

The U.S. Income Distribution Complex Web

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The economy of the United States is a complex web. Relevant studies of complex webs are:

- *Complex Webs: Anticipating the Improbable* by Bruce J. West and Paolo Grigolini (<http://www.scribd.com/doc/52465902/Complex-Webs-Anticipating-the-Improbable>)
- *Structural Properties of Scale-Free Networks* by Reuven Cohen, Shlomo Havlin, and Daniel ben-Avraham (<http://polymer.bu.edu/~hes/networks/reuven5.pdf>)

The last one is very mathematical. Near the end it talks about how to “immunize” a complex network:

“Efficient Immunization Strategies

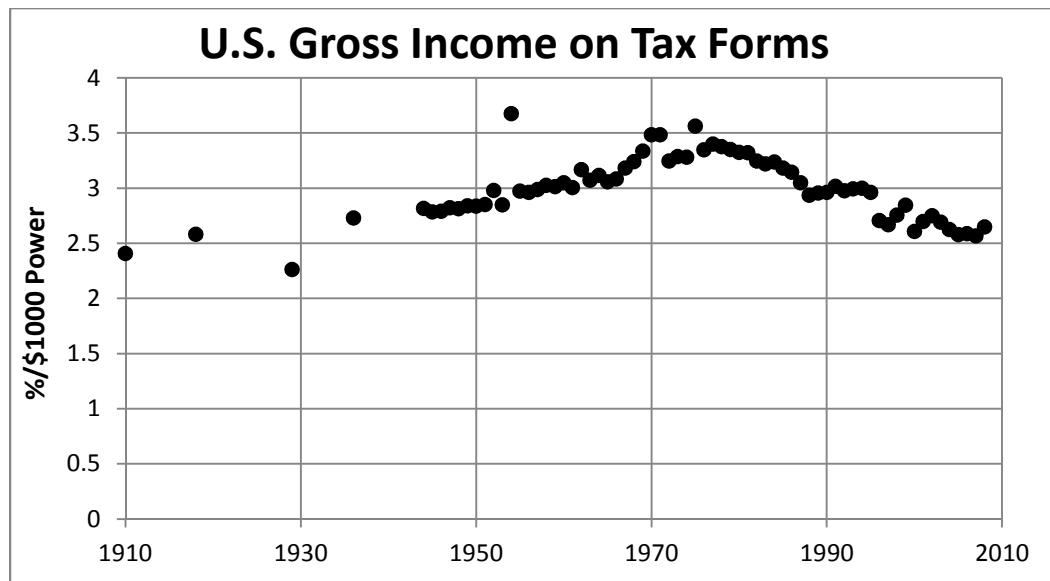
It is well established that random immunization fails to prevent epidemics of diseases that spread upon contact between infected individuals. On the other hand, targeted immunization requires global knowledge of the topology of the social network in question, rendering it impractical. We propose an effective strategy, based on the immunization of a small fraction of random acquaintances of randomly selected individuals, that prevents epidemics without requiring global knowledge of the network.

In our approach, we choose a random fraction of the population and ask each individual to point at an acquaintance with whom they are in contact. The acquaintances, rather than the individuals themselves, are the ones immunized.”

In the case of the economy, banks are obviously the network nodes to which many nodes are connected. So, banks have to be heavily regulated to make sure that they do not screw up the network; for example, by becoming very large and going broke (“too big to fail”).

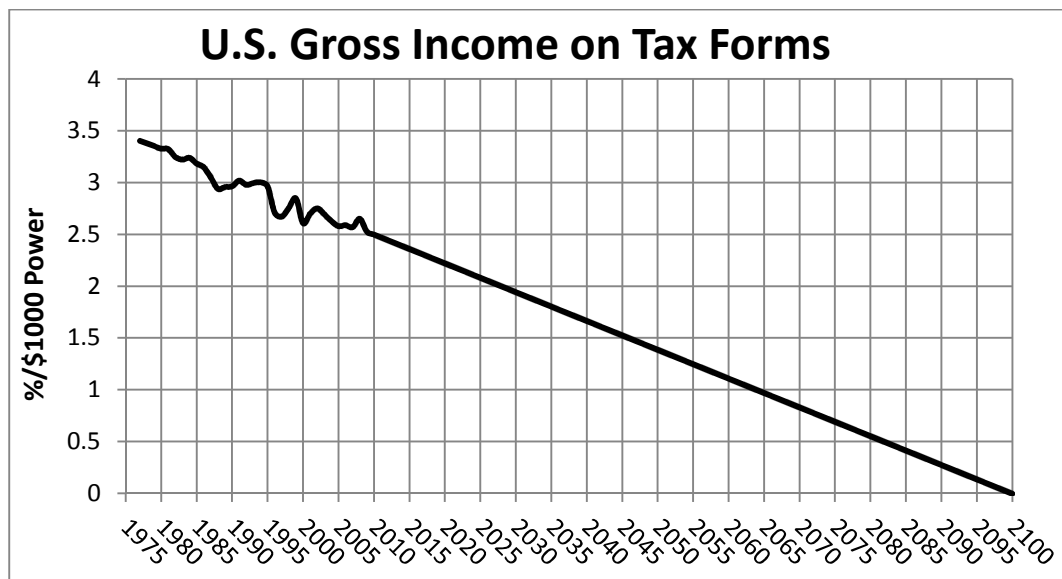
Scale-free networks have properties (e.g., income distribution versus income) that satisfy an inverse power law: $z = 1/x^n$ where n is usually in the range of 2 or 3 for most complex networks. Whenever the power n exceeds certain bounds, high and low, the networks can become unstable.

I have studied U.S. income distribution (<http://www.roperld.com/economics/IncomeDistribution.htm>), which studies show that the distribution satisfies the inverse power law for the high-income tail. Here are the powers for different years:



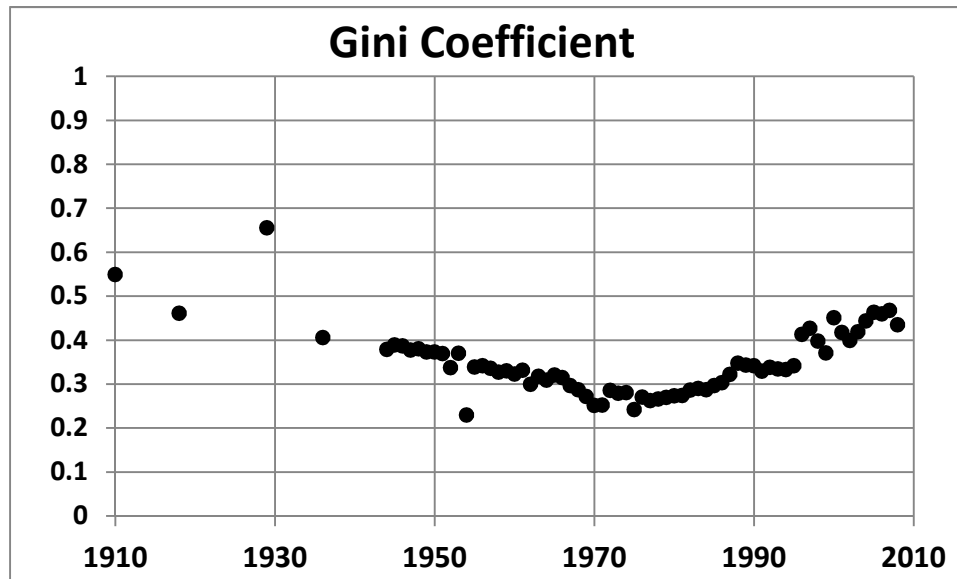
Note that the power decreased from ~1970 to now to be about what it was in 1930. Lower powers represent greater inequality. So, it is no surprise that we are having economic troubles now. The minimum stable power for the U.S. income complex web appears to be $> \sim 2.5$.

If the downward trend of the power continues into the future, the future powers would be:



The ridiculous power of 0 at year 2100 would mean that the income distribution tail is vertical.

The Gini Coefficient is $G = 1/(2x+1)$. For the values of x given above:



For $G=1$ one person has all the income. For $G=0$ income is evenly distributed among all persons. The recent situation is similar to the 1930s situation.

Bank regulation and progressive income tax need to be constantly adjusted by the federal government to keep the power in the 3 to 3.5 range. (See *The Gardens of Democracy: A New American Story of Citizenship, the Economy and the Role of Government* by Eric Liu and Nick Hanauer (<http://www.godemocracy.net/>))

Probably a similar result holds for wealth distribution.

References:

- Power Laws and Rich-Get-Richer Phenomena, <http://www.cs.cornell.edu/home/kleinber/networks-book/networks-book-ch18.pdf>
- Power-Law Distributions in Empirical Data, http://arxiv.org/PS_cache/arxiv/pdf/0706/0706.1062v2.pdf
- http://en.wikipedia.org/wiki/Pareto_distribution
- http://en.wikipedia.org/wiki/Pareto_index
- Gini Coefficient: http://en.wikipedia.org/wiki/Gini_coefficient
- http://en.wikipedia.org/wiki/List_of_measures_of_inequality