

Friede-Gard-Preis 2022

Gerd Schuster oct13th 2022



Basic information

- Founded: 2020 founder: Gerd Schuster
- Cooperation with Umwelt-Campus Birkenfeld
- Mission: to promote an alternative economic theory for the modeling of an economically, ecologically & socially sustainable economy & society (in place of the one-sided & deficient neoclassical mainstream)
- Means: Friede-Gard-Preis for Sustainable Economics – awarded annually – 10.000 €
- Award Winners:
 - 2021: Hermann Haken & Peter Flaschel
 - 2022: Steve Keen



Utmost Urgency

- +4,5°C means: -40% usable area for life on earth
- +5,5°C means: 60 deadly days per year in midaltitudes (approx. 40° N to 40° S) (home to 74% of world population)



• 700 ppm CO₂e are due approx. Year 2080 – 2100 (2021: 508 ppm; rising with approx. 2,5+ ppm per year)



Einstein's aphorism

- "Two things are infinite: the universe & human stupidity/ foolishness, Regarding the Universe I am not really sure"
- To-day we know: the universe is inconceivable big, but finite.
- Help us God, that Einstein was wrong on the second point also.
- Otherwise...



Otherwise – a joke becomes serious



for Nature humans are just a species like any other

That's it(High) Time to act ! Thank you for your understanding !

References: Wagner & Weitzman: Climate Shock (2015), p.53 Keen: The New Economics - a Manifesto (2022), p.73 NOAA Annual Greenhouse Gas Index

Acceptance Speech Prof. Steve Keen, PhD





HOCH Umwelt-Campus SCHULE Birkenfeld TRIER





Friede-Gard Prize 2022 Acceptance Speech

www.patreon.com/profstevekeen https://profstevekeen.substack.com/ www.profstevekeen.com

My heartfelt gratitude to the Friede-Gard Foundation

- Prizes in Economics normally reward believers in the Neoclassical religion
- I'm honoured to be the 3rd recipient, in the 2nd year, of the 1st prize for the heretics
- The <u>Friede-Gard Prize</u> rewards "scientific achievements that signify particular advances in the further development of economics into an economics of sustainability"
- Prof. Dr. dr hc mult. Hermann Haken for Synergetics: analysis of self-organizing complex nonlinear nonequilibrium systems



Prof. Dr. Peter Flaschenel for 'The Bielefeld School': modeling and analysis of social sustainability in macroeconomic models with a Keynesian character

- My award is for
 - "Mathematical modelling of Hyman Minsky's "Financial Instability Hypothesis" ...
 - Modelling an economy involving energy and natural resources, ...
 - Minsky, a system dynamics software specifically for economic modelling."
- Key components of a Complex Biophysical-Systems Economics...

Quick personal economic history

- Studies Economics, Maths & Law at Sydney University 1971-75
- Exposed to "Theory of Second Best" (Lipsey & Lancaster 1956) by rebel 1st year lecturer Frank Stilwell in 1971
- Realised education was mendacious:
 - No mention of this or Capital Controversies, despite Samuelson admitting defeat in "A Summing Up" (1966)
- Led student revolt against mainstream economics in 1973 "The Day of Protest"...



- Revolt successful, Department of Political Economy established
- But staff saw maths as the enemy—a mistake.
 - Neoclassical economists do "mythematics", not mathematics!
- Continued my own study via journals, reading post-University

Quick personal economic history

- Briefly a schoolteacher in 1977, then Freedom From Hunger Education Officer 77-83
- Incidental career as software editor for computing magazines 1981-1998
 - Reviewed 100s of computer programs during "Cambrian Explosion" of early PCs
- Worked in "Business-Union Accord" of Hawke Labor Government 84-87
- Saw Neoclassical public servants subvert social-democratic intentions of Accord
- Realised I had to fight Neoclassicals in their breeding grounds—Universities
- Started Masters part-time aged 31; became academic in 1987; began PhD at 40 in 1993
- <u>Masters thesis & first research papers</u> on how Marx's philosophy contradicts the Labor Theory of Value (Keen 1993a & 1993b)
- Inspired by Minsky's John Maynard Keynes in 1987, resolved to do what Minsky hadn't managed—produce a mathematical model of the Financial Instability Hypothesis
- Wrote **Debunking Economics** (2001, 2011) and became well-known internationally...

"Minsky + Goodwin = Chaos"

- Goodwin's "Growth Cycle": "A starkly schematized and hence quite unrealistic model of cycles in growth rates" (Goodwin 1967, p. 54)
- Minsky's "FIH": a theory which "makes great depressions one of the possible states in which our type of capitalist economy can find itself" (Minsky 1982, p. xi)
 - But no (workable) mathematics
- Keen: "Minsky + Goodwin = Chaos"
- "The chaotic dynamics explored in this paper should warn us against accepting a period of relative tranquility in a capitalist economy as anything other than a lull before the storm" (Keen 1995, p. 634)



Macroeconomics from macroeconomic definitions

- Minsky model originally built as extension to Goodwin
- In recent years I realized it can be derived directly from macroeconomic definitions
 - Employment Rate: $\lambda \equiv \frac{Employment}{Population} \equiv \frac{L}{N}$
 - Wages share of Output: $\omega \equiv \frac{Wages}{GDP} \equiv \frac{W}{Y}$ Debt to Output Level: $d \equiv \frac{Debt}{GDP} \equiv \frac{D}{Y}$
- Differentiate λ , ω , d with respect to time yields 3 Logically true statements statements:
 - The employment rate will rise if economic growth exceeds the sum of change in the output to labour ratio and population growth;
 - The wages share of output will rise if the total wages grow faster than GDP; and
 - The private debt to GDP ratio will rise if private debt growth exceeds the rate of economic growth
- Not yet a model. But shows complex macroeconomic cycles are an emergent property of capitalism—no need for "microfoundations", let alone Neoclassical fetish for equilibrium thinking

Deriving macroeconomics from macroeconomic definitions

- Create a model via simple wage change & investment functions...
- Similar to Lorenz (1963) Wages Share stylized weather model 2715
- Foundational dynamics of economic complexity Debt Ratio
- Approximate reality by adding more structural accuracy—prices, IO dynamics, etc.





1200

- If you take economists seriously, then you don't take climate change seriously:
- <u>HSBC's Stuart Kirk tells</u> <u>FT investors need not</u> <u>worry about climate</u> <u>risk</u>
- risk These numbers were made up by Neoclassical economists...
- Nordhaus on whether global warming will affect manufacturing...



Even by the UN IPCC own numbers, climate change will have a negligible effect on the world economy

A (large) temperature rise of 3.6 degrees by 2100 means a loss of 2.6 percent of global GDP. Let's assume 5%

- "the common argument even used by the IPCC is that it's going to hit GDP in 2100.... it's a long way off. Their worst-case model lops off five percent.
- What they fail to tell everybody is between now
 and 2100 economies are going to grow a lot...
- the world is going to be between 500 and a thousand percent richer...

2022

If you lop five percent off that in 2100, who cares,
 you will never notice..."

2100

- Nordhaus 1991: "for the bulk of the economy—manufacturing, mining, utilities [things like energy, sewerage, water!!], finance, trade, and most service industries—it is difficult to find major direct impacts of the projected climate changes over the next 50 to 75 years."
- Nonsense! This ignorance has its origins in Neoclassical production theory:
 - Labor, Capital & "Technology" in→Goods & Services out
 - No role for energy or raw materials
- Real world: "Labor without energy is a corpse, capital without energy is a sculpture" (Keen et al. 2019)
 - Labor & Capital convert energy into useful work, raw materials into useful products
 - Waste energy & matter inevitable & unavoidable (2nd Law of Thermodynamics etc.)
- When (not if) climate change forces drastic reductions in CO2 output, energy will plunge
 - What will the effects on GDP be?
 - If you ask a Neoclassical economist, "<u>small potatoes</u>"...

- Economists estimates of impact of global warming on GDP are delusional
- Keen (2020) "The appallingly bad neoclassical economics of climate change"
- Keen et al. (2022) "Estimates of economic and environmental damages from tipping points cannot be reconciled with the scientific literature"

ABSTRACT

Forecasts by economists of the economic damage from climate change have been notably sanguine, compared to warnings by scientists about damage to the biosphere. This is because economists made their own predictions of damages, using three spurious methods: assuming that about 90% of GDP will be unaffected by climate change, because it happens indoors; using the relationship between temperature and GDP today as a proxy for the impact of global warming over time; and using surveys that diluted extreme warnings from scientists with optimistic expectations from economists. Nordhaus has misrepresented the scientific literature to justify the using a smooth function to describe the damage to GDP from climate change. Correcting for these errors makes it feasible that the economic damages from climate change are at least an order of magnitude worse than forecast by economists, and may be so great as to threaten the survival of human civilization. Tipping points reduce global consumption per capita by around ... 1.4% upon 6 °C warming, based on a second-order polynomial fit of the data — Dietz et al. (1).

As Nobel laureate Solow said to Congress when criticizing economic models for failing to anticipate the "Great Recession," "Every proposition has to pass a smell test: Does it really make sense?" (2). The methods and conclusions in Dietz et al. (1) do not make sense.

Earth last experienced 6 °C warming in the Eocene epoch, \approx 40 million years ago (3). Asserting consumption would be just 1.4% lower with all tipping points breached, i.e., critical elements of the current climate destroyed—while also being much larger than today—is inconceivable, and impossible to reconcile with scientific literature (3–6).

• Damages will be far greater, & far sooner, than those who trust economists expect

Renewable Percent of Total Energy

- Reality makes a mockery of Nordhaus's "it is difficult to find major direct impacts of the projected climate changes over the next 50 to 75 years"
- "Labor without energy is a corpse, capital without energy is a sculpture"
- If When climate catastrophes from global warming force end of use of fossil fuel energy sources, GDP will plummet, since <20% of energy comes from non-fossil sources
- As usual, Neoclassicals won't see it coming...

Renewable Energy percentage of Total Energy



- Recent Neoclassical paper (Bachmann et al. 2022) predicts "economic losses from a -10% energy shock ... 1.5% of German GNE"
- 10% fall in energy causes:
 - →0.3% fall in GDP (Standard Neo);
 - →1.5% fall in GDP (Advanced Neo—using CES production function)
- Versus Post-Keynesian prediction:
 - 10% fall in energy, 10% fall in GDP...



Figure 1: Output losses following a fall in energy supply for different elasticities of substitution

cent change per yea

- Bachmann rejects Post-Keynesian/Leontief 1:1 ∆Energy → ∆GDP prediction because it conflicts with Neoclassical theory:
- "If factors markets are competitive so that factor prices equal marginal products,
- this then implies that similarly the price of energy jumps to $1/\alpha$ and the prices of other factors fall to zero"
- But data rejects Neoclassical theory:
 - ∆Energy→∆GDP Correlation=0.83
 - ⊿Energy → ⊿GDP relation IS 1:1 !



Annual Change in World Energy and GDP

Years

- Empirical data shows 1:1 relationship between Δ GDP and Δ Energy—why?
- Standard Leontief production function stated an empirical regularity:
 - $Q = u \times \frac{K}{v}$; where *u* is capacity utilization and *v* empirically-observed capital: output ratio. But what is the explanation for the regularity?
- Use $K \to K(E) = K \times E_K \times e_k$ • $O = \frac{Y}{E_K} = u \times K \times e_k$ • Output in Energy terms • Widgets/Year" • Widgets/Year"
- Empirical Leontief is $Q = u \times \frac{K}{n}$
- Energy-aware Leontief is $Q = u \times K \times e_k$
- $e_k = \frac{1}{n}$: "capital output ratio" is really "efficiency of conversion of energy into useful work"
- Linear \triangle Energy $\rightarrow \triangle$ GDP relationship: 10% fall in energy \rightarrow 10% fall in GDP

- Any model based on Leontief Production Function is inherently energy-based
- Waste generation also implicit $\rightarrow (1 e_k) \times u \times K > e_k \times u \times K$. Resource depletion/damage to capacity to produce, are easily added.





- Reality—energy and matter as well as essential inputs to production
- Hicks tried in 1935: "Wages and Interest: The Dynamic Problem"
 - Unsuccessful—paper gave us IS-LM instead! (see Hicks 1981)
 - His problem? He used a realistic consumption good (bread), which was an unrealistic investment good:
 - "the production of bread for the next market day, or in the production of bread for the more distant future (activity which, a week after, will only have resulted in the production of equipment)".
 - Stale bread as capital equipment???
- My solution (with Matheus Grasselli & Tim Garrett): imagine an unrealistic consumption good which is a realistic investment good
- Production with matter and energy on the <u>Planet of the Iron Giants</u>
 - (not yet published, but available on Patreon)

- Two inputs: matter (Iron Ore) and energy (Coal)
- One output: Iron
- Three forms of machinery: Iron Ore mining; Coal mining; Smelting and Rolling
- One form of consumption: Wage of Iron Giant workers paid in Iron
- Required 3 additions to production equation:
 - Yield of output in terms of energy input
 - Waste in matter terms ("slag") to apply Conservation of Mass to Iron Production
 - Units: Mass/Year (measured in kg) in addition to Energy/Year (Joules)

Equation	Units
$E = K_E \cdot E_E \cdot \varepsilon_E \cdot y_E$	Energy/Year
$M = K_M \cdot E_M \cdot \varepsilon_M \cdot y_M$	Mass/Year (Iron ore)
$F = K_F \cdot E_F \cdot \varepsilon_F \cdot y_F$	Mass/Year (Iron plus Slag)
$Y = \mu \cdot F$	Mass/Year (Iron)
$Y_W = (1 - \mu) \cdot F$	Mass/Year (Slag)

- Only 1st pass: yields determined by needs of factory sector rather than determined by current state of resource (Minerals→Iron Ore; Energy→Coal)
- Full model would have yield of factory sector varying in response to the state of Minerals & Energy mining sectors
- Outcome generalized Goodwin model:
- Future extensions:
 - Generalized model with multiple inputs/outputs/forms of waste
 - Financial sector a la Minsky
- Foundation for a realistic biophysical monetary model of production



Minsky

- Born of desire to enable proper dynamic modelling of money and debt
 - "Godley Tables" Inspired by Wynne Godley Stock-Flow consistent modelling

• All entries occur	Godle 🖥	ey Table : Private Banks									
7 m chances occur	File Edit	View Options Help									
twice on each row			+ ⊨→	Asset + — ← →	+ - ←→	Liability +⊢←→	Equity + ⊢←	A-L-E			
		Flows \downarrow / Stock Vars \rightarrow	Reserves 🔹	Loans 🗸	Bonds _B	Deposits	Equity _B				14.0
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Lighilition -	+ - 1 +	BOC buys bonds from NBFIs	Buy _{CB} NBFIs			Buy _{CB} NBFIs					
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Equity	+ - 1 +	Bank spending				Spend _{Banks}	-Spend _E				
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	4								I Contraction of the second se		

- Brilliantly programmed by my long-term friend and research collaborator <u>Dr Russell</u> <u>Standish</u> (just 38,000 tightly coded lines of OO [Object-Oriented] C++)
- Could not have been developed as well—or maybe at all—without him...

Minsky

- Interlocking Double-entry Bookkeeping tables yields
 Octuple-entry accounting
 - All entries occur at least 4, and up to 8 times...
- Enables easy modelling of actual monetary dynamics
- Exposes myths like "Money Multiplier", etc.



	Private Banks									
		Asset		Liability	Equity	A-L-I				
Flows \downarrow / Stock Vars \rightarrow	Reserves	Loans 🔻	Bonds _B	Deposits 🔹 🔻	Equity _{Banks} ▼	0				
Initial Conditions	266248	5651020	4129	4286520	1634877	0				
Net lending		Credit		Credit		0				
Interest on bank loans				-Int _{Loans}	Int _{Loans}	0				
Net government spending	Deficit			Deficit		0				
Bond sales to Banks	-Sell _{Banks}		Sell _{Banks}			0				
Bank Bond Sales to NBFIs			-Sell _{NBFIs}	-Sell _{NBFIs}		0				
BOC buys bonds from Bank	s Buy _{CB} Banks		-Buy _{CB} Banks	1		0				
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Bond interest to Banks	Int _{Bonds} Banks				Int _{Bonds} Banks	0				
Bond interest to NBFIs	Int _{Bonds} NBFIs			Int _{Bonds} NBFIs		0				
Bank spending				$Spend_{Banks}$	-Spend _{Banks}	0				
QE with Banks	QE_{Banks}		-QE _{Banks}			0				
QE with NBFIs	QE _{NBFIs}			QE_{NBFIs}		0				

				С	'enti	ral Ban	k				
		Asset				Liabil	ity			Equity	A-L-E
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Bond sales to Banks				-Sell _{Banks}				Sell _{Bank}	:s		0
Bond interest to Banks				Int _{Bonds} Banks				-Int _{Bonds} Banks			0
Bond interest to NBFIs		Int _{Bonds} ¹		Int _{Bonds} N	BFIs			-Int _{Bonc}	ls ^{NBFIs}		0
Central Bank Bond purc	hases	Buy _{CB} Bar	ıks	Buy _{CB} Bar	ıks						0
BOC buys bonds from N	BFIs	Buy _{CB} NB.	FIs	Buy _{CB} NB.	FIs						0
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BOC buys bonds from NBFIs			Βι	19CB ^{NBFIs}			-Bu	<i>YCB^{NBF1}</i>	s		0
Net government spending	-Defi	cit							-Defi	cit	0
Bond interest to Banks	-Int _B	onds ^{Banks}							-Int _B	onds ^{Banks}	0
Bond interest to NBFIs	-Int _B	onds ^{NBF1s}			~ 1		0.1		-Int _B	onds ^{NBFIs}	0
Bank Bond Sales to NBFIs					-Sel	NBFIs	Sell	NBFIs			0
QE with Banks			QI	E _{Banks}	-QE	Banks	~ ~				0
QE with NBFIs			QI	E _{NBFIs}			-QI	NBFIs			0
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		Asset		Liability	Equity	A-L-E
Flows ↓ / Stock Vars →	Deposits 🔹 🔻	Cash _{Public}	Bonds _{NB}	Loans 🔻	Equity _{Public} 🔻	0
Initial Conditions	4286520	115006	2505000	5651020	1255506	0
Net lending	Credit			Credit		0
Interest on bank loans	-Int _{Loans}			_	-Int _{Loans}	0
Net government spending	Deficit				Deficit	0
Bank Bond Sales to NBFIs	-Sell _{NBFIs}		Sell _{NBFIs}			0
Bond interest to NBFIs	Int _{Bonds} NBFIs				Int _{Bonds} NBFIs	0
BOC buys bonds from NBFIs	Buy _{CB} NBFIs		-Buy _{CB} NBFIs			0
Bank spending	Spend _{Banks}				Spend _{Banks}	0
QE with NBFIs	QE _{NBFIs}		-QE _{NBFIs}			0

<u>Minsky</u>

- One of many "system dynamics" programs (Stella, Ithink, Vensim, Simulink)
- Cheaper than most (free). Manuals at http://www.profstevekeen.com/Minsky
- Many other innovations:
 - Equations on canvas rather than behind text boxes
 - Pass data by variable name as well as by wire—far less clutter
 - Direct generation of $L^{A}T_{E}X$ equations for documentation
 - Live simulation with ability to vary parameters (& even the model) during a run
- One crucial omission
 - **Deliberately** does not support "periods"—Difference equations, "period analysis"
 - Periods are the crack cocaine of the economist
 - "Friends don't let friends use periods"
- Capable now of extremely sophisticated modelling...



- Minsky's chief "evangelist" is Tyrone Keynes (YouTube Channel Modelling with Minsky)
 - Beautiful models of everything from the pandemic to Limits to Growth...



Introducing **Ravel**[©]

- Funding for non-mainstream economics is woeful
 - Government funding bodies controlled by Neoclassical economists
- My long-term solution: fund my research by selling data analysis program Ravel[®]
- To be distributed soon to my supporters:
 - Patreon:
 - https://www.patreon.com/ProfSteveKeen
 - •Substack:

•https://profstevekeen.substack.com/



Debt_{BIS}





GDP growth rate calculation



Thank you...

- Thank you to the Friede Gard Foundation for the recognition and support
- Time is of the essence
- Neoclassical economics may destroy capitalism—via climate change trivialization and monetary idiocy—before complex biophysical economics is fully developed
- I conclude with a prescient quote from mathematician John Blatt from in 1983:
 - "At present, the state of our dynamic economics is more akin to a crawl than to a walk, to say nothing of a run.
 - Indeed, some may think that capitalism as a social system may disappear before its dynamics are understood by economists." (Blatt 1983, Dynamic Economic Systems, p. 5)
- I look forward to seeing (some of) you at the workshops tomorrow and Saturday...

To keep in touch with and support my work, join Patreon: https://www.patreon.com/ProfSteveKeen or Substack: https://profstevekeen.substack.com/

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Award Ceremony to Prof. Steve Keen, PhD Laudation (Prof. Dr. Michael Roos)





Friede-Gard Award to Steve Keen

Birkenfeld | 13 October 2022

Prof. Dr. Michael Roos





Neoclassical economics

Stable world in general equilibrium

Economy as an isolated system

Michael Roos | Birkenfeld | 13 October 2022

Limits to growth



Michael Roos | Birkenfeld | 13 October 2022

Climate economics

William D. Nordhaus Facts



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William D. Nordhaus The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2018

Born: 31 May 1941, Albuquerque, NM, USA

Affiliation at the time of the award: Yale University, New Haven, CT, USA

Prize motivation: "for integrating climate change into longrun macroeconomic analysis."



Prize share: 1/2

Michael Roos | Birkenfeld | 13 October 2022



Tue 11 Jul 2017 06.00 BST



How economics became a religion

Its moral code promises salvation, its high priests uphold their orthodoxy. But perhaps too many of its doctrines are taken on faith. By John Rapley by John Rapley



Michael Roos | Birkenfeld | 13 October 2022

Conclusion – Gerd Schuster

Chairman Friede-Gard-Stiftung





System. Dynamics. Economics A look back & aside & ahead

Gerd Schuster

for FGP 2022 ceremony at UCB (oct 13th)



Overview

- A look back:
 - Jay Forrester & System Dynamics
 - Meadows & ,The Limits to Growth'
 - Hartmut Bossel & ,System Design'
- A look aside:
 - Biology: Cell -> Organism -> Ecosystem
 - Medicine: Brain // Pathology Diagnosis Therapy
 - Computer science: object orientation & hierarchies
- A look ahead:
 - Mainstream Economics: Equilibrium & Optimization
 - ,New Economics': Dynamics & Complexity
 - Challenges: ,Green Growth' vs. ,Green Shrinking'



Forrester & System Dynamics

- Jay Forrester (1918 2016)
 - ,Father' of System Dynamics
 - 1958 Industrial Dynamics ... 1971 World Dynamics
- System Dynamics
 - Broadly adopted in many sciences, e.g. climate science
 - Systems View + Dynamics, e.g. causal loop diagram





Meadows & ,Limits to Growth'

- Dennis (*1942) & Donella Meadows (1941-2001)
 - -, Master Minds' of the , Limits to Growth' Series
 - Reports to the Club of Rome 1972, 1992, 2004, 2012
- ,World 3' System Dynamics Model of Growth
 - Growth of population, ,nature use' & world economy
 - Prices & monetary side missing
 - Model equations & other details in 1974 ,Technical report' ,The Dynamics of Growth in a Finite World"
- ,Killed' by Nordhaus & followers



,Limits to Growth'-World3

• Subsystems: Population, Capital, Agriculture, Resources, Pollution





System Design'

- Hartmut Bossel (* 1935)
 - -, Master Mind' of System Dynamics in Germany
 - Pioneer of Ecological
 System Dynamics
 - ,Energiewende' pioneer
- Fundamental properties of environment
 & basic Orientors
 [Bossel 1994, p.244]





Conclusion ,anticipated'

• Complexity

- Issue in many scientific fields differently advanced
- Worthwhile to look for analogies, transferability of methods & results
- System Control ... ,System Design'
 - Task of influencing the behavior of a system common to many scientific fields – differently advanced
 - Worthwhile to look for analogies, transferability of methods & results
- -> Every expert in such a scientific field is potential contributor to progress in economics



Cell -> Organism -> Ecosystem

- Cell
 - ,Biochemical Pathways': some ten-thousand reactions
 - Fine structures for specific purposes (organelles)
 - Regulation: nested negative feedback structures (energy & information)
- Organism
 - ,System' made of organs
 - Regulation: neuro-psycho-immuno-endocrinological
- Ecosystem
 - Many species with competition, cooperation, synergism
 - Food chains ... ,web of life'
 - Regulation: self-organization



Biochemical Pathways

1970's
 Citric Acid Cycle
 in the centre

2010's
 Citric Acid
 Cycle
 small spot
 in centre
 only





Brain

- Neurons
 - Special cells ... electric abilities
 - Ability to connect to very many other neurons
 - Ability to built new connections (synapses) learning
- Neural networks
 - Neuron ... {synapse} ... Neuron
 - Coupling ... Synchronization
 - Information ... Pattern Formation ... Pattern Recognition
 - Learning ... Adaptation
 - Regulation: (thought/ will/ mind) much to be discovered



Medicine

- Pathology ... Pathophysiology
 - Search for causal (material) roots of disease
 - Complex, e.g. 3 mechanisms for Long COVID discussed
 - Basis for ,rational treatment' of disease
- Diagnosis
 - Pattern recognition task thousands of patterns known
 - Complex: patterns often overlapping & new emerge
- Therapy
 - Sometimes causal, often symptomatic
 - Alternative ,non-School-Medicine' approaches compete



Computer Science

- ,Cell'
 - Single computer (with hardware & software)
 - Hardware architectures (similar to organelles of cell)
 - Regulation: (hierarchies) of software programs
 - Software: object-orientation (,network' of objects)
- Computer networks
 - Computer... {interface} ... Computer
 - Coupling ... Synchronization
 - Adaptation ... Machine Learning
 - Regulation: interface protocols ... system administrators



Mainstream Economics (1)

- Equilibrium
 - automatic balance of demand & supply (and whole economy)
 - Destabilization only by external shocks (but equil. is restored)
- Optimization (Maximization)/ Optimality
 - Profit maximization/ utility maximization
 - Optimal growth path
 - Rational expectations ... perfect foresight
- Critique from ,reality'
 - Prices only ,work' if ,they tell the truth' (no externalities)
 - No one ,likes' perfect markets (zero profit), everyone wants to get rid of it (via marketing & lobbying to oligopoly/ monopoly)



Mainstream Economics (2)

- Energy ... Material Resources .. ,Nature'
 - No issue, since there is plenty of everything
 - If scarcity would arise, substitution solves issue
- Climate Change ... Pollution
 - No issue, since damages to ,Nature' & ,Climate' today can be easily ,repaired' in future by capital generated in meantime
 - Impact on economy & civilization is ,peanuts'
 - All problems solvable by ,technological progress'/ innovations
- Political Impact
 - ,Monopoly' in teaching, research & political counselling
 - dissenting opinions suppressed



,New Economics'

- Dynamics
 - ,cells': firms, households, economic agents,
 - ,regulation': markets/ prices, ... rationing
- Complexity
 - From 3 dimensions on chaos possible (e.g. Lorenz-system with strange attractor – i.e. no fix points, no ,equilibrium')
 - Synergetics, Phase transitions/ Tipping points





Steve Keen's ,New Economics'

• Model genealogy





Keen's Goodwin-model

- ,Ingredients'
 - Employment rate λ
 - Wage share ω (of whole income)(other ,half' is profit)
- Dynamics



- high λ -> higher wages -> higher ω -> lower profits -> less investment ->lower λ -> higher profits -> more investment
- Structure as Lotka-Volterra-model (predator & prey)
- System is stable (limit cycle)



Keen's Minsky-model

• ,Ingredients'

- Employment rate λ , Wage share ω (as in Goodwin-model)
- (Private) debt ratio dr (monetary side of economy)
- Dynamics



- Structure similar to Lorenz-attractor
- System is possibly chaotic (strange attractor)



Steve Keen's ,New Economics'

- Goodwin-model
 - Endogenous business cycles (no external shock needed)
- Keen-Minsky-model
 - Inherent financial instability of monetary economy (no automatic equilibrium, => constraints on economy needed (external order))
- Goodwin- model with energy & matter
 - Handling of energy & matter determines shape of limit cycle (can be more or less ,user-friendly')
 - First step ,only', but sound basis to build on
 - Some next steps clear
 - Further , mega-hours' of work needed (as e.g. in biochemistry)

F G S FRIEDE-STIFTUNG

,Green Growth' vs. ,Green Shrinking'

- ,Green Growth' (could be unrealistic)
 - Decoupling (further growth with less material resources)
 - Abundance of renewable energy expected
 - Cave: ,heat death' in some hundred years [Murphy 2021]
- ,Green Shrinking' (prob. needed (living within planetary limits)
 - top 1%: 118 to CO², lowest 5 %; 5,4 to CO² (D 2021) planetary limit approx.1 to CO² (similar for whole ,Western Sphere')
 - Renewable energies remain expensive
 - Rebound effect
 - Consequence: ,war economy' (British Empire 1939ff)
 - Rationing same share for everybody (instead of: everybody according to what (s)he can pay or force)



Some ,wishful thinking'

• In economics

- quickly develop alternatives to neoclassical mainstream economics (attract researchers, spend money)
- Within alternative approaches
 - Cooperation & bundling of resources... master plan
 - Unite to build better alternative fast
 - ,Self-Marketing' to gain resources
- In politics
 - Debate & consensus on technological, economic and behavioral changes needed to save our civilization
 - Prerequisite: accept the truth about the critical situation (technological progress alone will not fix it)



That's it(High) Time to act!





https://www.lukaskoehler.de/GoodNewsSunday

Thank you for your understanding !

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