Statistical Theories of Income and Wealth Distribution

by

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Summary

This manuscript presents and discusses a multi-agent dynamic model of trading inspired by the physics of energy distribution in many-body thermodynamic systems which produces realistic-looking distributions of income and wealth. Specifically, the steady-state distribution for such a model is a gamma-like one for the bulk and a power-law for the upper tail of the distribution of both income and wealth, as has been found empirically.

Reviewing Remarks

I have no major comments regarding the manuscript, which can be published pretty much as it is. However, some remarks (list given below) may contribute a little to its improvement.

- **"Worrying Trends"** The class of models surveyed by the Authors is exactly the one which encountered the major criticism on the part of the economists during the debate about "worrying trends" in econophysics (Gallegati et al. 2006). Nonetheless, there is no statement throughout the manuscript as to why it is still worthwhile for the economists community to treat these models as a coherent, alternative framework for explaining the distribution of income/wealth once this criticism is taken into account. I think that the Authors should be more clear on this in order to make their work more valuable.

- **On Data** In Section 2, page 4, the Authors state that "[...] there are *strong* empirical evidences that the Gamma distribution [...] fits better with the data [...]" (italic mine) for the bulk of the income/wealth distribution compared to the lognormal model, and cite a series of works supporting this claim. Personally, I would be more cautious on this point. Indeed, as far as the distribution of income is concerned, the results from the studies cited are primarily derived from income tax data, the use of which is often regarded by economists with some suspicion because of at least three reasons:

  1. tax data are collected as part of an administrative process, so that the definitions of income, income unit, etc. are not necessarily those that an economist would have chosen; this causes particular difficulties for comparisons across countries, but also for time-series analysis where there have been substantial changes in the tax system, such as the moves to and from the joint taxation of couples;

  2. it is obvious that those paying taxes, and the rich in particular, have a strong incentive to understate their taxable incomes in a way that reduces tax liabilities,

thus resulting in tax avoidance and evasion;

3. studies of income distribution based on tax data can not portray the bottom of the income distribution because low-income households typically do not file a tax return, thus offering an incomplete picture of the overall distribution of income.

These shortcomings limit what can be said from tax data, and partly explain why economists tend to rely more on household survey data. However, this does not mean that tax data are worthless. Like all economic data, they measure with error the "true" variable in which one is interested. And indeed household surveys themselves are not without shortcomings, as they generally under-represent the very high incomes and suffer from (non- and/or incomplete) response bias. It goes without saying that combining household survey data with information on upper income ranges from tax sources (see, for example, Bach et al. 2009) would encompass the whole spectrum of the population, from the very poor to the very rich, and provide a more reliable picture of the entire income distribution. Nevertheless, the message I would like to pass to the Authors is that the "dispute" between exponential and lognormal as the best model to describe the distribution of income among the vast majority of the population could be related back to the underlying data, and the findings sensitive to possible shortcomings of them. Therefore, I suggest that the Authors take into account these considerations by slightly revising the Section accordingly. Useful references on the subject could be Atkinson and Brandolini (2009) and Atkinson et al. (2009).

- **Unnumbered Formulas** Some displayed equations in the manuscript are not numbered. I would recommend to number all displayed equations. Even if the Authors do not refer to these equations, the future readers of the paper may want to cite specific equations from it.

- **English Language** The manuscript is basically written in proper English language. Nevertheless, there are some typos/spelling mistakes. Therefore, I suggest that the Authors go read again to fix them. As an help, a brief list of some small imperfections I found is given below:

  ○ on page 4, penultimate line, the citation "Clementi and gallegati, 2005a" should be "Clementi and *G*allegati, 2005a" (italic mine);

  ○ on line 7 of Section 3, I found the occurrence of "alongwith" instead of **"*along with*"** (italic mine);

  ○ on the penultimate line of page 7, a period was erroneously placed after the closing round bracket;

  ○ on the second line of Section 5, the citation "Das and yarlagadda, 2003" should be "Das and *Y*arlagadda, 2003" (italic mine);

  ○ on page 16, line 8, the citation "Chakrabarti and chakrabarti, 2009" should be "Chakrabarti and *C*hakrabarti, 2009" (italic mine);

  ○ on page 16, lines 16 and 24, I found two occurrences of "upto", which will be better substituted by "*up to*" (italic mine);

  ○ in the reference list, 6th entry, "The inequality process as an wealth maximizing process" should be corrected with "The inequality process as *a* wealth maximizing process" (italic mine);

  ○ in the reference list, 15th entry, the title of the article ("*Microeconomics of the ideal gas like market models*") should be written in plain text;

- in the reference list, 40th entry, "Taxes in a simple wealth distribution model by inelastocally scattering particles" should be corrected with "Taxes in a simple wealth distribution model by *inelastically* scattering particles" (italic mine);
- in the reference list, 54th entry, "K.Kaski" needs a space to divide words.

References

Atkinson AB, Brandolini A (2009) On data: a case study of the evolution of income inequality across time and across countries. Camb J Econ 33:381-404

Atkinson AB, Piketty T, Saez E (2009) Top incomes in the long run of history. NBER Working Paper No. 15408, National Bureau of Economic Research. http://www.nber.org/papers/w15408

Bach S, Corneo G, Steiner V (2009) From bottom to top: the entire income distribution in Germany, 1992-2003. Rev Income Wealth 55:303-330

Gallegati M, Keen S, Lux T, Ormerod P (2006) Worrying trends in econophysics. Physica A 370:1-6