



Long Finance & UCL Autumn Conference 2012

"When would we know our financial system is working?"

“Measures Beyond Money”

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Welcome

Professor Malcolm Grant

**President and Provost,
University College London**



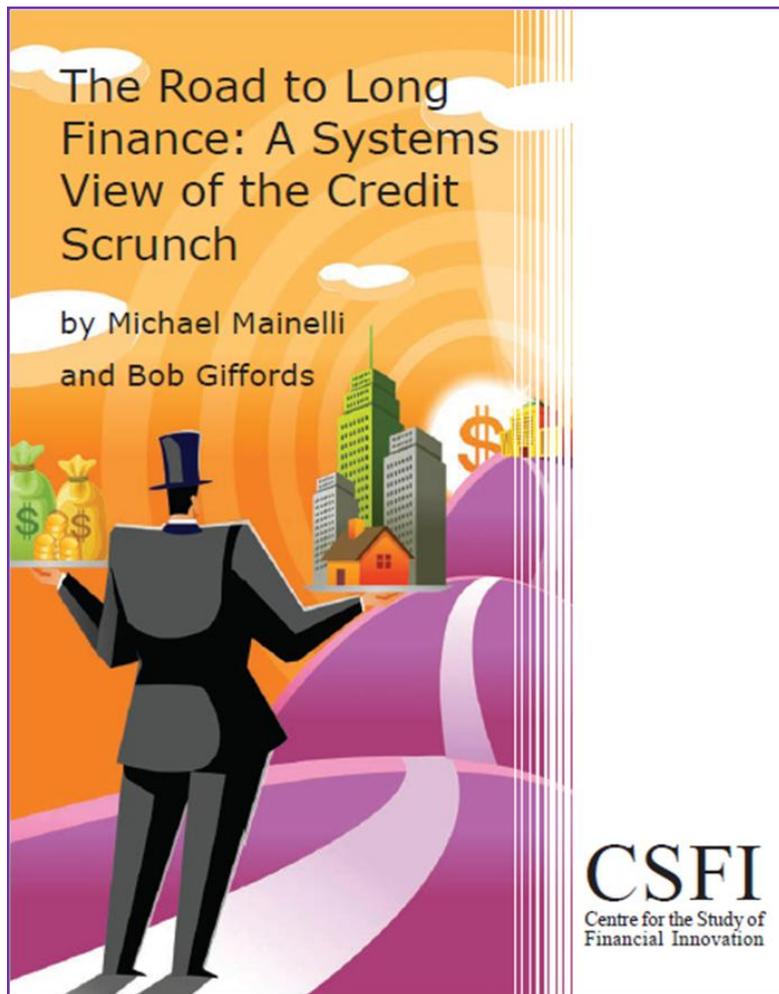
Introduction

Professor Michael Mainelli

Chairman, Z/Yen Group

Principal Advisor, Long Finance

About Long Finance



'When would we know our financial system is working?'

Objectives:

- ◆ Expand Frontiers
- ◆ Change Systems
- ◆ Deliver Services
- ◆ Build Communities

Programmes:

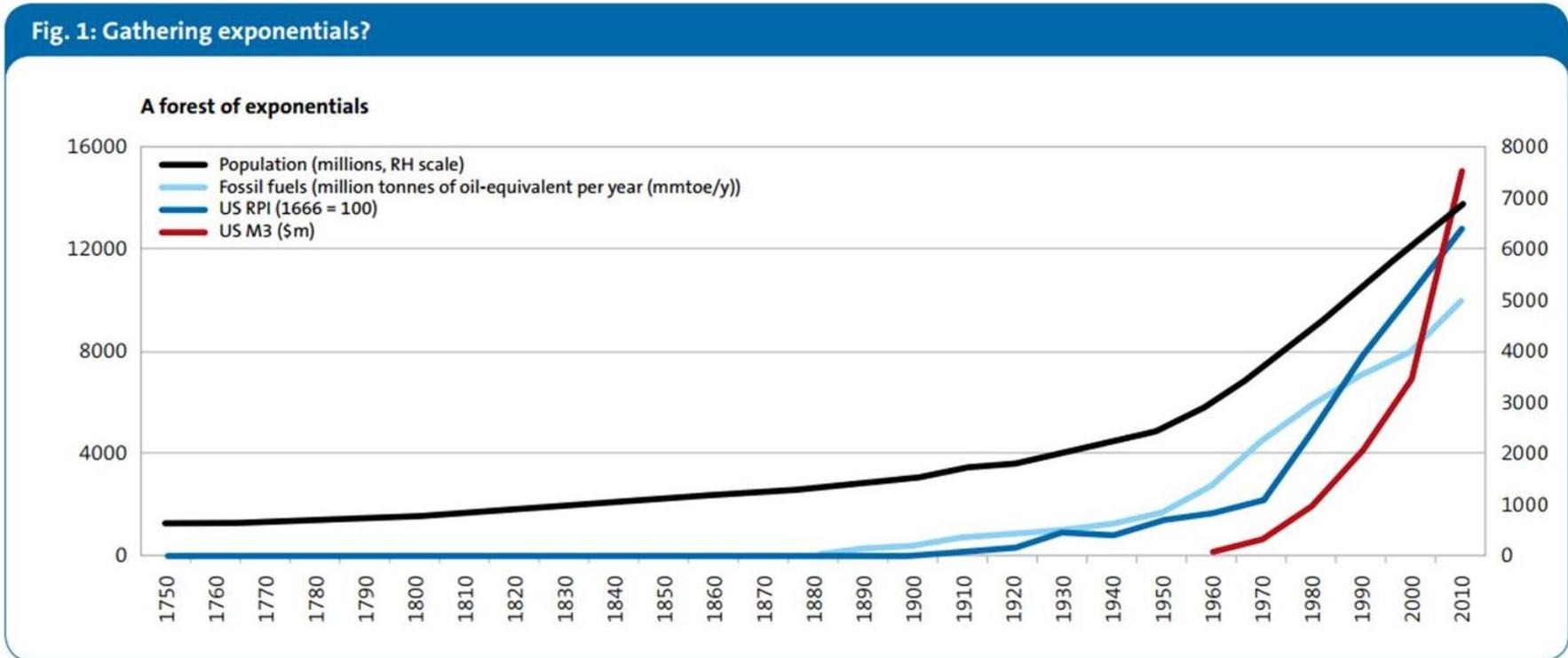
- ◆ London Accord
- ◆ Financial Centre Futures
- ◆ Meta-Commerce
- ◆ Eternal Coin

Dangerous Exponentials

“The biggest shortcoming of the human race is our inability to understand the exponential function.”

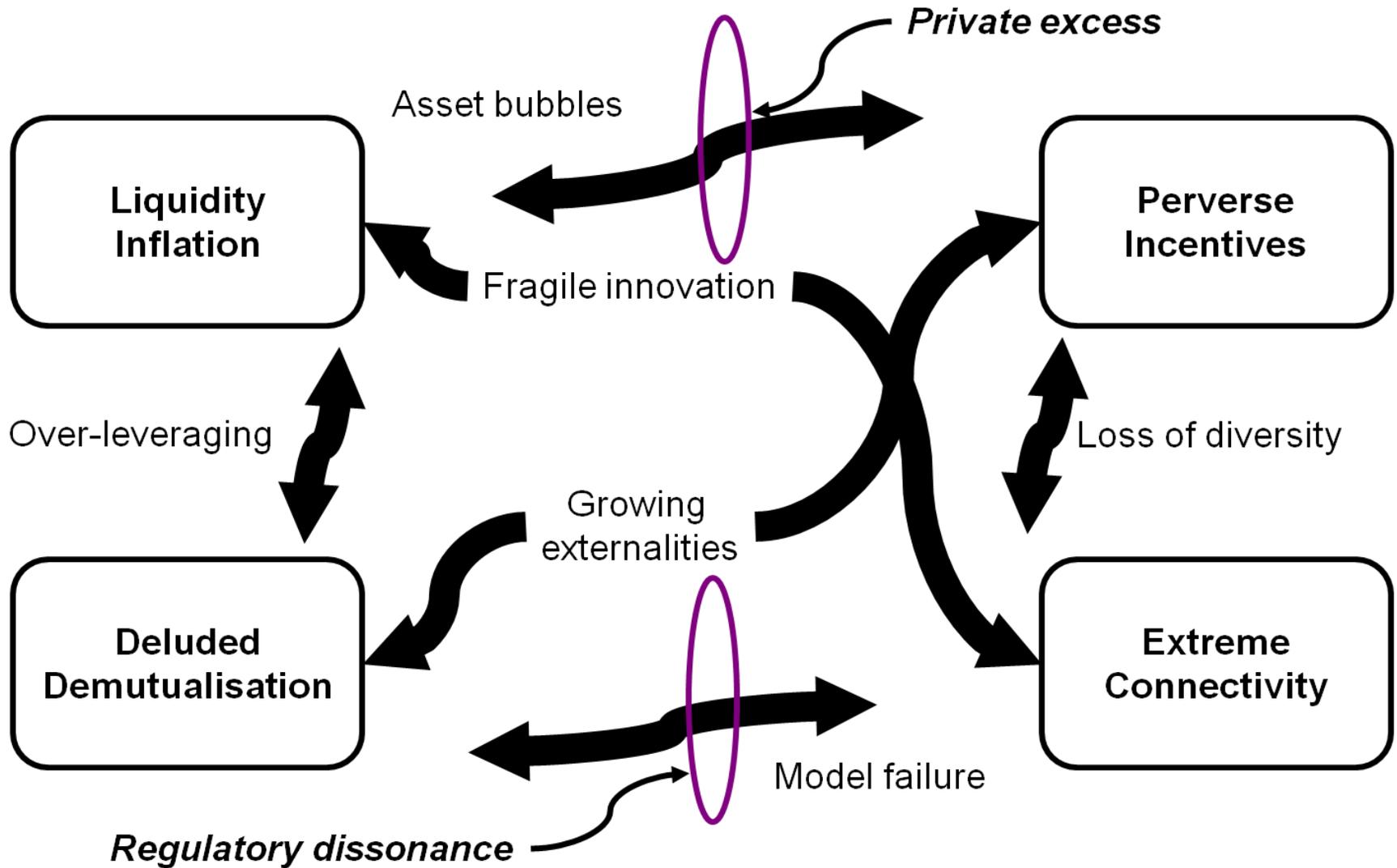
Professor Al Bartlett, University of Colorado

Fig. 1: Gathering exponentials?



[source: Dr Tim Morgan, *Dangerous Exponentials*, Tullett Prebon (June 2010)]

Value?

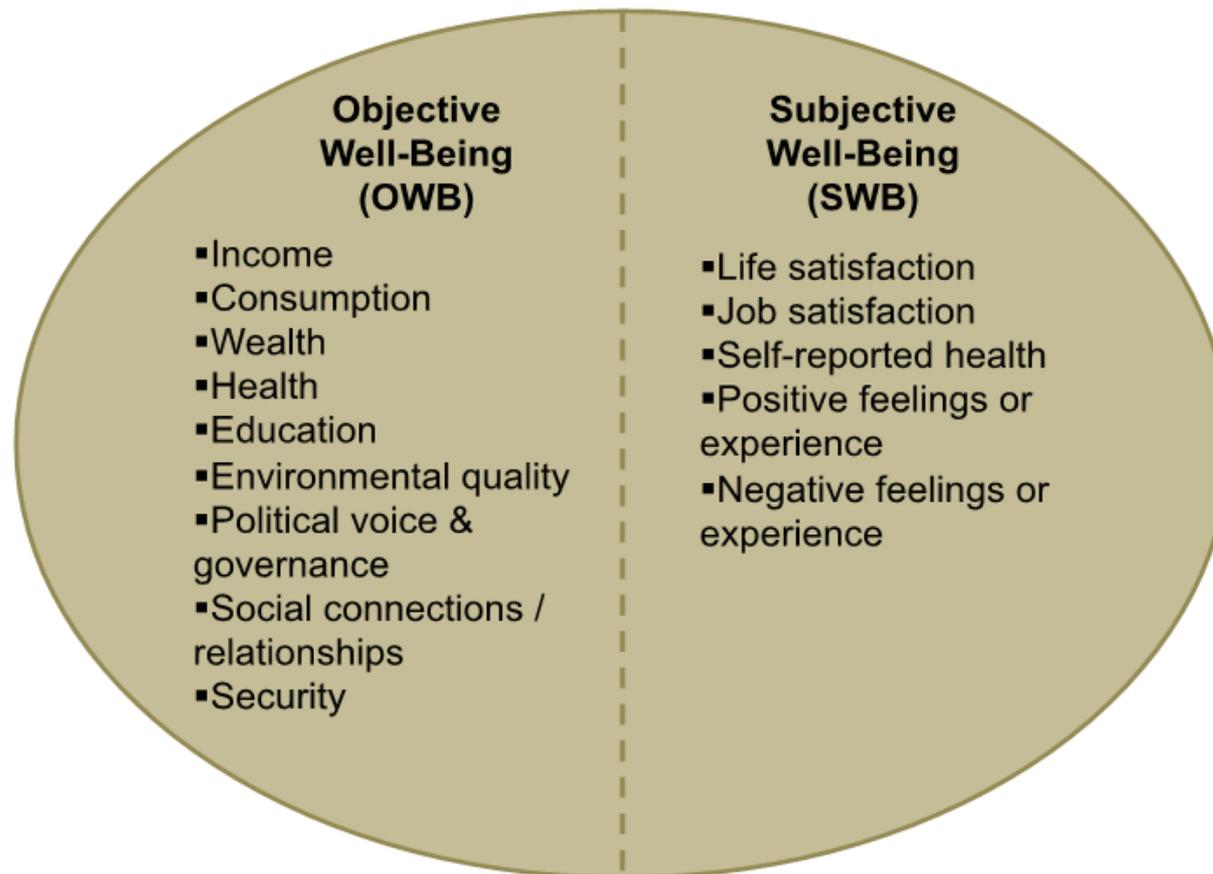


GDP

Robert F. Kennedy, 1968

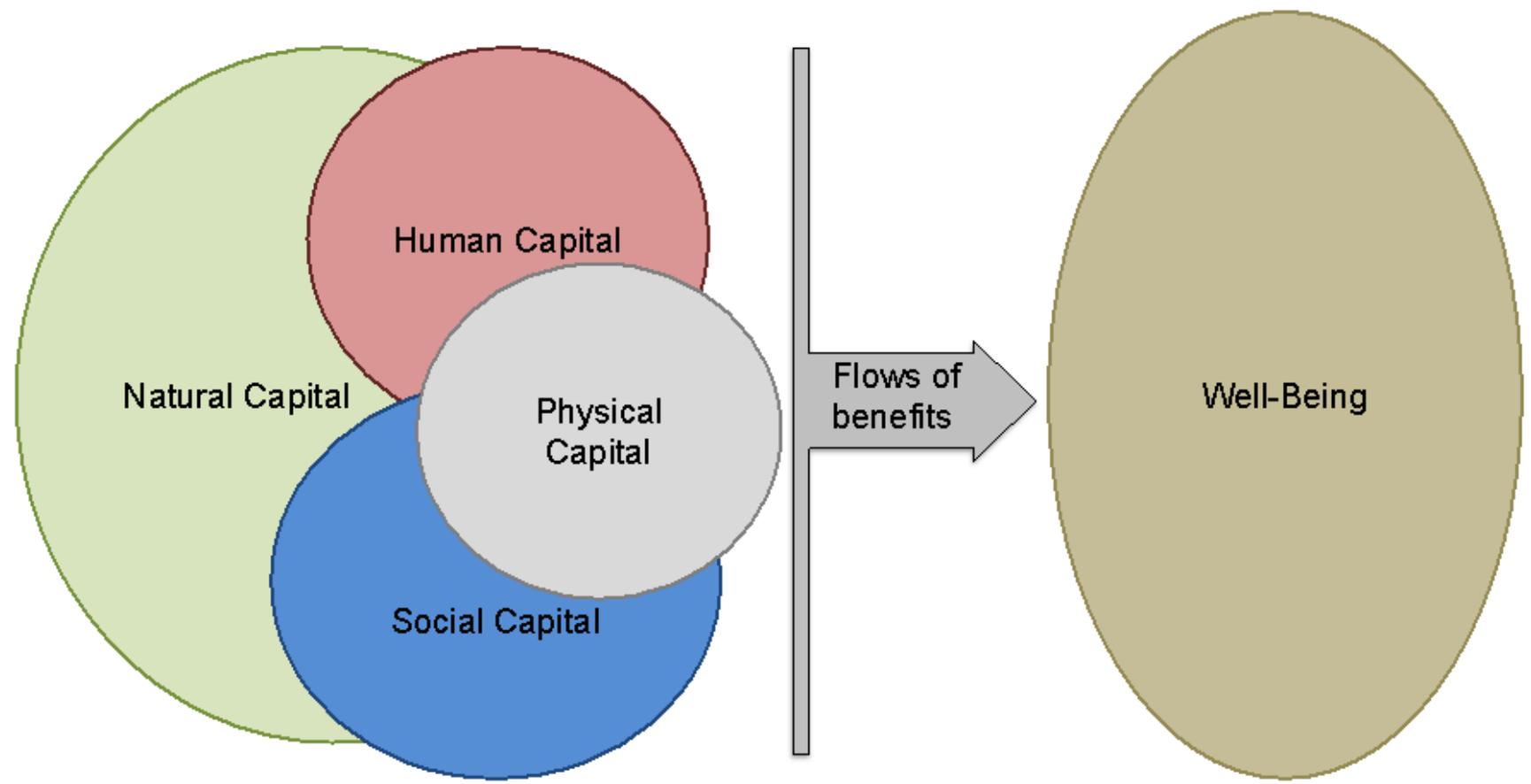
"Yet the gross national product does not allow for the health of our children, the quality of their education, or the joy of their play. It does not include the beauty of our poetry or the strength of our marriages; the intelligence of our public debate or the integrity of our public officials. It measures neither our wit nor our courage; neither our wisdom nor our learning; neither our compassion nor our devotion to our country; it measures everything, in short, except that which makes life worthwhile."

Objective & Subjective



[source: adapted from Stiglitz E., Sen A., Fitoussi J.P. *et al*, "Report by the Commission on the Measurement of Economic Performance and Social Progress" (2009)]

Capital Stock Model & Well-Being



Rio +20

Article 111 of the zero draft for Rio +20

111. We also recognize the limitations of GDP as a measure of well-being. We agree to further develop and strengthen indicators complementing GDP that integrate economic, social and environmental dimensions in a balanced manner. We request the Secretary-General to establish a process in consultation with the UN system and other relevant organizations.

Agenda

- | | |
|----------------------|---|
| 14:30 – 14:35 | Welcome |
| 14:35 – 14:40 | Introduction |
| 14:45 – 15:15 | Keynote: “Energy & Emergy – Measuring Well-Being Among Nations” – Denis White, Oregon State University |
| 15:15 – 16:00 | Panel: “Beyond GDP: Measures of Growth and Well-Being” |
| 16:00 – 16:20 | Break |
| 16:20 – 16:40 | Presentation: “Green Growth: the What, Why and How”
– Professor Paul Ekins, UCL Energy Institute |
| 16:40 – 17:25 | Panel: “Green Growth: The Grand Policy Challenge and the Role of Science” |
| 17:25 – 17:30 | Close |
| 17:30 – 18:30 | Reception |



Keynote Address

“Energy & Emergy – Measuring Well-Being Among Nations”

**Denis White,
Oregon State University**

Energy & Emergy – Measuring Well-Being Among Nations

Denis White

white@onid.orst.edu

Long Finance Conference

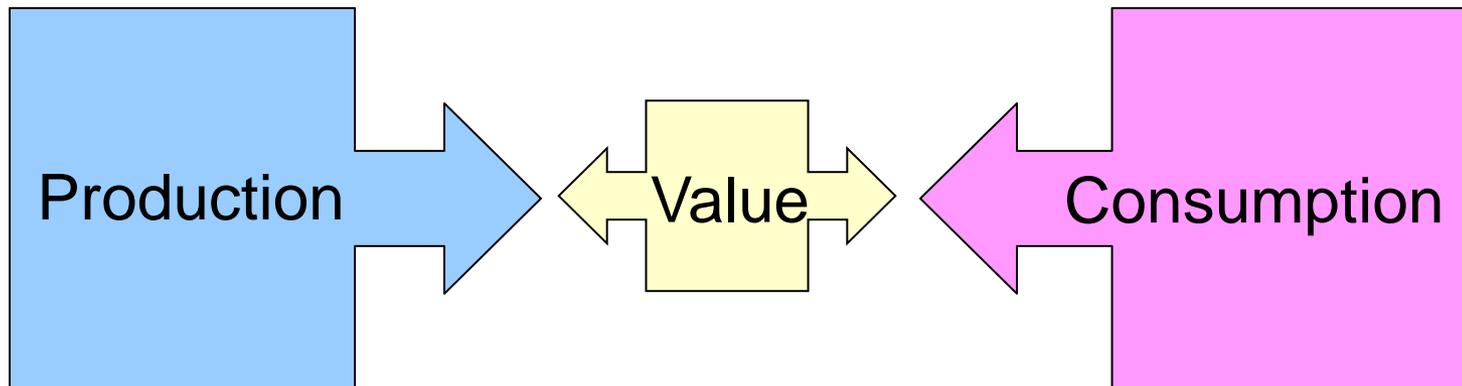
14 November 2012

With credits to Dan Campbell and Mark Brown

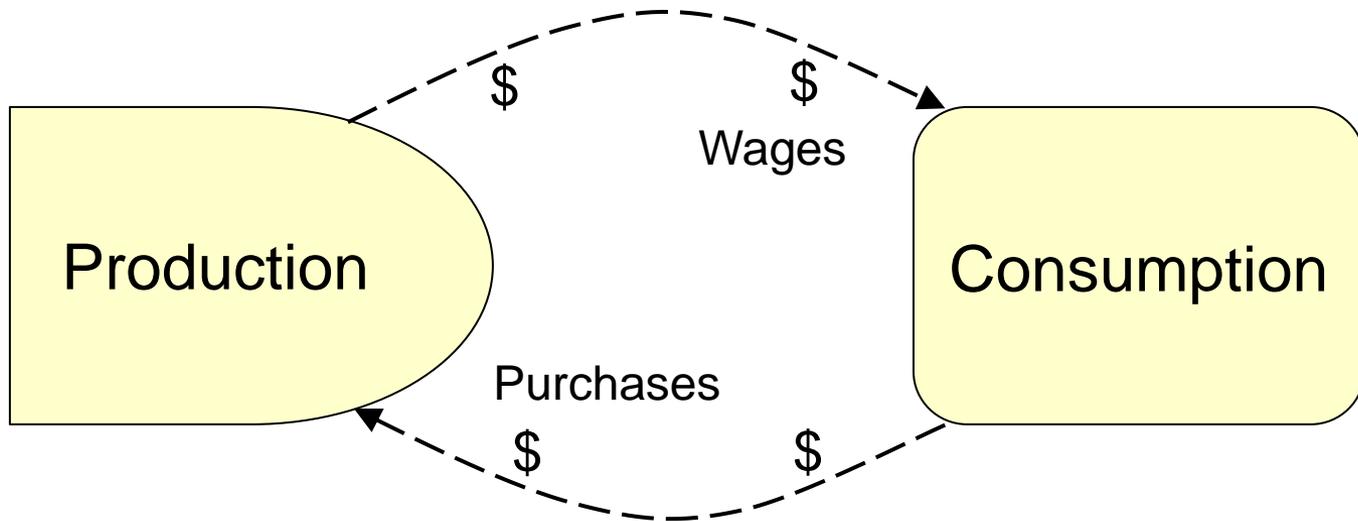
Two kinds of value

1. Value is based on what something contains, “donor-based”

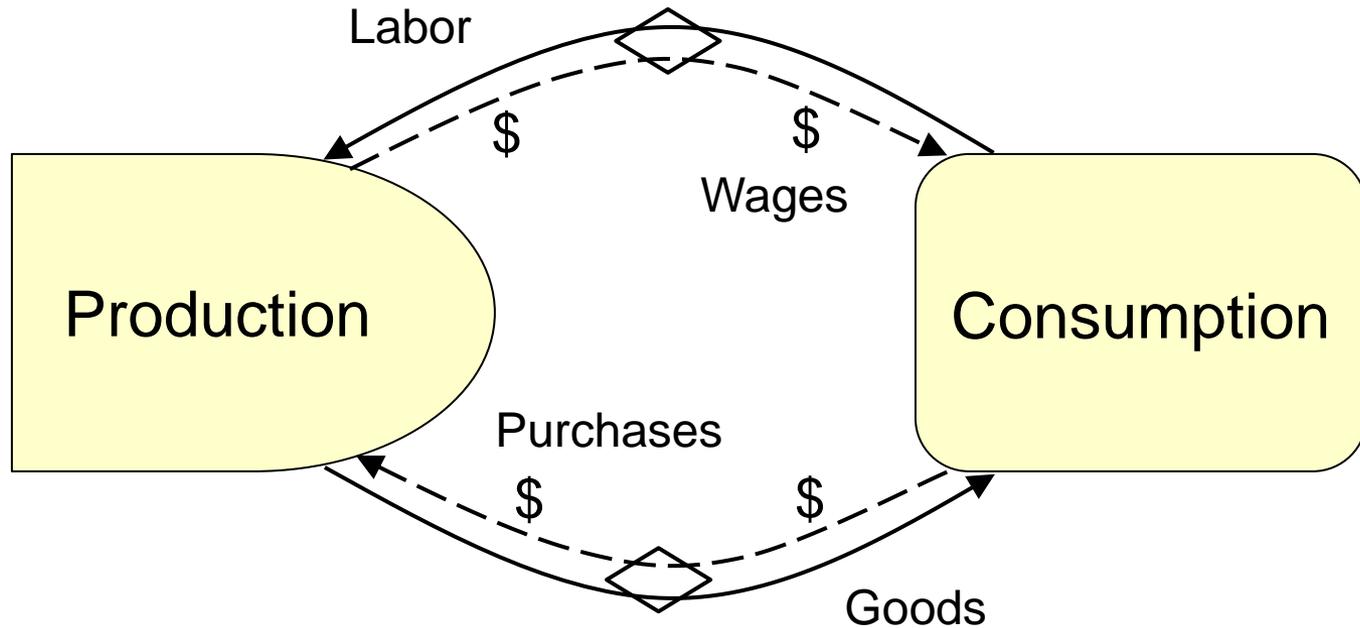
2. Value is based on how much something is desired, “receiver-based”



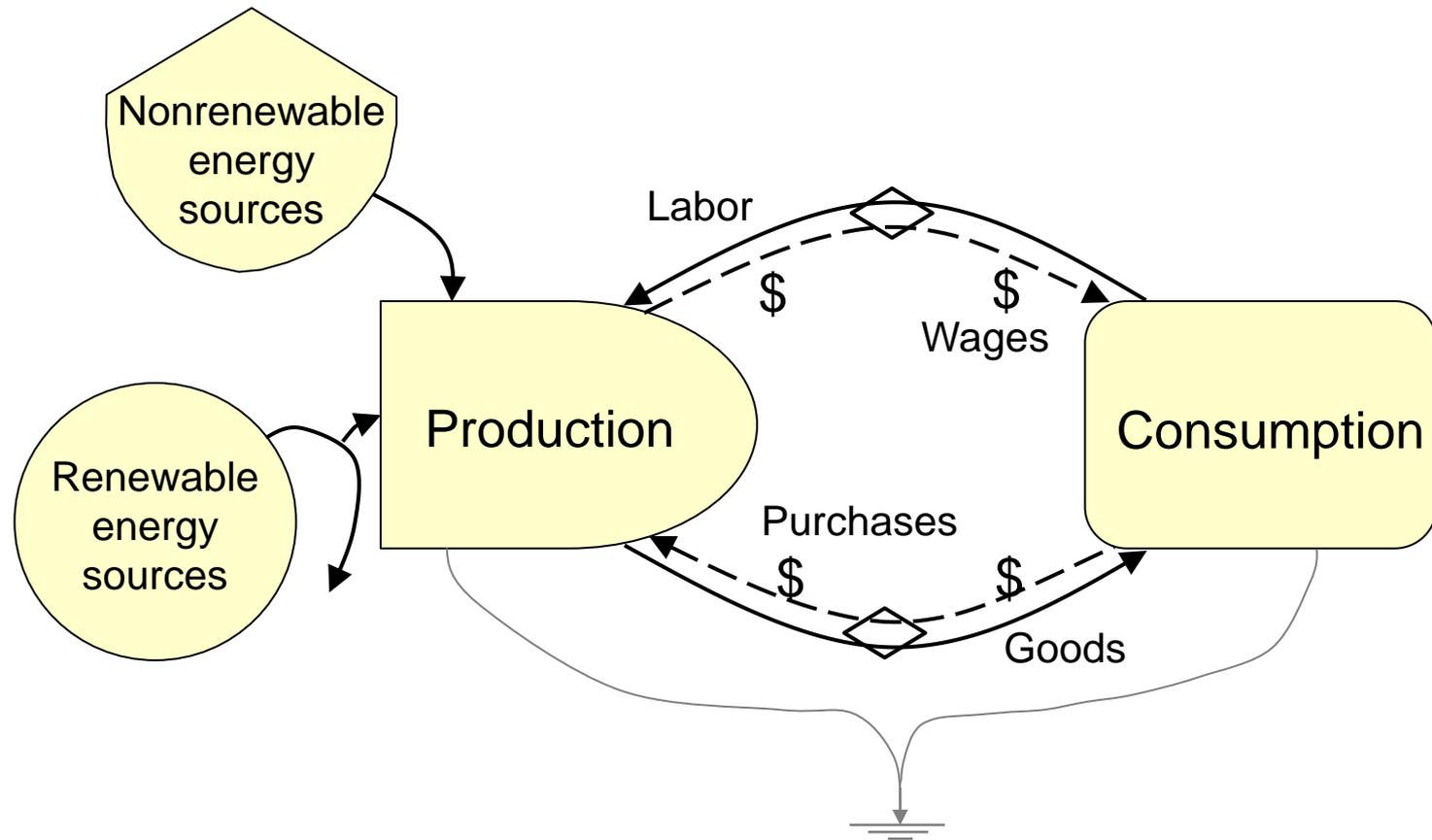
Simple economic model



Value is transferred back



The environment supplies value



An alternative value system

- All action is accompanied by the transformation of available energy
- The available energy used in the past to create a good or service is a measure of what was required to produce that good or service
- But available energy of different kinds has different ability to do work when used in a network

What is emergy?

- **Emergy** is the available energy of one kind previously used both directly and indirectly to make another form of energy, product or service
- Emergy can be thought of as energy memory
- Most studies use solar energy as the starting point. The units of emergy are then solar emjoules.

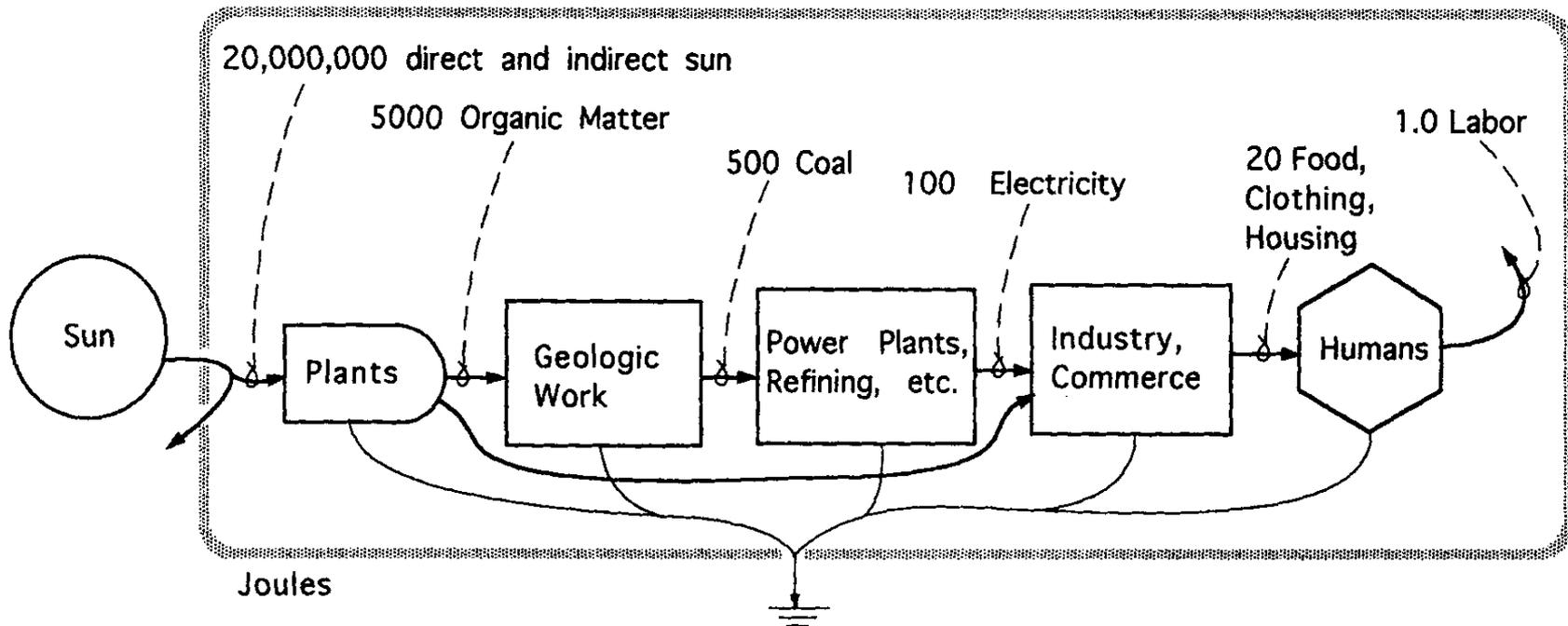
What is the basis for emergy?

- Based on the laws of physics and thermodynamics
- Derived from energy systems principles
- All goods, services and information (either environmental, economic or cultural) are put into a common unit of measure

Energy quality

- Sunlight \neq Wind \neq Fuels \neq Electricity
- Calories of one form of energy are not necessarily equal to calories of another form in their ability to cause work
- Energy quality is related to
 - Concentration
 - Flexibility
 - Ease of transportation
 - Convertibility

Hierarchy of energy transformations



A contemporary energy chain to provision humans

Transformities

- The energy along any pathway can be quantified
- The ratio of total energy coming into the system to the energy leaving any component is a useful number known as the energy per unit ratio
- If the unit is available energy, the ratio is called a transformity

Transformities (typical)

Sources, goods, and services	Solar Emcalories per calorie
Sunlight energy	1
Wind energy	1,500
Organic matter, wood, soil	4,400
Potential of elevated rainwater	10,000
Chemical energy of rainwater	18,000
Mechanical energy	20,000
Large river energy	40,000
Fossil fuels	50,000
Foods	100,000
Electric power	170,000
Protein foods	1,000,000
Human services	100,000,000
Information	1×10^{11}
Species formation	1×10^{15}

Market price, standard of living

- When environmental resources are abundant, little work is required to obtain them, costs are small and prices are low
- Net contributions to the economy are greatest then, there are abundant resources and standard of living is high
- When resources are scarce, costs are higher, supply is low and prices are higher
- Then real wealth is scarce and standard of living is low

Market price, real wealth

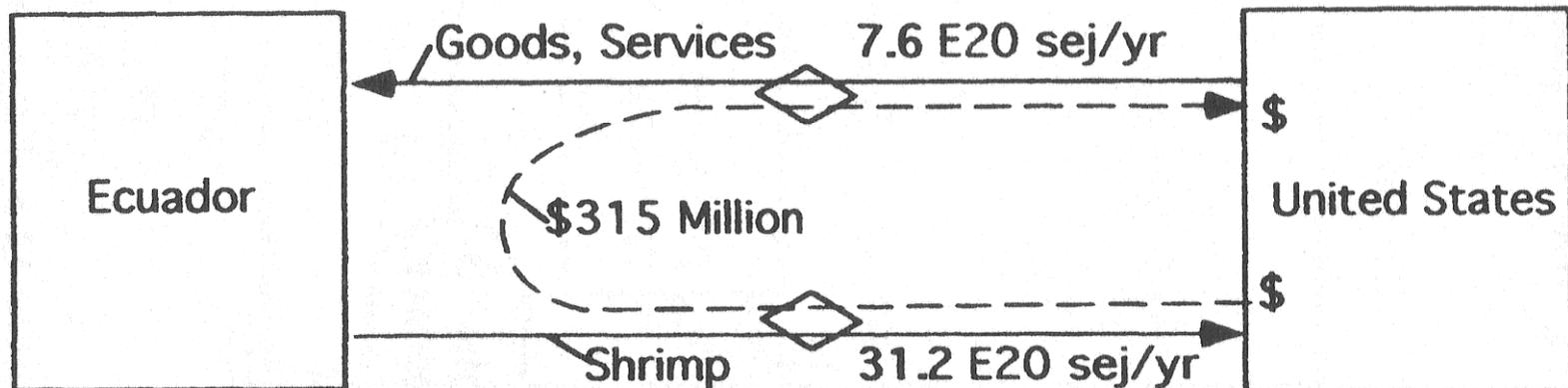
- Thus, market prices are inverse to the real wealth contributions of the environment
- Note also that money is paid only to people for their work, not to the environment
- Market prices also do not value impacts on the environment, which become liabilities on a balance sheet

Balance sheet

Description	Data	Unit	Emergy/Unit sej/unit	Emergy x 10 ²⁰ sej
Assets				
Forest biomass	1.04x10 ¹⁹	Joules	28,200	2,933
Coal	1.42x10 ²¹	Joules	39,200	556,640
Knowledge of People	1,816,000	Individuals	Various	4,498
Buildings	4.45x10 ⁹	\$	1.08x10 ¹²	481
Accumulated Depreciation	18x10 ⁹	\$	1.08x10 ¹²	(194)
Total Assets				564,358
Liabilities				
Extraction Damage	1.25x10 ¹⁹	Joules	Average, 1.0x10 ⁵	17,400
Bonds Outstanding	3.956x10 ⁹	\$	1.08x10 ¹²	43
Public and private equity				
Built Capital	22.5x10 ⁹	\$	1.08x10 ¹²	244
Natural Capital	1.43x10 ²¹	Various	Various	542,173
Human Capital	1,816,000	Individuals	Various	4,498
Total Liabilities + Equity				564,358

International trade

- Emergy analysis can reveal imbalances in international trade
- Assume all income from shrimp production in Ecuador was spent on goods and services from the US (1991 data)
- Ecuador exported $31.2/7.6 \approx 4.1$ times more emergy than it received from the US

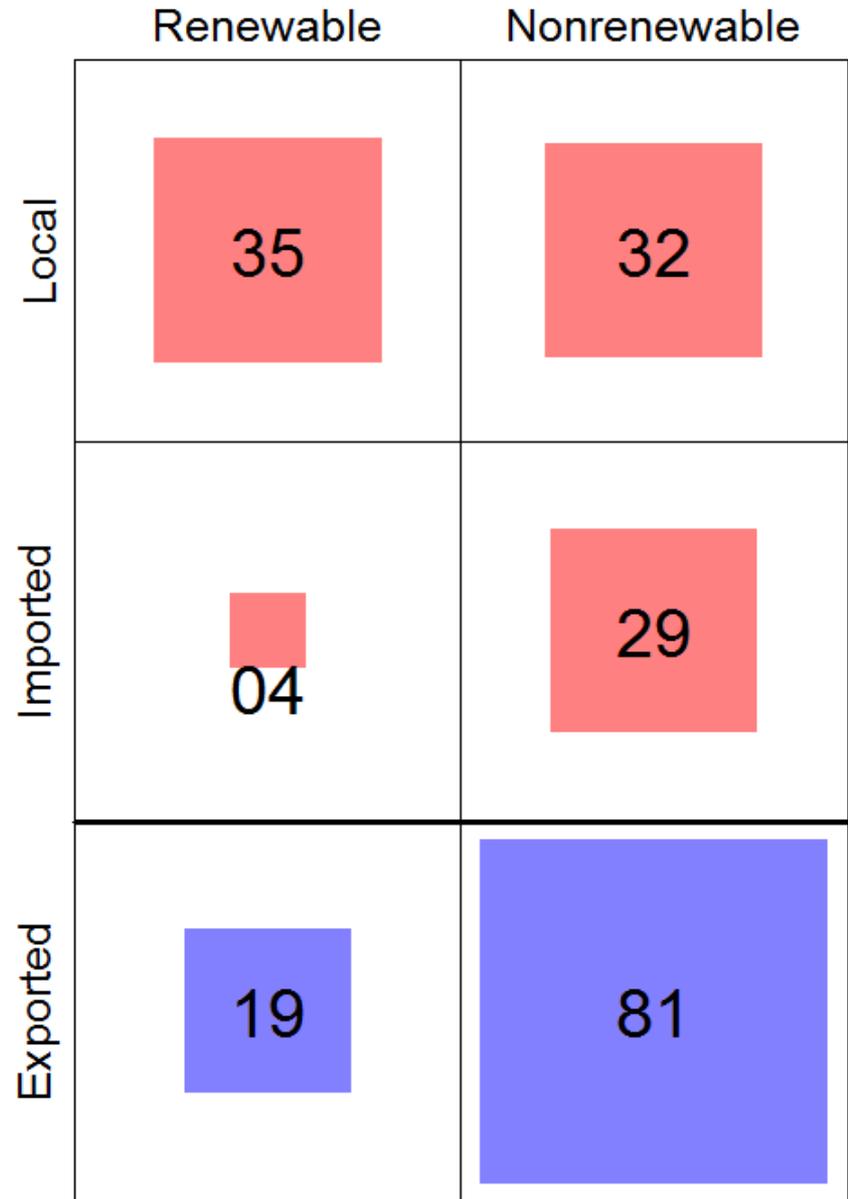


Emprint of emergy

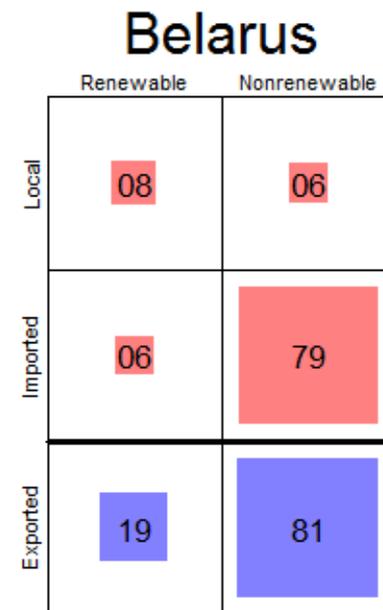
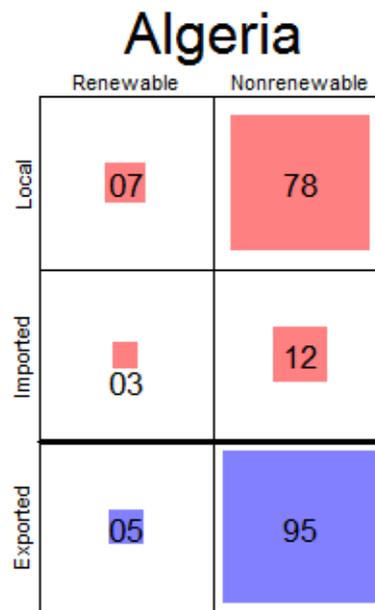
- 3x2 matrix with columns for renewable and nonrenewable emergy and rows for local, imported, and exported emergy
- Based on the emergy budget for a fixed time (one year) for a well defined system (a nation, or group of nations for example)
- Snapshot of system inflows and outflows that shows the relative sustainability and self-sufficiency of a system at any given point in time

Emprint of all Countries

Mean Emprint for 163 Countries

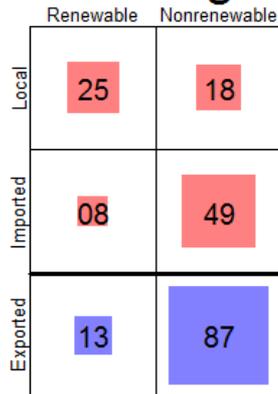


Emprints of countries at extremes

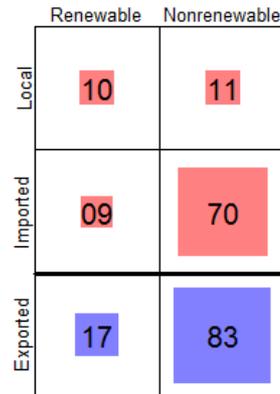


Emprints of selected EU countries plus US

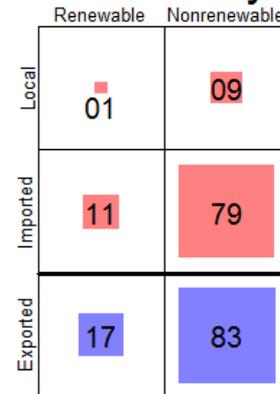
United Kingdom



France



Germany



Italy



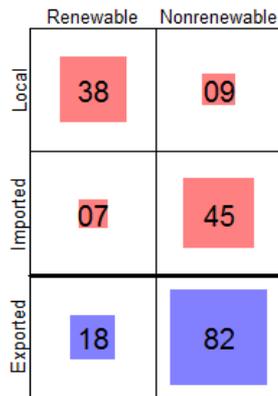
Spain



Portugal



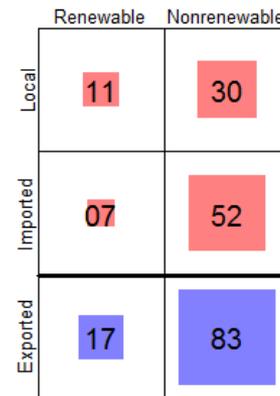
Ireland



Greece

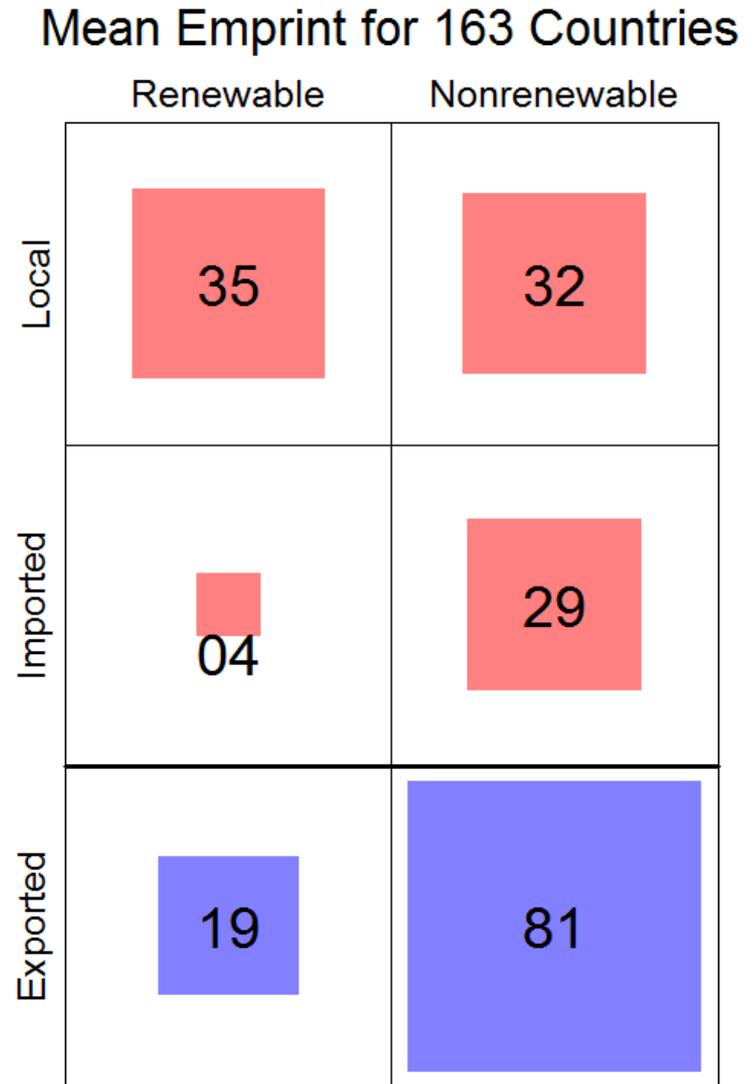


United States

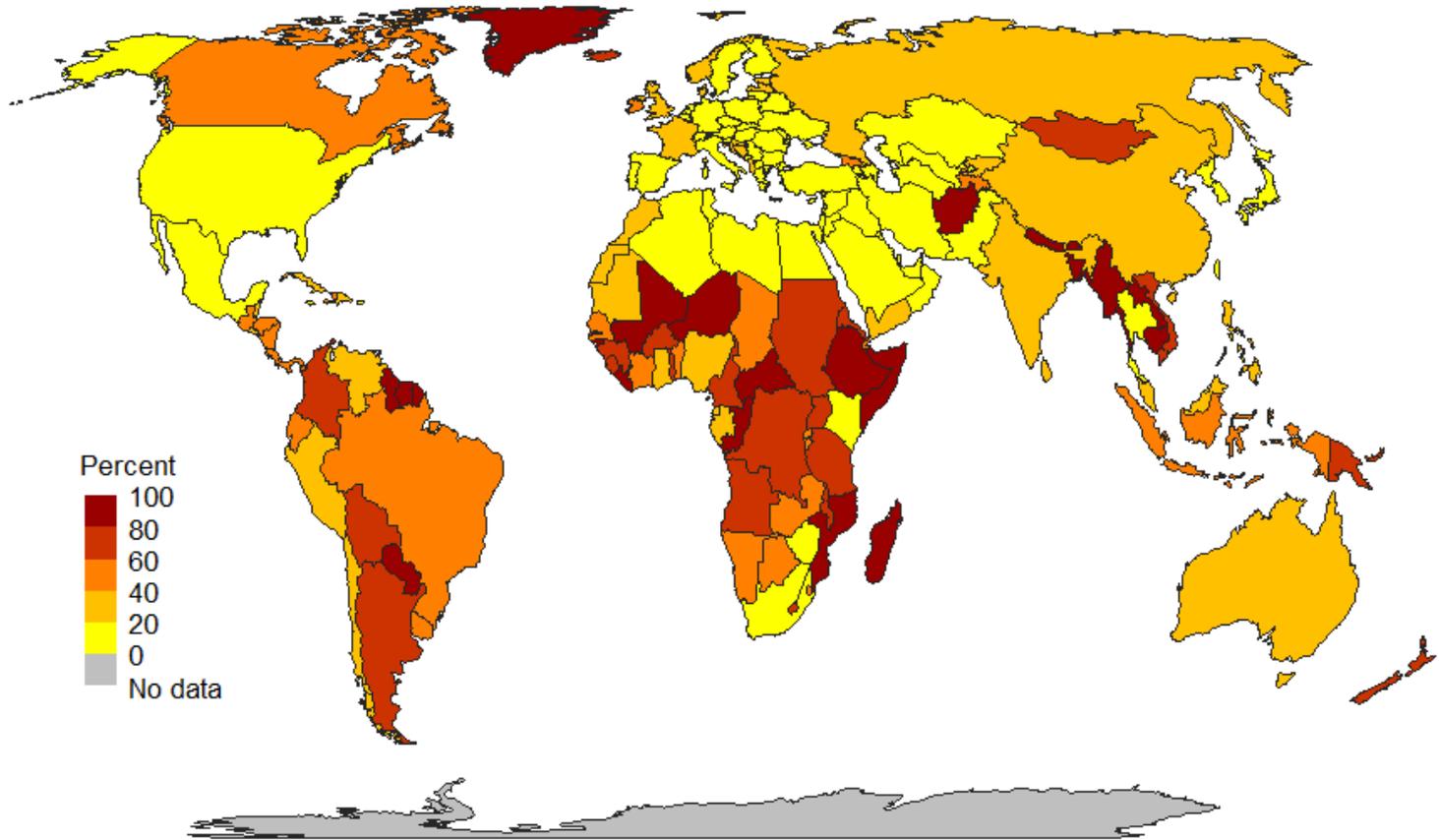


Self-sufficiency, Sustainability

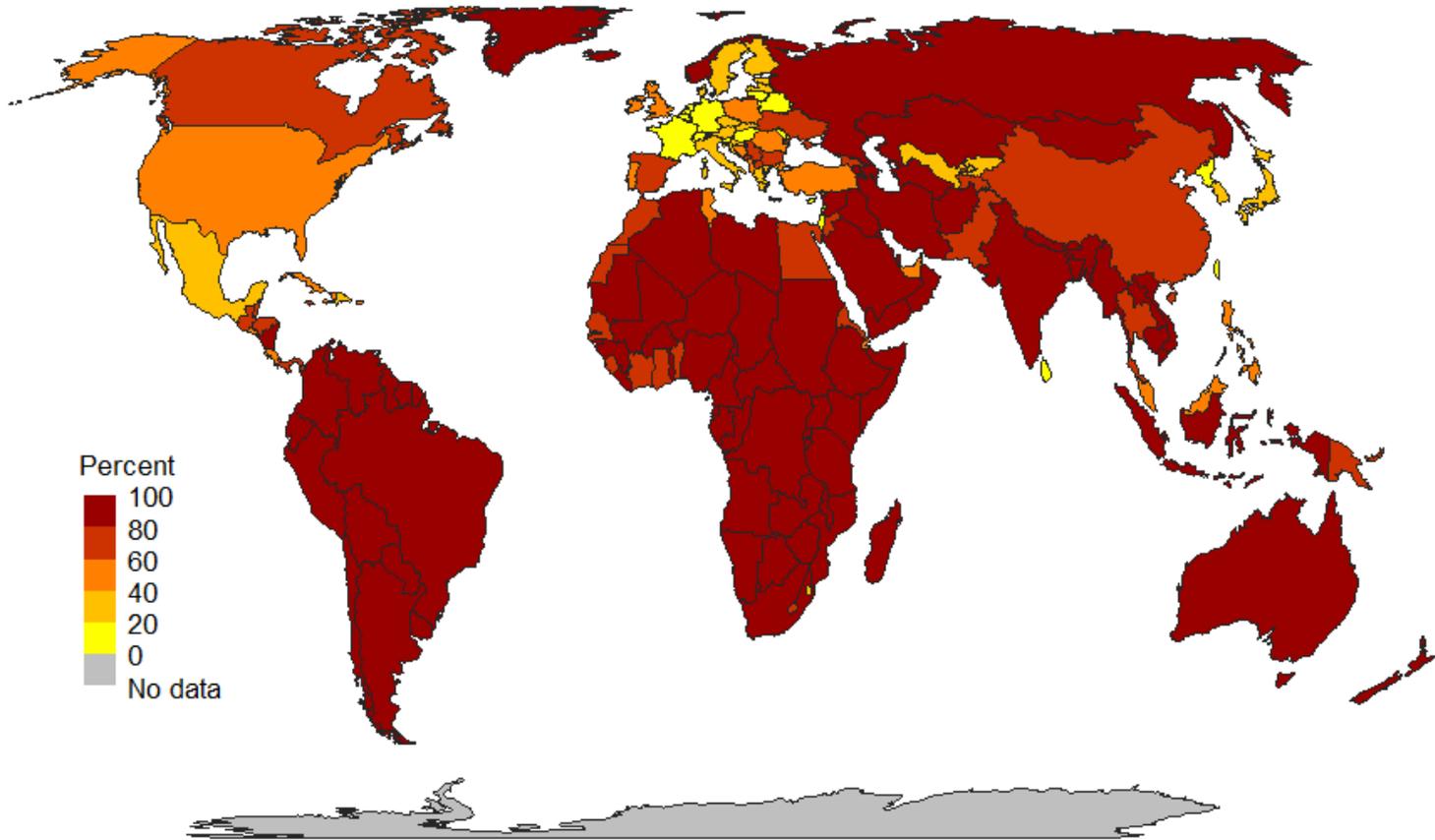
- Sustainability is the sum of the local and imported renewable energy (first column, first two rows)
- Self-sufficiency is the sum of the local renewable and nonrenewable energy (top row of imprint)



Sustainability index



Self-sufficiency index



Sustainable, Self-sufficient

Most Sustainable	%	Least Sustainable	%
Guinea-Bissau	97.9	Kuwait	2.0
Central African Republic	95.7	Luxembourg	3.6
French Guiana	92.8	Armenia	4.3
Somalia	92.5	Qatar	4.9
Mozambique	91.1	United Arab Emirates	5.5
Laos	91.0	Saudi Arabia	5.6
Bhutan	88.3	Jordan	5.9
Congo DRC	87.9	Zimbabwe	7.1
Ethiopia	86.7	Syria	7.3
Nepal	86.6	Ukraine	7.3
Most Self-sufficient	%	Least Self-sufficient	%
Central African Republic	99.4	Switzerland	3.9
Congo DRC	99.3	Taiwan	4.8
Chad	98.8	Lebanon	5.8
Guinea-Bissau	98.6	Germany	9.9
Gabon	98.4	Israel	10.6
Congo	97.8	Netherlands	13.1
Zambia	97.7	France	13.4
Madagascar	97.0	Sri Lanka	14.1
Angola	96.8	Belarus	14.5
Zimbabwe	96.5	Slovenia	15.5

Comparison with other indices

- Human Development Index (HDI), UNDP, 2000
- Happy Planet Index (HPI), New Economics Foundation, 2005
- Environmental Performance Index (EPI), Yale & Columbia Universities, 2000
- Ecological Footprint (EF), Global Footprint Network, 2001

Correlations of ranks

	HDI	HPI	EPI	EF	Sustain- ability	Self- sufficiency
HDI	1					
HPI	0.06	1				
EPI	0.45	0.03	1			
EF	0.71	-0.09	0.36	1		
Sustainability	-0.32	-0.02	-0.01	-0.38	1	
Self-sufficiency	-0.43	-0.12	-0.25	-0.38	0.36	1

Conclusions

1. **Real wealth** is the value in human goods and services, and non-human environmental goods and services
2. Energy is contained in every good, service, and environmental process
3. Energy has different quality depending upon the source and position in a chain of energy transformations
4. **Emergy** is the most comprehensive and scientifically correct method for valuation

Panel Discussion 1

“Beyond GDP: Measures of Growth and Well-Being”

Balazs Magyar, Bank Sarasin
Professor Stephen Smith, University College London
Denis White, Oregon State University

Professor Michael Mainelli (Chair)



Break

Please come back
to your seats by **16:20**

Presentation

“Green Growth: the What, Why and How”

Professor Paul Ekins,
UCL Energy Institute

GREEN GROWTH: THE WHAT, WHY AND HOW

**A presentation to the Long Finance Autumn Conference
2012: 'Measures Beyond Money'**

Paul Ekins

Professor of Resources and Environmental Policy

UCL Institute for Sustainable Resources

University College London

University College London

November 14th, 2012

Green Economy: definition and characteristics

A Green Economy is more easily characterised than defined. It:

- Has very low levels of carbon and other emissions to the atmosphere, and does not pollute the land, freshwater or seas.
- Has very high levels of resource productivity, which means that it delivers high levels of human value, measured in money or other terms, for low throughput of energy and material resources.
- Results in aggregate human activity remaining within local and planetary environmental limits, such that it does not damage human health, deplete renewable resources, or cause climate change or ecosystem degradation, because it takes due account of the values and human benefits which a stable climate, high environmental quality and resilient ecosystems provide.
- Intersects with two important high-level public policy agendas – those on environmental sustainability and ‘GDP and Beyond’.
- May or may not experience economic (GDP) growth

Where does economic growth come from?

- Applied knowledge and innovation
 - Turning non-resources into resources (e.g. fossil fuels)
 - Finding better ways of doing things
- Investment in knowledge and innovation is at an all-time high globally
- There is no shortage of renewable energy if we knew how to harness it (cost-)effectively
- There is no shortage of materials if we knew how to manipulate and use them
- It is not clear how policy makers could ‘stop’ economic growth even if we wanted to
- BUT economic growth must be consistent with environmental sustainability (and currently is not so)

How big can the economy get? what kind of growth?

- Physical growth (growth in the amount of matter/energy mobilised by the economy: indefinite growth of this kind is impossible in a finite physical system subject to the laws of thermodynamics)
- Economic (GDP) growth: growth in money flows/incomes/value added/expenditure: there is no theoretical limit on this kind of growth
- Growth in human welfare:
 - Dependent on sustaining environmental functions
 - Complex relationship to economic growth (although hard to argue that, *ceteris paribus*, more money is not better than less)
 - Dependent on many other factors
- ‘Green growth’: increases in GDP that *either* keep the economy within the safe operating space *or* move it back towards this space [optional: while also increasing human well-being]
- ‘Green growth’ requires decoupling of GDP growth from resource use and environmental impact

Why green growth (1)?

- The current human population is in excess of 6 billion. Barring catastrophe it will rise to 9 billion by 2050
- The vast majority of the relatively poor want to live like rich consumers in Europe, North America and other currently rich countries, while the relatively rich in those countries want to get still richer
- Large populations in relatively poor countries now have the human and technical capacity to get richer
- There will be a considerable increase in resource consumption, energy use, greenhouse gas emissions and destruction/degradation of ecosystems
- Science (IPCC, MEA) is suggesting that environmental degradation is already beyond safe limits

Why green growth (2)?

- Brown growth is unsustainable, i.e. it will not/cannot continue
- Thailand floods: “GDP declined 9% in the three months through December [2011] from a year earlier.” (Bloomberg Finance)
- “Sustained heat, above 38°C – never before endured in 130 years of record keeping” caused fires in Russia which destroyed over a quarter of Russia’s crops, took 1% off GDP (\$15 bn), destroyed 50 villages (with a rebuilding cost of \$400m - £1 billion) and took 15,000 lives. (BBC, Daily Telegraph, Bloomberg, Aug.2010)
- “The worst drought in the US in at least half a century has destroyed one-sixth of the country’s expected corn crop in a month threatening a surge in global food price inflation.” (Financial Times, 10/8/12)
- This is with less than 1°C average global warming. What about 6°C ?
- Prof Sir John Beddington, CSA, 2009: ‘The perfect storm’ of crises in food, water and energy by 2030

Projections from the 2011 UNEP Green Economy Report

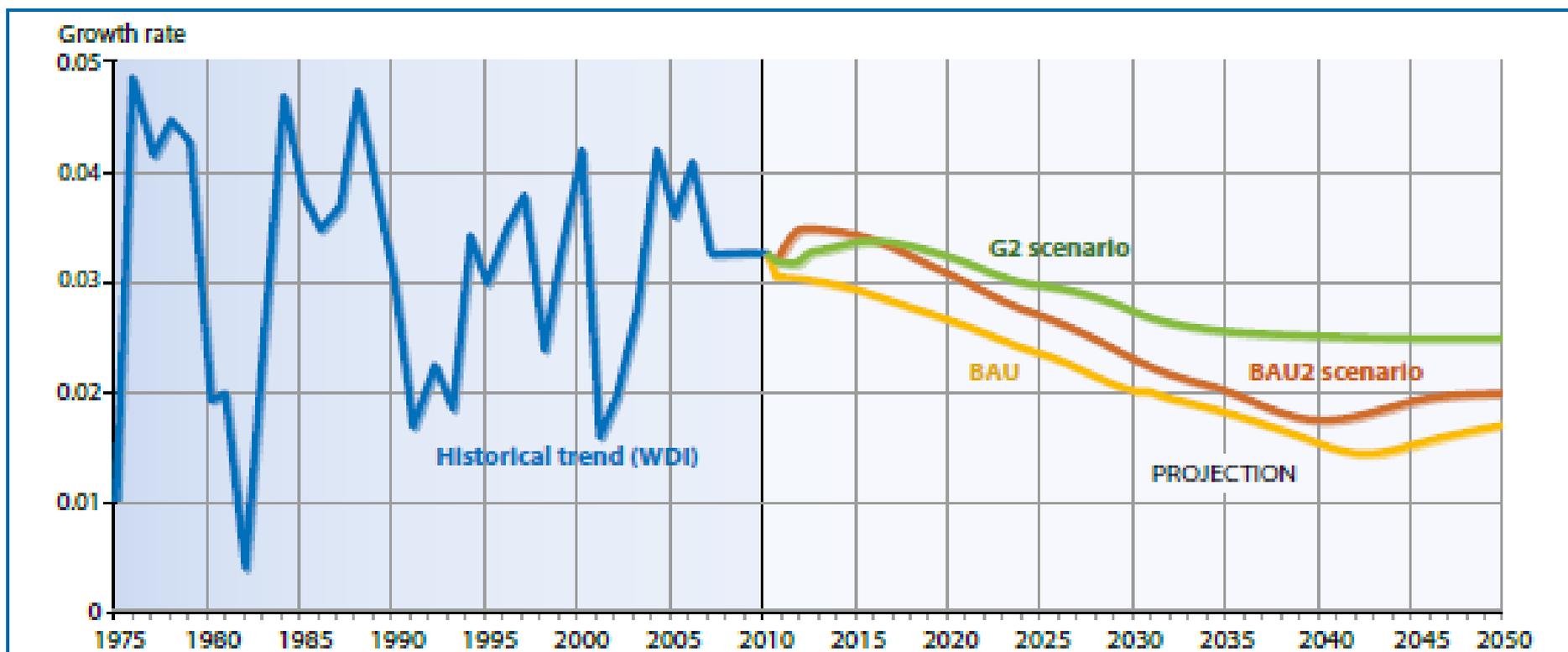


Figure 13: Trends in annual GDP growth rate, historical data (WDI, 2009) and projections in BAU, BAU2 and G2 scenarios

An unprecedented policy challenge

The Stern Review Policy Prescription for climate change

- Carbon pricing: carbon taxes; emission trading
- Technology policy: low-carbon energy sources; high-efficiency end-use appliances/buildings; incentivisation of a huge investment programme
- Remove other barriers and promote behaviour change: take-up of new technologies and high-efficiency end-use options; low-energy (carbon) behaviours
- The basic insights from the Stern Review need to be applied to the use of other environmental resources (water, materials, biodiversity [space])
- In a market economy, pricing is the key to resource efficiency, investment and behaviour change
- Policy is required to bring about a step-change in eco-innovation

Policy approaches for green growth

- Resource efficiency/productivity
- Circular economy (reduce, re-use, recycle)
- Waste hierarchy
- Extended producer responsibility
- Industrial symbiosis
- Instruments (market-based, regulation, voluntary agreements, information, R&D/innovation):
 - Resource and environmental taxation
 - Recycling and efficiency targets
 - Take-back/deposit requirements
 - Consumer information/labelling

The benefits of increased resource productivity

- Negative cost opportunities for resource efficiency in the UK economy of £23 billion (Oakdene Hollins 2011)
- Innovation and investment: new technology, economic activity, exports
- Increased resource security (reduced vulnerability): food, water, energy, rare materials
- Environmental improvement: reduced GHG emissions, waste to landfill, extraction of virgin materials



UCL

Thank You

www.ucl.ac.uk/sustainable-resources

Panel Discussion 2

“Green Growth: The Grand Policy Challenge and the Role of Science”

Professor Paul Ekins, UCL Energy Institute

Dr Steven Fries, DECC

Chris Goodall, Carbon Commentary

Andrew Simms, the new economics foundation

Professor Michael Mainelli (Chair)



Closing Remarks

Professor Michael Mainelli

Chairman, Z/Yen Group

Principal Advisor, Long Finance

Long Finance Programmes

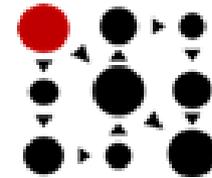


London Accord

- ◆ Founded 2005
- ◆ Focus on finance & ESG issues
- ◆ Over 50 contributing organisations
- ◆ Over 300 reports free to access on the website
- ◆ Long Finance's '*sustainable finance*' programme



Financial Centre
Futures

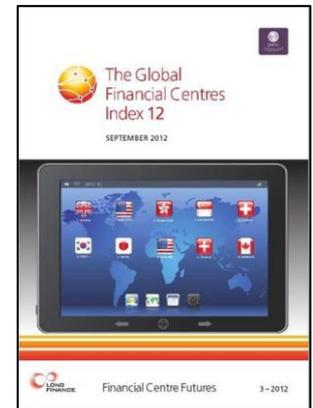
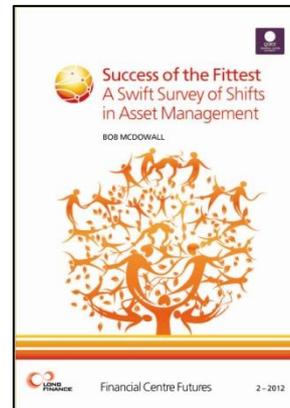
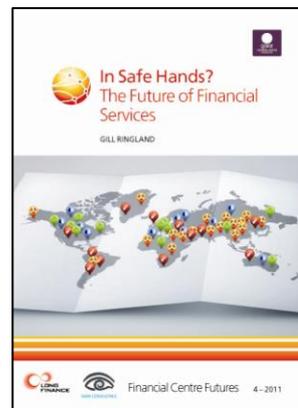
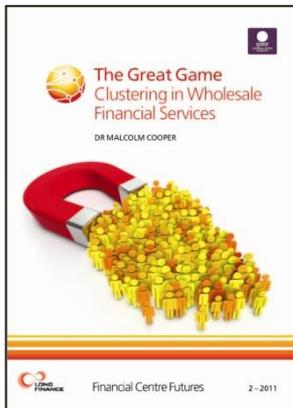
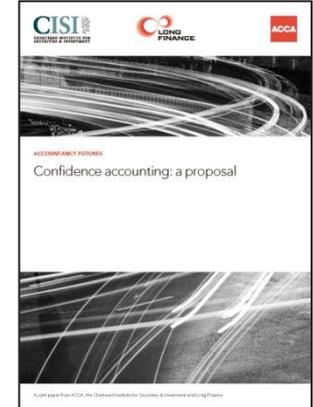
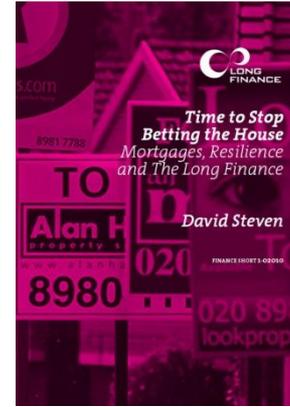
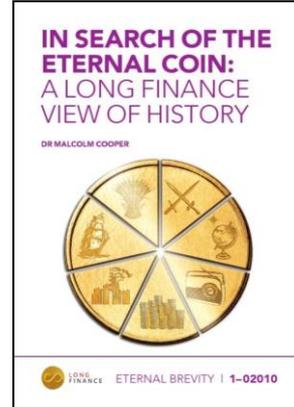
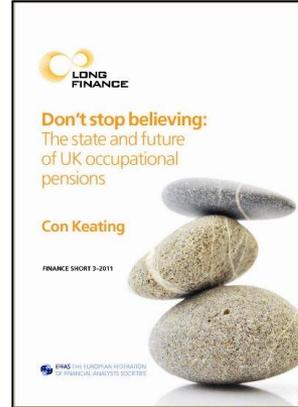


Meta-Commerce



Eternal Coin

Long Finance Publications



Outlook 2013

◆ Events

- **The Role of Government Finance – 4 December 2012**
- **Confidence in Corporate Reporting – 6 December 2012**
- **The Currency of Management - What Managing Money Teaches Us About People – 13 December 2012**
- **Long Finance Spring Conference – 13 March 2012**
- **What Makes a Good Professional – 23 April 2013**

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◆ Publications

- **Impact of the Euro Crisis on Emerging Markets – January 2013**
- **GFCI 13 – March 2013**

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