

# Strong Wealth Condensation in Stochastic Transfer Potential Economies

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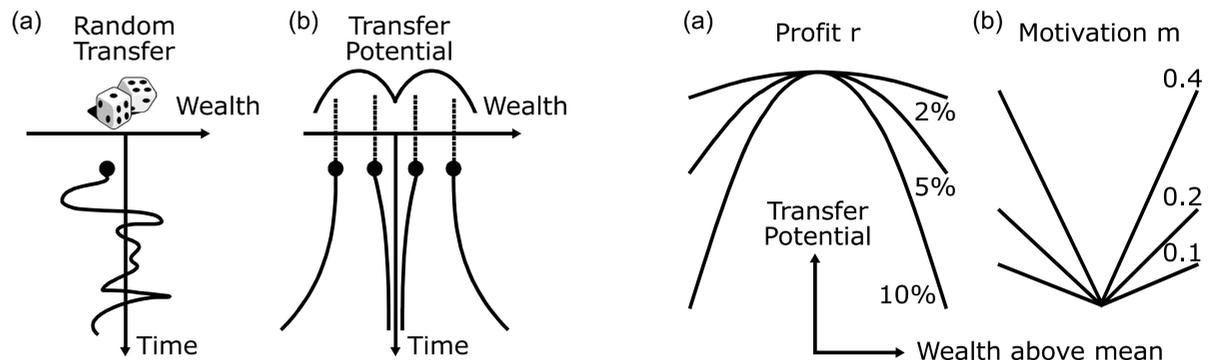
## Abstract

*We analyze wealth condensation for a wide class of stochastic economy models on the basis of the economic analog of thermodynamic potentials, termed transfer potentials. The economy model is based on three common transfer modes of wealth: random transfer, profit proportional to wealth and motivation of poor agents to work harder.*

*The economies never reach a steady state. Wealth condensation is the result of stochastic tunneling through a metastable transfer potential. In accordance with reality, both wealth and income distribution transiently show Pareto tails for high income subjects.*

*All studied metastable transfer economies show exponential wealth condensation as a robust feature. The simplest model with 10 % annual profit leads to a situation where 1% of the population owns 50 % of the wealth after 50 years. The time to reach such a strong wealth condensation is a hyperbolic function of the annual profit rate.*

## Transfer Potential Economy Models

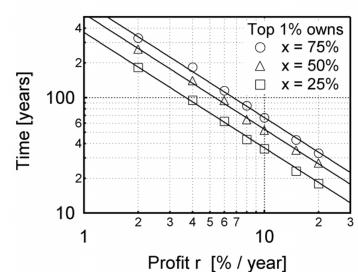
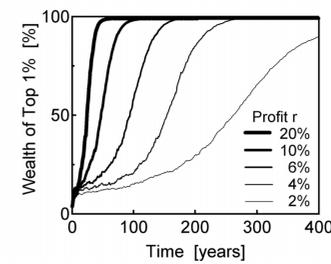
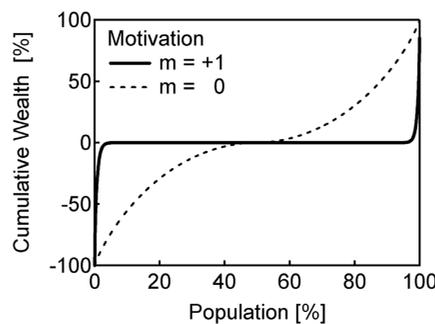
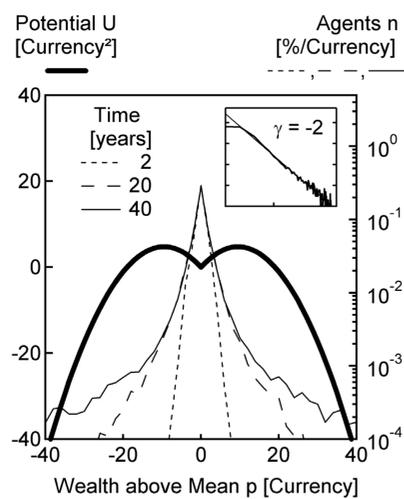


Agents exchange wealth analogous to particles exchanging momentum. We divide the transfers: (a) Random wealth transfer, stemming from uncontrolled external variables and (b) systematic wealth transfer subsumed into a transfer potential.

Systematic transfers model profit and motivation. (a) Return of investment with profit rate  $r$  gives parabolic transfer potential. (b) Motivation is given by the constant gain or loss  $m$  depending on whether your wealth is below or above average.

## Wealth Condensation

Wealth dynamics. The combination of profit rate and motivation results in a parabolic profit potential with a central local motivation minima. Most of the agents are stabilized in the central motivation minimum. The potential however can be tunneled statistically, which leads to a minority of agents with fast growing wealth based on an unperturbed profit potential. Their distribution follows transiently at  $t=40\Delta t$  a Pareto power law (inset).

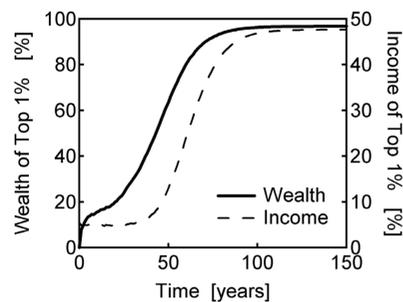


Strong Wealth Condensation. The cumulative wealth distribution shows strong condensation, visible at the sharp tails of the distribution. As a result, the top wealthy 1% own virtually 100% of above-average wealth. The final result does not depend on profit rate  $r$ .

The profit rate  $r$  only affects the time to reach strong wealth condensation. For  $r = 2\%$  / year, it only takes about 265 years to leave more than 50% in the hands of the top 1% of agents whereas for  $r = 20\%$  / year the same condensation is found after 26 years.

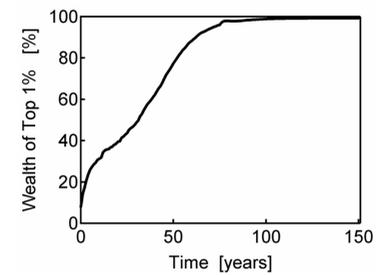
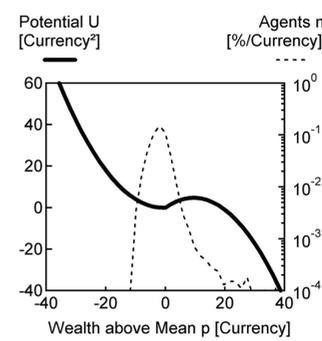
## Income lags Wealth

Dynamics of condensation: wealth leads, income follows. The dynamics of wealth condensation is seen in the income distribution only with a delay of about ten years for the shown profit rate of  $r = 10\%$  / year.



## Robustness

Wealth condensation is general feature of metastable transfer potentials. Very similar wealth condensation is found for a completely different, asymmetric economy model.



## Conclusion

Statistical model economy implementing a realistic balance of profit and motivation have a tendency for fast and catastrophic wealth accumulation. A minority tunnels through the motivational potential hammock and yields fast growing fat tails in the wealth distribution. The model demonstrates how economies have to walk a fine line between motivation and profit.

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