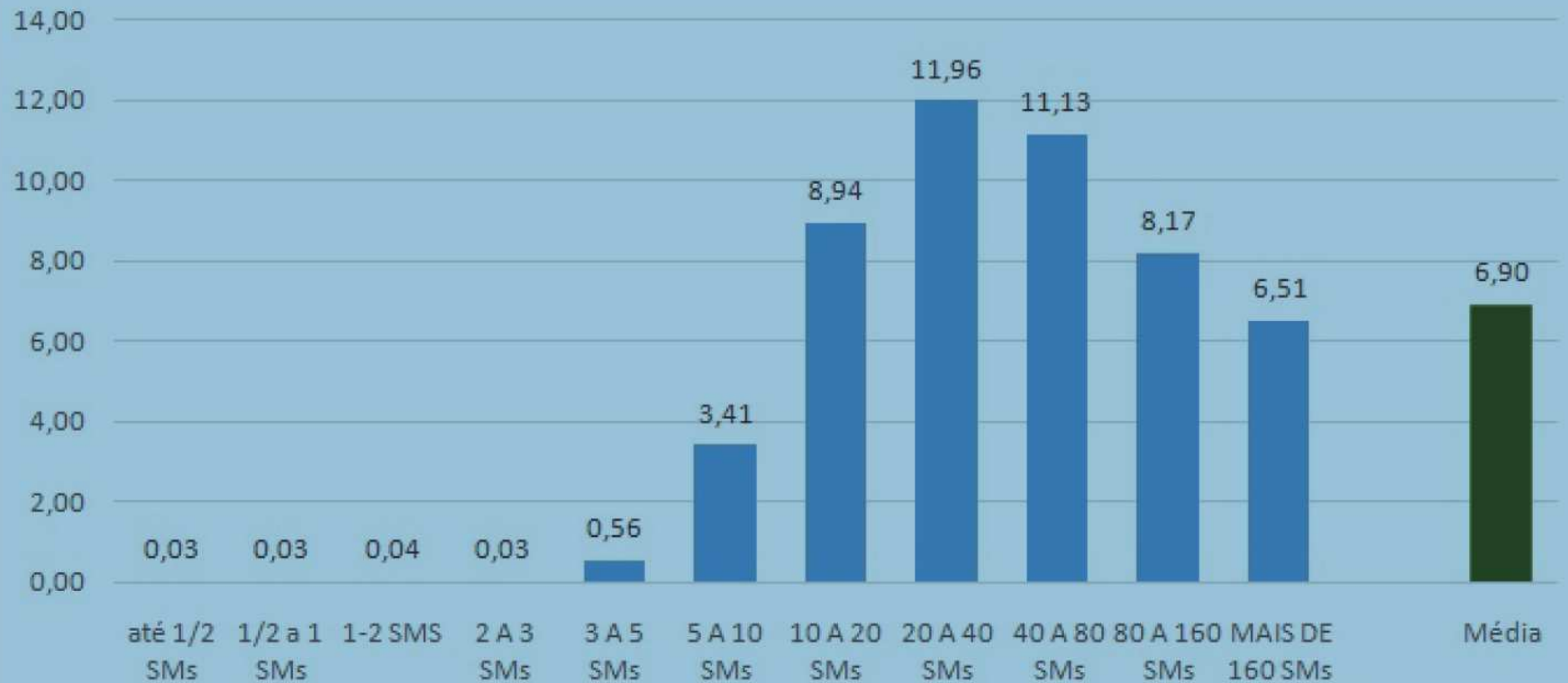
This work is not yet finished.

I have still many doubts (*).

I hope you can help me with new ideas.

Reality

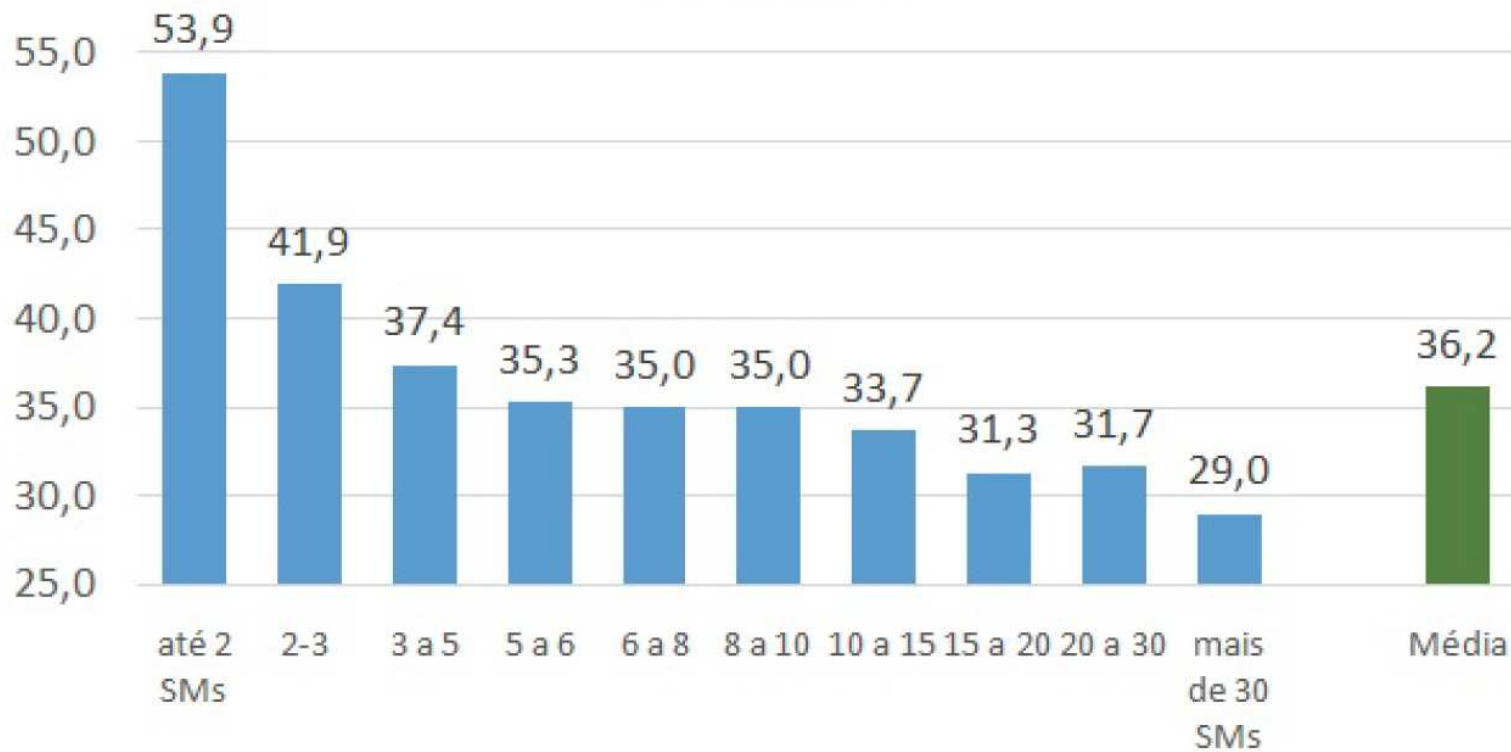
Gráfico 2 - Brasil: IR total/ renda total(%) por faixa de rendimento



Fonte dos dados brutos: Valor Econômico, edição 10/08/2015

Reality

Gráfico 3 - Brasil: carga tributária bruta por faixa de renda familiar mensal (2008)



Fonte: IPEA (2009)

Very Simple Model

N agents, with their own wealths $W_i(t)$, $i = 0, 1 \dots N - 1$.
Initial wealths are randomly tossed at $t = 0$, and normalized ($\sum_i W_i = 1$). Time t is counted in years.

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During the year, agents are randomly tossed to increase their wealths, $W_i \rightarrow 2W_i$.

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renormalization step

As we are not interested in the global economic growth, the distribution is renormalized ($\sum_i W_i = 1$).

Nevertheless, the global growing factor can be booked.

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step II (annual taxes)

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Renormalization again, before next year. Annual global growing factor booked.

Further ingredient, computer limits

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But some unlucky agents decrease their wealth continuously, and may reach the computer minimum real number figure ($\approx 10^{-300}$).

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In this case, the wealth becomes null (exactly zero on computers), the corresponding agent is artificially ruled out of the game. Therefore, the system size N becomes meaningless.

In order to keep always the same system size N , every time an agent reaches the minimum computer figure, it is replaced by a copy of another random agent.

Results

After a large number of years, for instance with fixed $p = 0$, the result is a catastrophe: A single agent becomes owner of the whole population wealth. We interpret this as a collapse of the society. It is an absorbing state.

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Adopting p slightly positive, the collapse time increases but the collapse still occurs.

For large enough positive values of p however, the system remains forever alive, no collapse. There is a transition from society extinction on the absorbing state towards an active forever changing dynamics, by surpassing a certain positive critical threshold p_c .

Comments

The dynamics is historical, not ergodic. Following the tree of possibilities by choosing one particular possible branch, other also possible branches become impossible from now on.

The tree of possibilities shrink as time goes by.

The lucky agents frequently tossed in the very first time steps tend to stay in the top set forever.

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In evolutionary biology this is called the founders effect.

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Technically, the bad side of the historical status of the model is the impossibility of applying mean-field reasonings in time evolution. One cannot compute the next-year distribution of wealths from the many-sample-average of the current state.

This technical difficulty is particularly important in what concerns following the history of the single richest agent in the collapsed phase.

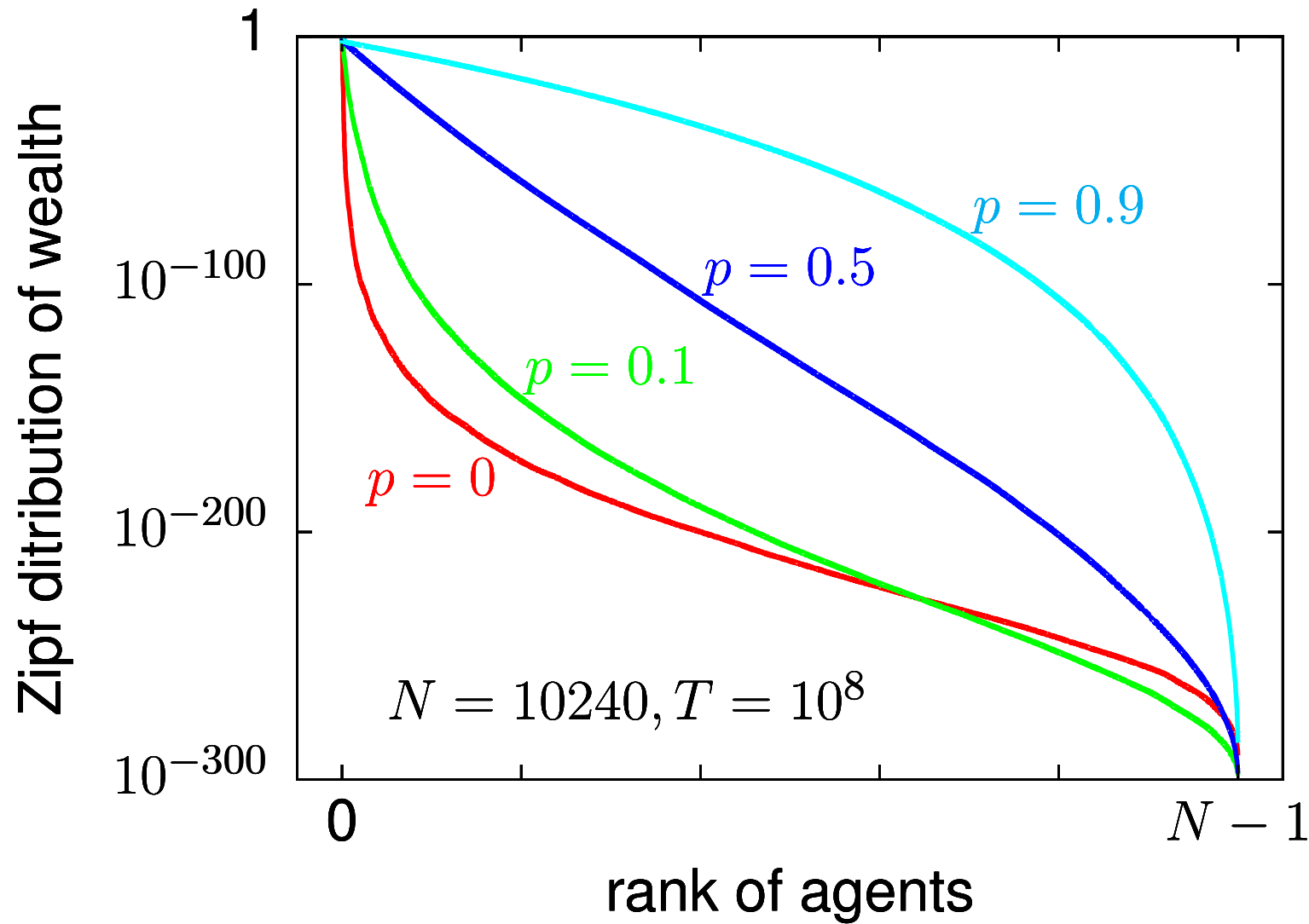
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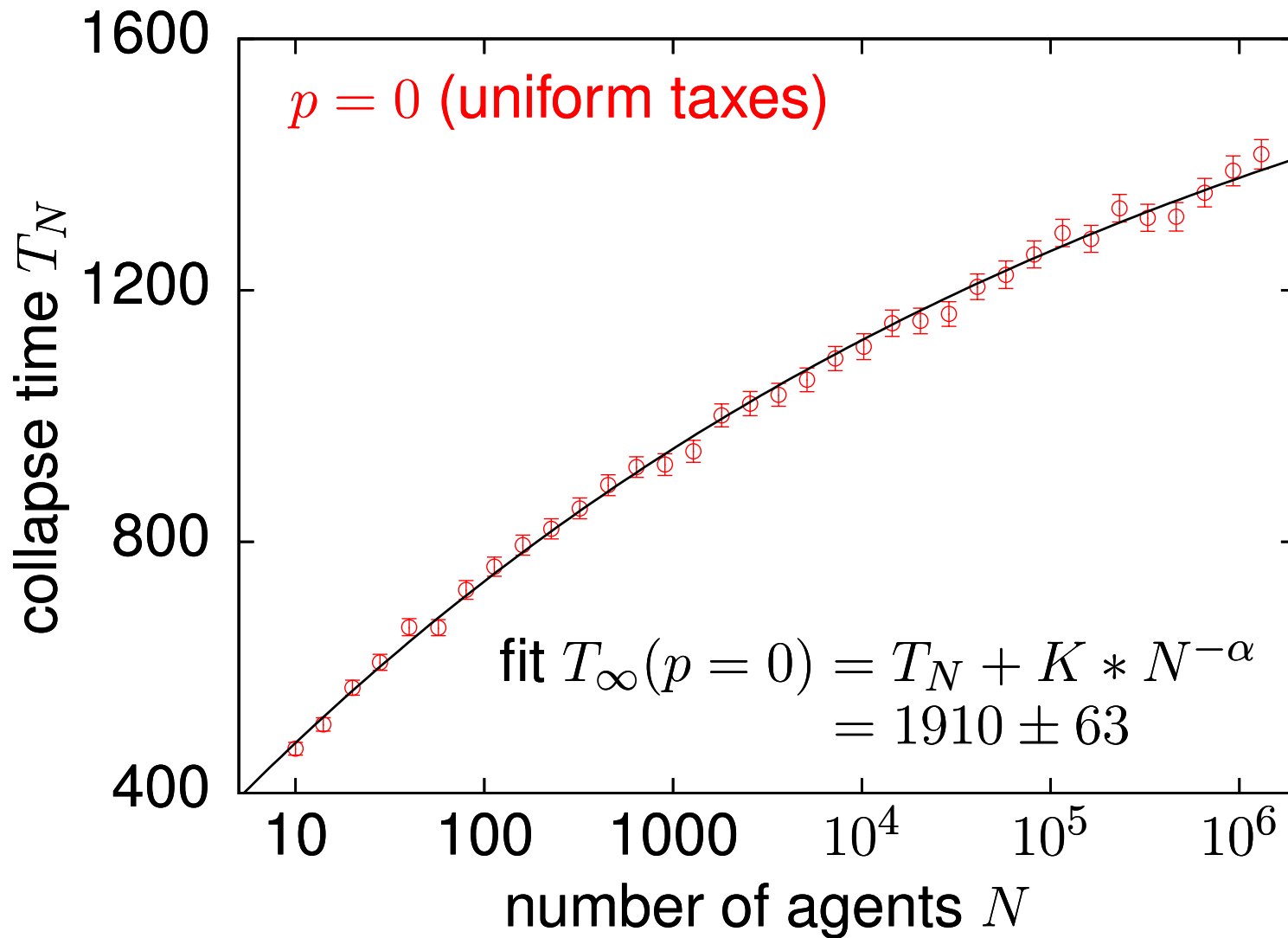
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Nevertheless, the wealth evolution of each agent is independent of others, therefore, perhaps mean-field reasonings may be applied “spatially” among agents themselves, generating an analytical formulation. Evaldo Curado investigates this possibility.

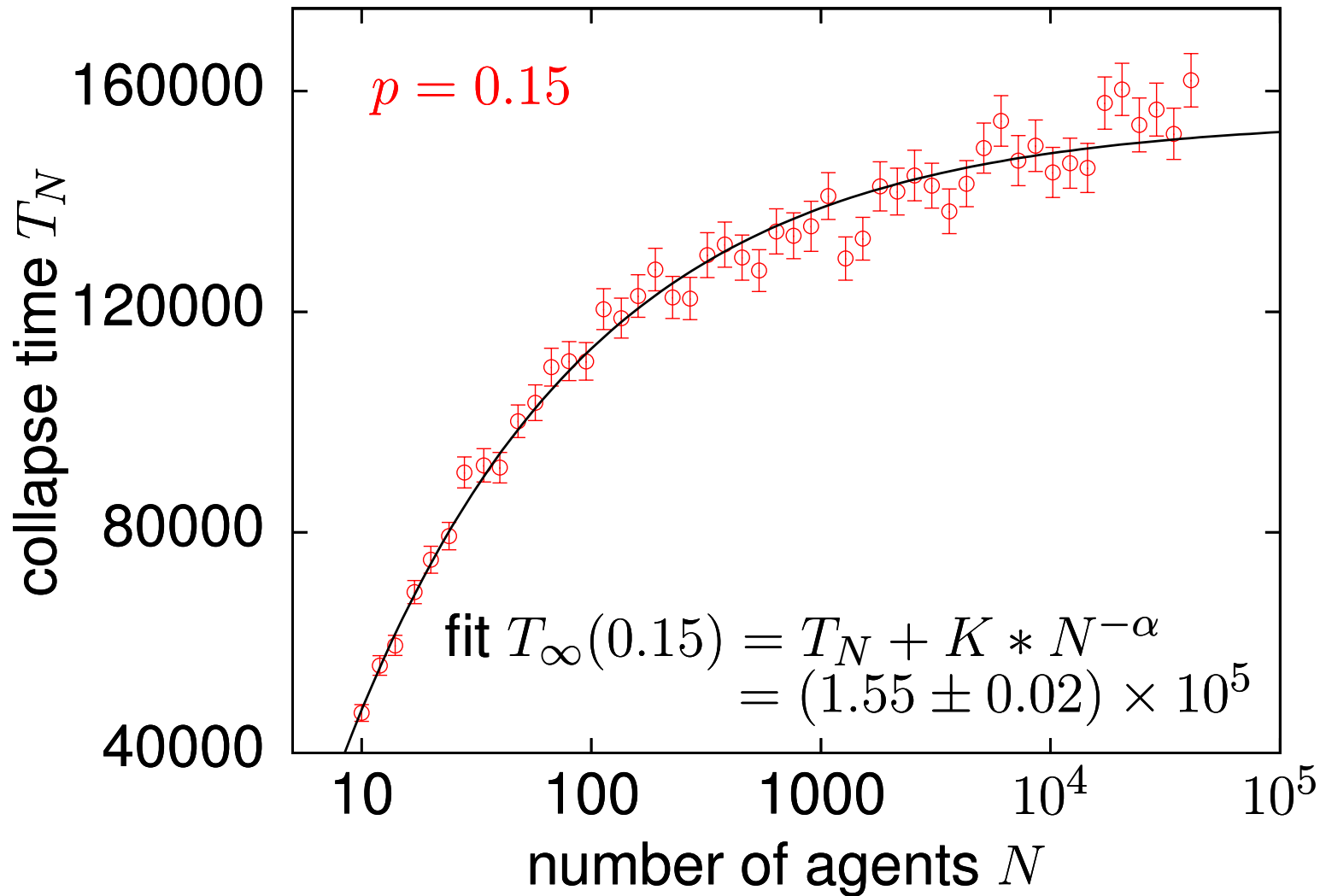
Zipf distribution



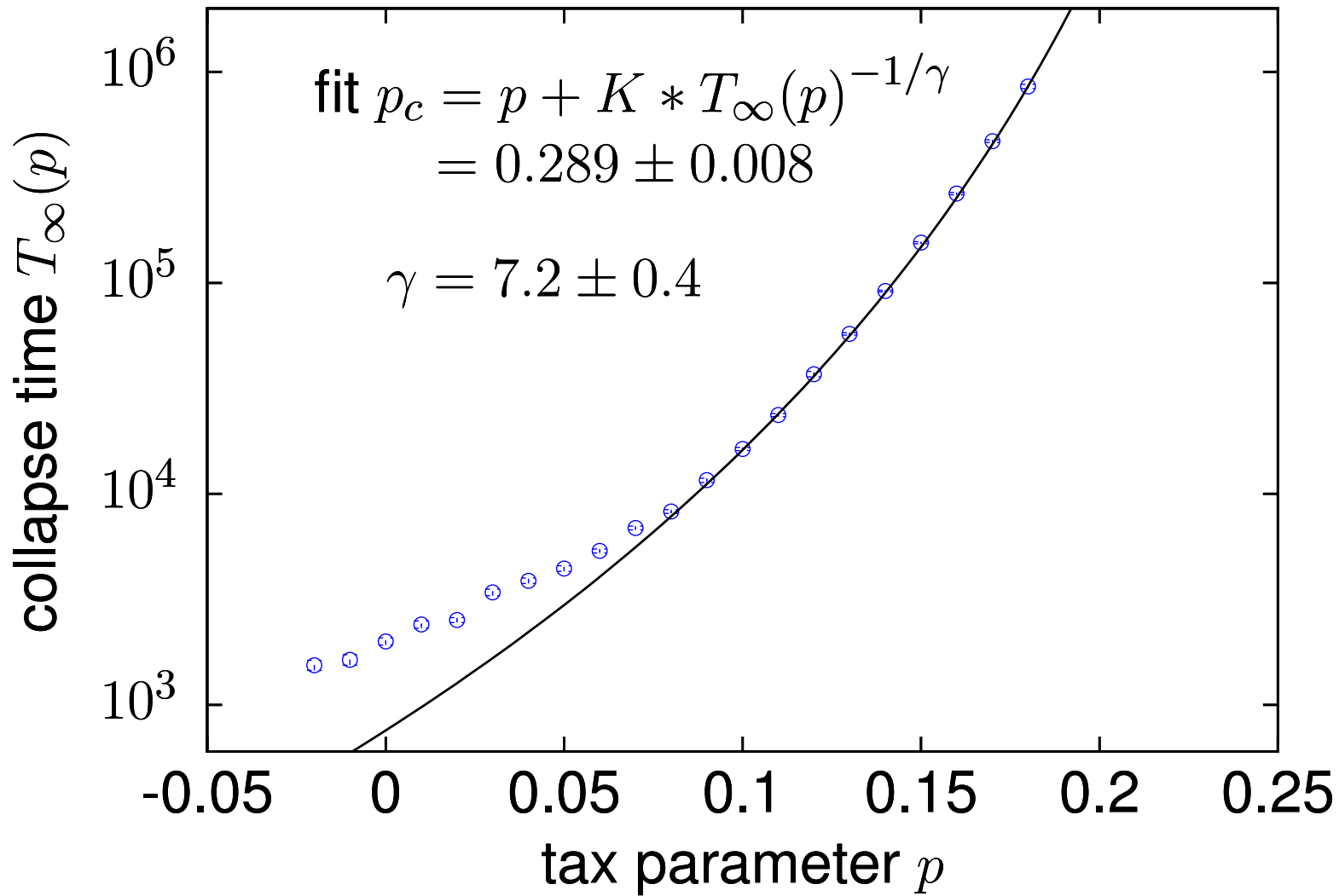
Collapse time ($W_0 > 0.999999$) (*)



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$$T_{\infty} \times p (*)$$



Zipf first moment (*)

