Centro di Ricerca e Documentazione Luigi Einaudi

Dipartimento di Economia e Statistica Cognetti de Martiis

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Opening speech

Cyber Markets: What About Economic Freedom?

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These slides at
https://terna.to.it/PietroTernaGiorgioRotaConference2020.pdf

CYBERNETICS

PLANNING AND MODELS

AGENT-BASED SIMULATION

ARTIFICIAL INTELLIGENCE

MARKETS

EMPLOYMENT

The dawn of information technology (1/2)

The magic moment is that of the mid-1940s, when great minds like John von Neumann, Oskar Morgenstern, and John Nash, led to an exceptional joint emergence.

That of: (i) new calculation tools; (ii) a new language for the social sciences (game theory); (iii) the concept of complexity.

Hanappi, H. (2013). The Neumann-Morgenstern Project–Game Theory as a Formal Language for the Social Sciences. In H. Hanappi, editor, *Game Theory Relaunched*. InTech.
Moscati, I. (2011). Von Neumann, Morgenstern, and the creation of game theory. From chess to social science, 1900–1960. *Journal of Economic Methodology*, 18(4):434–440, 2011. doi: 10.1080/1350178X.2011.628460.

The dawn of information technology (2/2)

With them, Norbert Wiener and the **cybernetics**.

https://en.wikipedia.org/wiki/Norbert_Wiener

Wiener, N. (1948), *Cybernetics: Or Control and Communication in the Animal and the Machine.* MIT Press, Camb. MA, 2nd revised ed. 1961.

https://en.wikipedia.org/wiki/Cybernetics:_Or_Control_and_Communication_in_the_Animal_and_the_Machine#cite_note-1

Rosenblueth, A., and Wiener (1945), The Role of Models in Science, *Philosophy of Science*, 12, 4, 316-321., N.

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PLANNING AND MODELS

AGENT-BASED SIMULATION

ARTIFICIAL INTELLIGENCE

MARKETS

EMPLOYMENT

Economic planning and models (1/6)

From cybernetics and the basic idea of input-output tables, we saw the emergence of *the too*ls for economic planning.

Micro detailed data are essential there, and the calculation power is crucial but not sufficient.

To plan an economy, you need the data and–most of all–the decentralization of their collection and utilization.

Economic planning and models (2/6)

In Gerovitch (2008), we have an outline of the critical links among information technology, planning, and economic reality in the Soviet Union.

Gerovitch, S. (2008). InterNyet: why the Soviet Union did not build a nationwide computer network. History and Technology, 24(4), pp. 335–350.

ECONOMIC PLANNING AND MODELS (3/6)

Quoting Gerotvich (2008):

> In October 1961, just in time for the opening of the Twenty-Second Congress of the Communist Party, the Cybernetics Council of the Soviet Academy of Sciences published a volume appropriately entitled, ***Cybernetics*** *in the Service of Communism*. This book outlined the great potential benefits of applying computers and cybernetic models in a wide range of fields, from biology and medicine to production control, transportation, and economics.

The great computerized economic plan did not turn into a reality due (i) to a sequence of complex contrasts between the decision-makers, much more than (ii) for technological problems.

Economic planning and models (4/6)

The main issue was the design to create a perfect top-down system,

forgetting the necessity of proceeding by process of trial and error, adaptation, and learning that has to characterizes the development of any wide-ranging computerized system.

Economic planning and models (5/6)

Cybernetics at (in) the Service of Communism

At https://terna.to.it/CybCom/ we have several chapters of Berg (1961) in the 1962 English translation.

To have an image of that period, we suggest Spufford (2010/2012).

Berg, A., I. (a cura di) (1961). *Kibernetiku–na sluzhbu kommunizmu (Cybernetics at the service of communism).* vol. 1, Gosenergoizdat, Moscow. Traduzione pubblicata da: Office of Technical Services, U. S. Department of Commerce, Washington, D. C., 1962.
Spufford, F. (2010), Red Plenty. Faber&Faber, (2012), Gray Wolf.

ECONOMIC PLANNING AND MODELS (6/6)

The usual objection, from "Il ministro della produzione nello stato collettivista" of Enrico Barone (1908a,b) quoting from the Barone [2012] translation, p. 110:

> The determination of the coefficients economically most advantageous can only be done in an *experimental way*: and not on a *small scale*, as could be done in a laboratory; but with experiments on a *very large scale*, because often the advantage of the variation has its origin precisely in a new and greater dimension of the undertaking.

Barone, E. (1908a). Il ministro della produzione nello stato collettivista. *Giornale degli Economisti*, 37 (Year 19):267–293. ISSN 11252855. URL http://www.jstor.org/stable/23222736. Barone, E. (1908b). Il ministro della produzione nello stato collettivista (continuazione). *Giornale degli Economisti*, 37 (Year 19):391–414. ISSN 11252855. URL http://www.jstor.org/stable/23221778. E. Barone (2012). The ministry of production in the collectivist state. Giornale degli Economisti e Annali di Economia, 71 (Year 125) (2/3):75–112, (Italian edition 1908). ISSN 00170097. URL http://www.jstor.org/stable/43828055.

CYBERNETICS

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ARTIFICIAL INTELLIGENCE

MARKETS

EMPLOYMENT

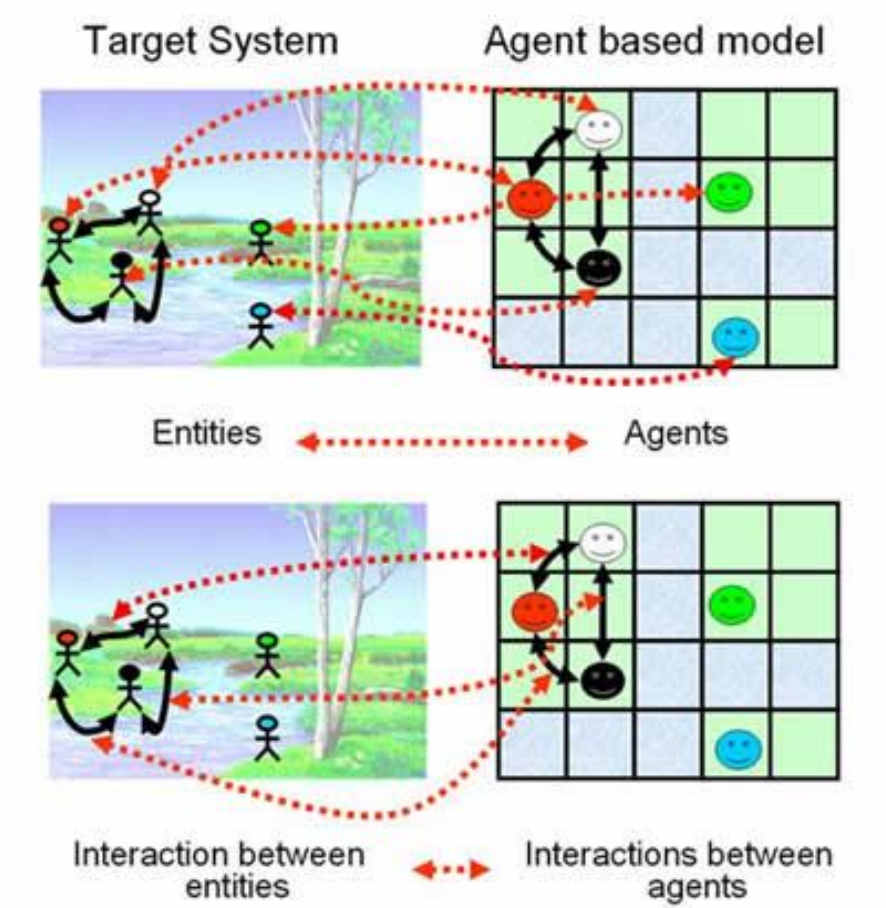
Agent-based simulation, also for planning (1/2)

Starting about 30 years ago, we had Agent-Based Models (ABMs) that we can also use to implement experiments and trial and error learning processes.

This methodology allows the construction of artificial worlds, populated by agents, interactively explaining the emergence of macro-level effects with their behavior.

AGENT-BASED SIMULATION, ALSO FOR PLANNING (2/2)

Observer &
Model: two levels



From M. Galán, L.R. Izquierdo, S.S. Izquierdo, J.I. Santos, R. del Olmo, A. López- Paredes, B. Edmonds: Errors and artefacts in agent-based modelling. *Journal of Artificial Societies and Social Simulation*, 12 (1):1, 2009. ISSN 1460-7425. URL http://jasss.soc.surrey.ac.uk/12/1/1.html and from B. Edmonds (2001) The Use of Models - making MABS actually work. In Moss S and Davidsson P (Eds.) *Multi-Agent-Based Simulation*, Lecture Notes in Artificial Intelligence 1979: 15-32. Berlin: Springer-Verlag..

CYBERNETICS

PLANNING AND MODELS

AGENT-BASED SIMULATION

ARTIFICIAL INTELLIGENCE

MARKETS

EMPLOYMENT

Artificial intelligence (1/2)

Kasparov (2018) offers us a fulminating *incipit*:

> The recent world chess championship saw Magnus Carlsen defend his title against Fabiano Caruana. But it was not a contest between the two strongest chess players on the planet, only the strongest humans.

Kasparov, G. (2018). Chess, a Drosophila of reasoning. *Science*, Vol. 362, Issue 6419, pp. 1087, DOI: 10.1126/science.aaw2221. URL http://science.sciencemag.org/content/362/6419/1087.full.

Artificial intelligence (2/2)

Indeed, it is a *Drosophila*. We cannot imagine that a self-learning system, having assimilated all the texts of philosophy, could give us the "fundamental answer."

In a *simpler* field–even if so complex–like economics, machine intelligence can instead very quickly produce surprising suggestions.

CYBERNETICS

PLANNING AND MODELS

AGENT-BASED SIMULATION

ARTIFICIAL INTELLIGENCE

MARKETS

EMPLOYMENT

Artificial intelligence and ABMs, economic planning and markets (1/6)

The novelties are already here

How Amazon deliver us not routinary items in just a few hours? It feeds its warehouses, mostly decentralized, based on forecasts, and we know that it does so using relatively soft artificial intelligence.

If a colossal buyer decides how much to buy, it is not far from determining how much to produce; moreover, if it chooses selling prices for those productions, it is not distant from planning the economy.

Artificial intelligence and ABMs, economic planning and markets (2/6)

The Economist (2019), with another *incipit*:

Amazon's six-page memos are famous. Executives must write one every year, laying out their business plan. Less well known is that these missives must always answer one question in particular: how are you planning to use machine learning? Responses like "not much" are, according to Amazon managers, discouraged.

(The) Economist (2019). Amazon's empire rests on its low-key approach to AI. Apr 11th 2019. URL https://www.economist.com/business/2019/04/13/amazons-empire-rests-on-its-low-key-approach-to-ai?frsc=dg%7Ce

Artificial intelligence and ABMs, economic planning and markets (3/6)

Back to Barone, with Ludwig von Mises (1920) and the so-called *Economic calculation problem.*

(Do not forget Peter John De La Fosse Wiles (1964), with his systematic analysis of the political economy of communism.)

Mises, L. (1920). *Die wirtschaftsrechnung im sozialistischen gemeinwesen*. Archiv für Sozialwissenschaft und Sozialpolitik, 47(1):86–121, 1920. Tradotto come *Economic calculation in the socialist commonwealth*, volume 47. Lulu Press, Inc, 2016, URL https://www.mises.ch/library/Mises_Economic_Calculation_in_the%20Socialist_Commonwealth.pdf.

Wiles, P. J. D. (1964), *The Political Economy of Communism*, Harvard University Press, Boston.

Artificial intelligence and ABMs, economic planning and markets (4/6)

Following Barone, without a price system that changes through a trial and error process, in this way determining the production choices, the activity of the *ministro della produzione dello stato collettivista* is unfeasible.

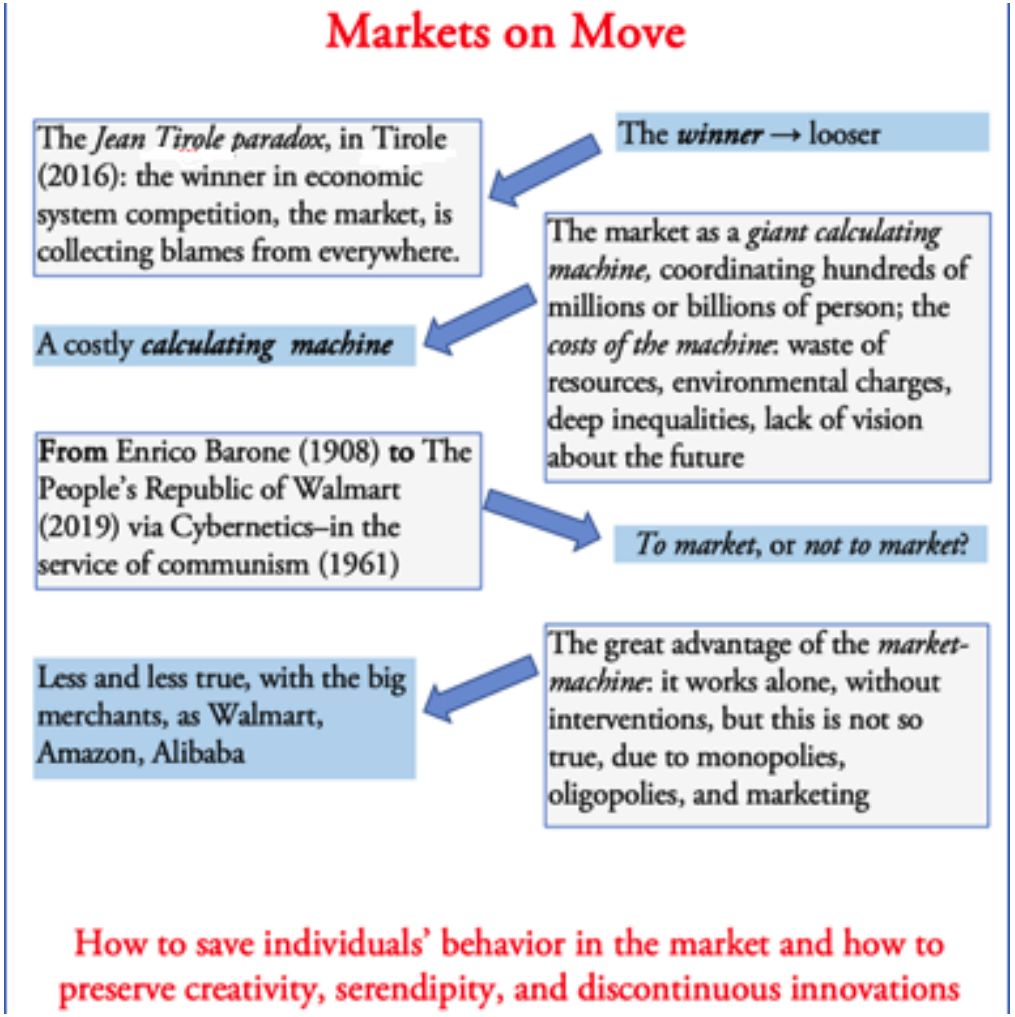
The novelty now is that, with artificial intelligence and ABMs, it is possible to simulate those processes of trial and error.

While AI is generating possible choices, ABMs can quite easily verify the related consequences.

Artificial intelligence and ABMs, economic planning and markets (5/6)

Tirole, J. (2016), *Économie du bien commun*, Presses Universitaires de France, Paris.

Phillips, L., and Rozworski, M. (2019). *The People's Republic of Walmart: How the World's Biggest Corporations Are Laying the Foundation for Socialism*. Verso, 2019.



Artificial intelligence and ABMs, economic planning and markets (6/6)

Summarizing: AI POWER and MARKETS, what's emerging?

A network of AI capabilities helping in reducing transportation overload, waste of resources, energy needs, environment damages, inequalities, or …

a world of fighting or colluding oligopolies, managing markets, and directing consumptions?

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PLANNING AND MODELS

AGENT-BASED SIMULATION

ARTIFICIAL INTELLIGENCE

MARKETS

EMPLOYMENT

New World Economy and Employment (1/5)

Employment and robots

New World Economy and Employment (2/5)

Leontief, quoting a 1983 paper (p.405):

Using a somewhat shocking but essentially appropriate analogy, one might say that the process by which progressive introduction of new computerized, automated, and robotized equipment can be expected to reduce the role of labor is similar to the process by which the introduction of tractors and other machinery first reduced and then completely eliminated horses and other draft animals in agriculture. The competitive price mechanism played a decisive role in this process.

Leontief, W. (1983), Technological advance, economic growth, and the distribution of income. *Population and Development Review*, pages 403–410.

New World Economy and Employment (3/5)
ABMs again

"Compactly, in agent-based computational models a population of data structures representing individual agents is instantiated and permitted to interact."

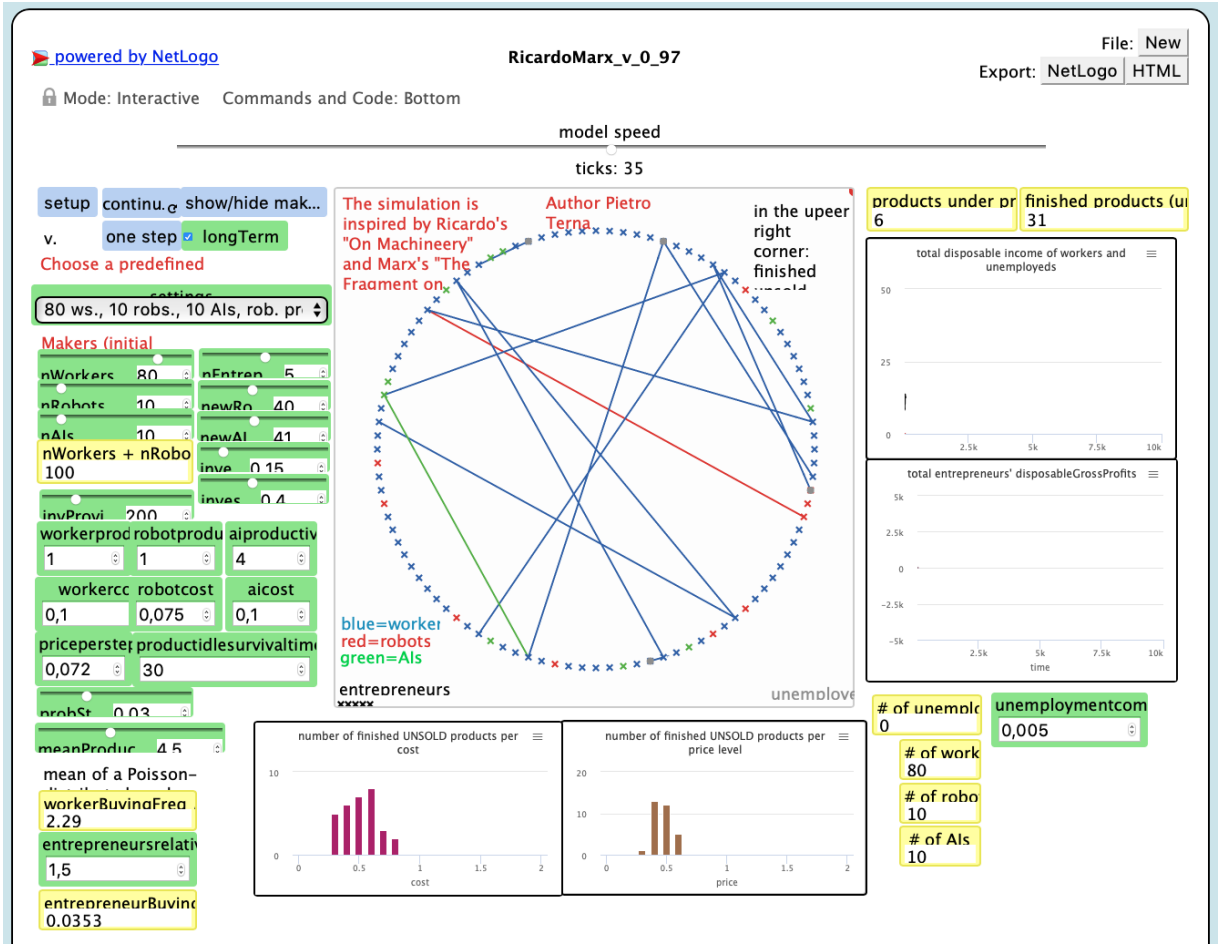
"Different agents may have different decision rules and different information; usually, no agents have global information, and the behavioral rules involve bounded computational capacities—the agents are *simple*."

Axtell, R. L., and Epstein, J. M. (2006). Coordination in transient social networks: an agent-based computational model of the timing of retirement. In J. M. Epstein, editor, Generative social science: Studies in agent- based computational modeling, page 146. Princeton University Press.
http://www.econ.tuwien.ac.at/lva/compeco.se/artikel/epstein_coordination_in_transient_social_networks.pdf Look at p.6 on line

New World Economy and Employment (4/5)

A quite recent model of mine:

http://www.netlogoweb.org/launch#http://ccl.northwestern.edu/netlogo/community/RicardoMarx_v_0_97.nlogo



New World Economy and Employment (5/5)

A tale of production, profits, employment, and prices … but this is another story.

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