A Mathematical Model, Adopted as Econophysics, to Detect Tax Noncompliance

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Take-aways from this talk:

- There is more information in money income data than is recognized in academic economics.
- Fr'instance, a math model of income exposes simulated stealthy tampering with labor income data to promote the popularity of a wannabe dictator. The model was developed independently of academic economics.

A Potential Real-Life Application of the Model: Closing the Tax Gap

- The tax gap is estimated by the Taxpayer Compliance Measurement Program (TCMP), an SRS survey. This talk's model might uncover useful information in TCMP data that makes the survey more focused on noncompliance.
- **The model's credibility**:
- The model has been adopted as econophysics, the branch of physics re-making academic economics into a science. See the 2020 Cambridge University Press textbook, "***Income Distribution Dynamics of Economic Systems: an Econophysics Approach***":

The Model as Econophysics:

First paragraph under the section heading "The Angle Process", (page 154):

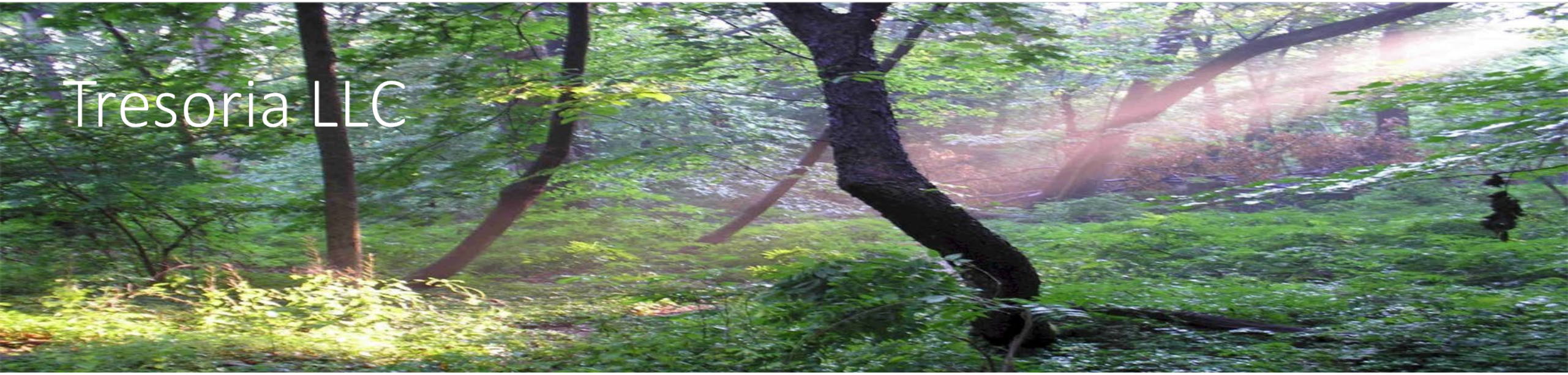
- "Before the term econophysics was even created, Angle (1983) advanced the fundamental concepts of an agent-based model of wealth formation based on particle-like microscopic interactions of agents. *The Angle process*, was elaborated in a long sequence of papers spanning decades [citations to 29 of Angle papers]."

The Model as Econophysics:

Last paragraph of "The Angle Process" section (page 158):

- "…John Angle has in fact pioneered the statistical econophysics approach to the income and wealth distribution problem, [an] approach which was, often independently, followed later by other econophysicists …."

(Marcelo Byrro Ribeiro. 2020. "***Income Distribution Dynamics of Economic Systems: an Econophysics Approach***. Cambridge, U.K.: Cambridge University Press).



The model is abstracted from two ideas:

1) Pervasive competition among people for wealth in flow or stock form, the human version of population biology's view of competitive exclusion allocating niche to individuals, and,

2) the speculation that that human workers more productive of wealth are more sheltered in this pervasive competition for wealth.

The model:

1) All particles in a population are randomly paired.
2) Each pair flips and calls a fair coin.
3) If Particle A wins the toss, it receives a share of Particle B's wealth. That share is B's parameter.
4) If Particle B wins the toss, it receives a share of Particle A's wealth. That share is A's parameter.
5) Particle parameters are fractions of 1.0, excluding1.0 and 0.0.

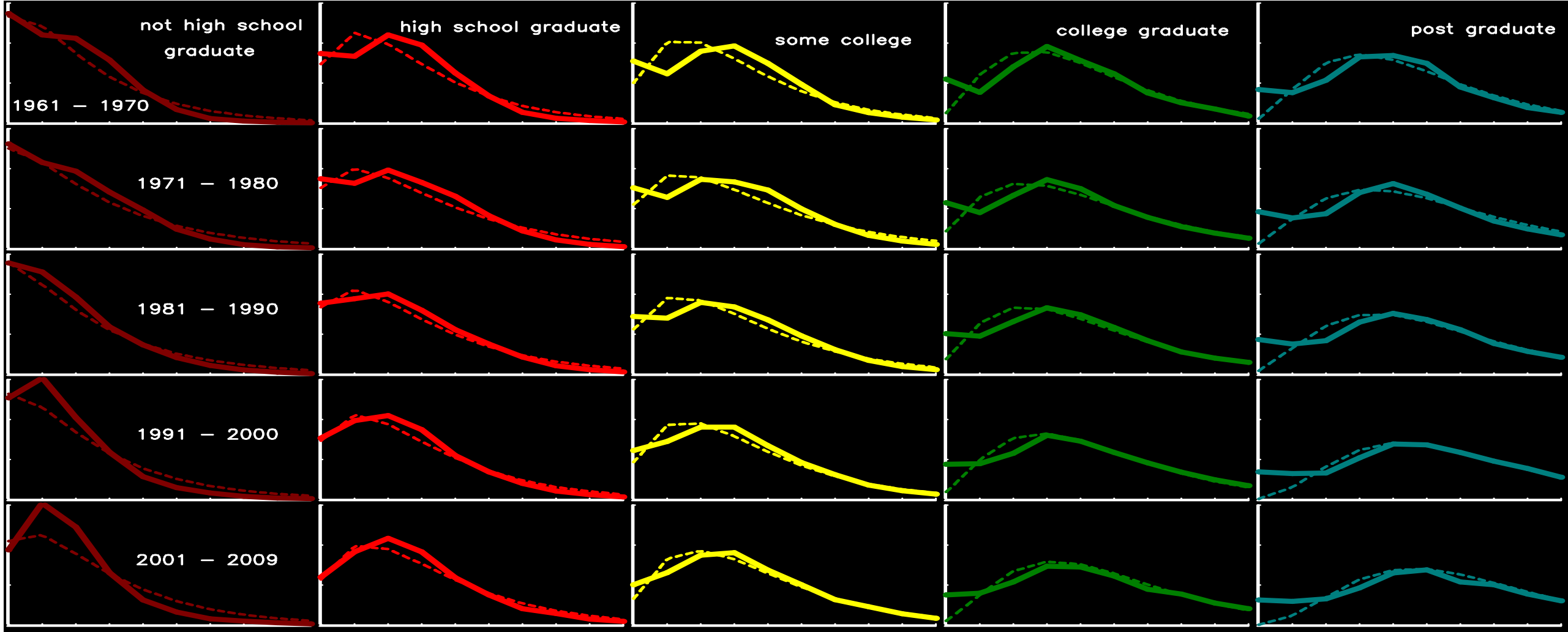
This model is simple, testable, and the empirical process it mimics apparently ubiquitous, i.e., the model is a candidate for a law of nature. Physicists like it.

Confirmations of the Model:

- Many dozens of empirical confirmations grouped under 15 headings in the handout. See Handout, also example on next slide (dotted curves are model fits).

- Seven maxims of mainstream economics never suspected in academic economics of being the joint consequence of such a simple stochastic model. See Handout.

- Hundreds of citations in the econophysics literature.



Distribution of Labor Income Conditioned on Education

x–axis is labor income
from $5k to $115k
y–axis is proportions
from 0 to .3

All dollar amounts in terms of 2010 dollars.
Workers Aged 25+
Source: March Current Population Survey

Simulation of Model Exposing Stealthy Tampering with Labor Income Data to Help Wannabe Dictator Get Past the Last Free Election[1]

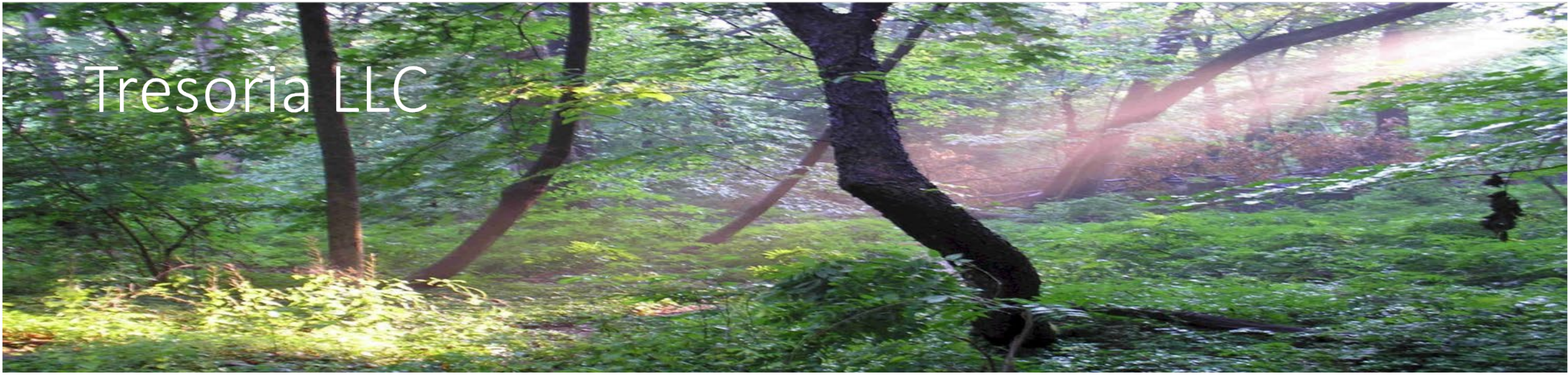
Cast of Characters (the story is fiction, the data set U.S. because it is clean, the time is now, the setting is in a land far, far away):

1) ***Wannabe Dictator*** needs enthusiastic support from blue collar authoritarians to be re-elected despite falling incomes of the less skilled;

2) ***Administrator*** of the national statistics agency promises ***Wannabe*** "***GREAT STATS***!!" before election day;

3) A crew of ethically compromised statisticians is promised "***leapfrog***" promotion if the crew's "***statistical adjustment***" of the data helps ***Wannabe*** win.

[1]Angle, J. 2017. "Detecting Politically Motivated Tampering With Workers' Labor Income In Survey Data". ***Proceedings of the 2017 Joint Statistical Meetings***, (American Statistical Association, Social Statistics Section, Joint Statistical Meetings). Pp.1681-1686. CD-ROM. Alexandria, VA: American Statistical Association. Data to be tampered with are from public use samples of the March Current Population Survey, labor income 1961-2010.



First meeting of the "***GREAT STATS***!!" Committee:

- ***Agency Administrator*** tells the "***leapfroggers***" to add a random increase to the reported labor incomes of respondents without a post-secondary education in a just completed national survey;
- ***Leapfrogger A*** says that "***adjustment***" will obliterate frequency spikes over round numbers, a feature of respondent answers, something that hostile academics will seize on.

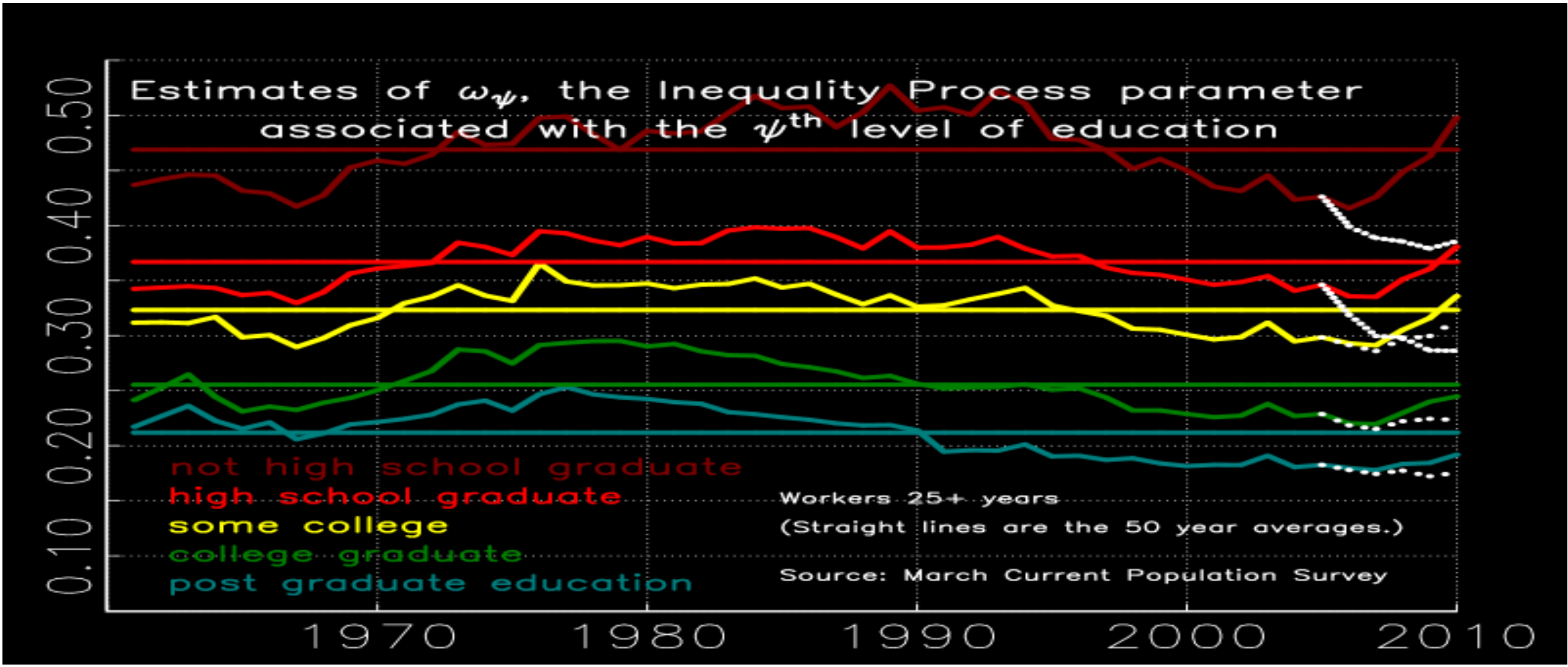
Then bumptious ***Leapfrogger B*** unveils a plan:

"Journalists haven't a clue about raking. That's where we'll get away with data tampering.", says ***B.***

Agency Administrator sternly admonishes ***B*** to never say 'tamper'. ***B*** stands corrected, and is permitted to continue to describe the plan for an ***adjustment***:

"During raking, we'll increase the weight of records in the target group with labor incomes above the target group's median, and decrease the weights of those with labor incomes below their median, ….". [More details about B's plan in Angle, 2017].

While frequency spiking after stealthy "***adjustment***" has only changed imperceptibly, as intended in ***B's*** plan, median labor incomes of workers without post-secondary education are substantially up. [dotted white lines]



- But…. the parameters of this talk's model are violated, exposing tampering that substantially changed estimates for workers without a post-secondary education: white dotted curves. Upshot: now wannabe dictators can't get away with keeping two sets of income data, one set for the media, another for oligarch pals and economic and military planning.

- I offer this model and its findings to the Federal Committee on Statistical Methodology in hopes that the U.S. Government can benefit from them.
- I'd be happy to do short term consulting on applications of the model, gratis.

Photo Credit: National Park Service

All ears?

What about synthetic income data for privacy protection? Generated by the model?

Other questions?

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