China – the empire that did not bark: the economics of a failed attempt at modern economic growth

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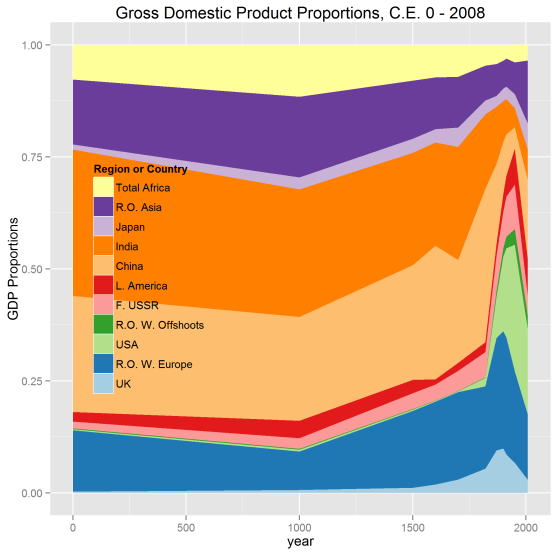
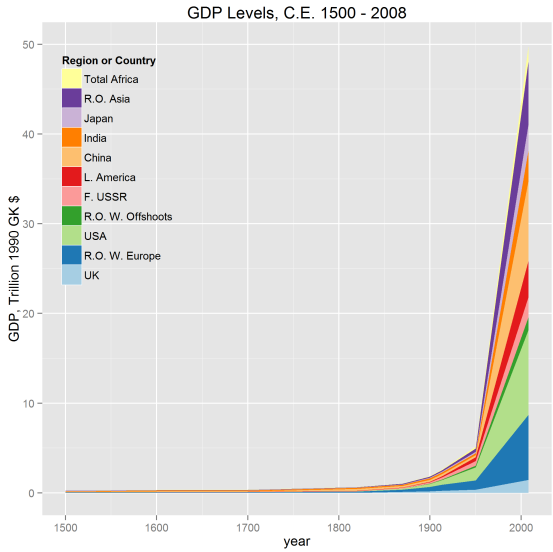
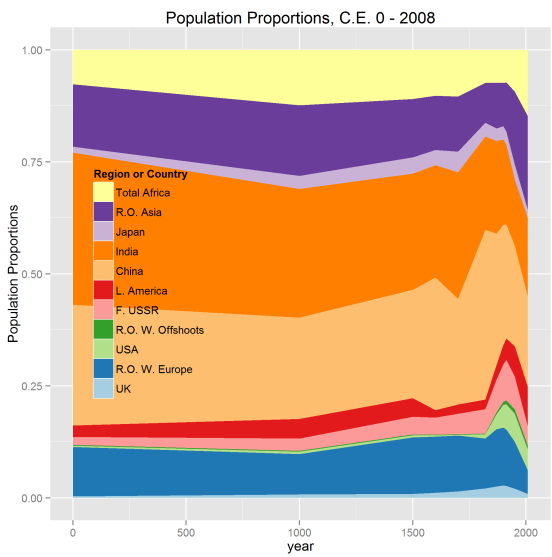
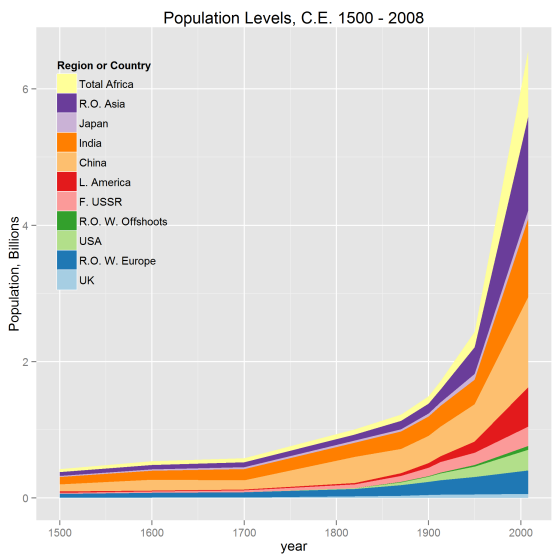
- In **each** case the same *economic* explanations are sufficient

Global Context (Source: Maddison): a Western Bubble?

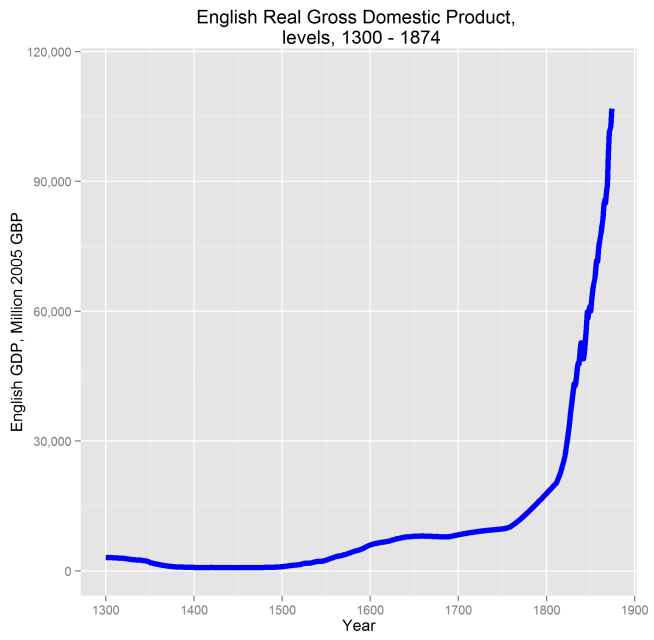


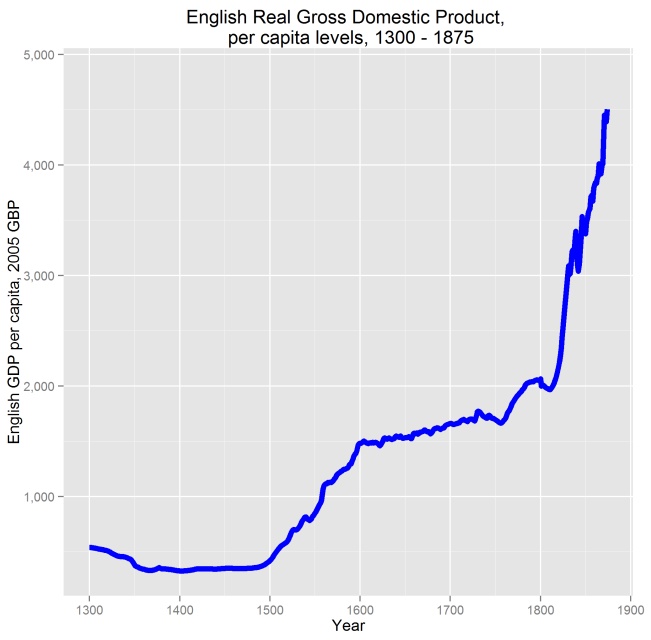


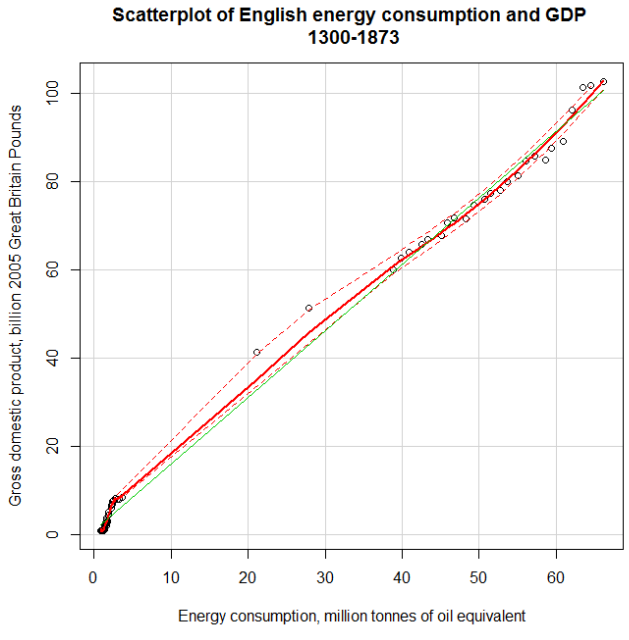




The English data – two energy revolutions that ***were*** the EIR







Two energy consumption revolutions driving the machine-age, productivity gains, and rising living standards; no “Solow” residual required. This is arguably the deepest, physical (real), identity in all of economic theory

Comparative energy consumption

Year	England	China	Netherlands	India
1650[a]			0.63	
1820	0.61			
1840[a]			0.33	
1870	2.21			
1970[a]			8.07	0.33
1973		0.48		
1998[b]	6.56	1.18		
2008[b]	5.99	2.56	9.86	

Table: Per-Capita Primary Energy Consumption, annual Tonnes of Oil Equivalent. *Source:* Angus Maddison, [a]de Zeeuw, [b]US DOE EIA

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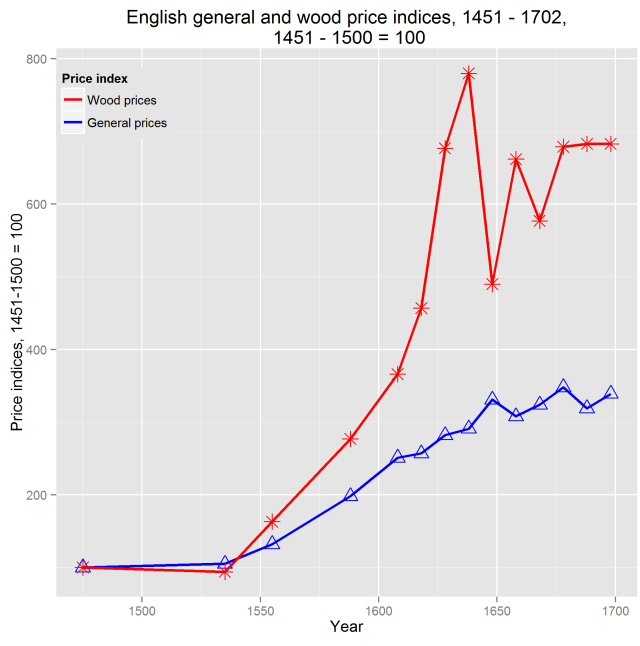
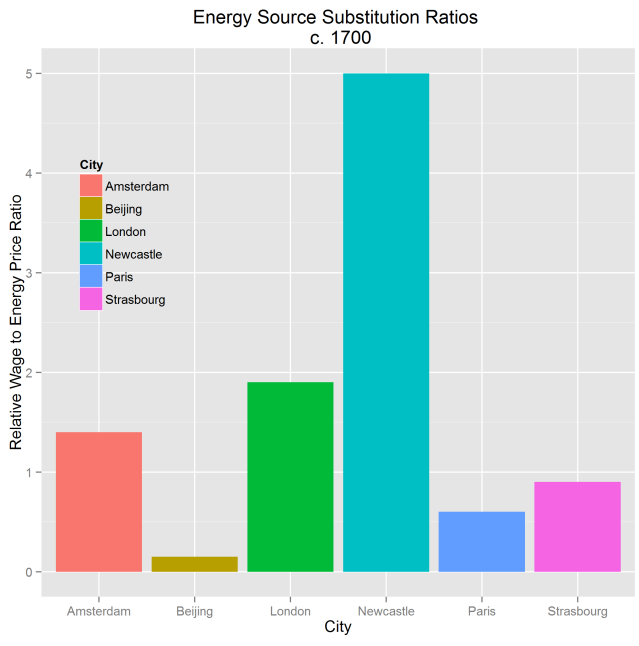
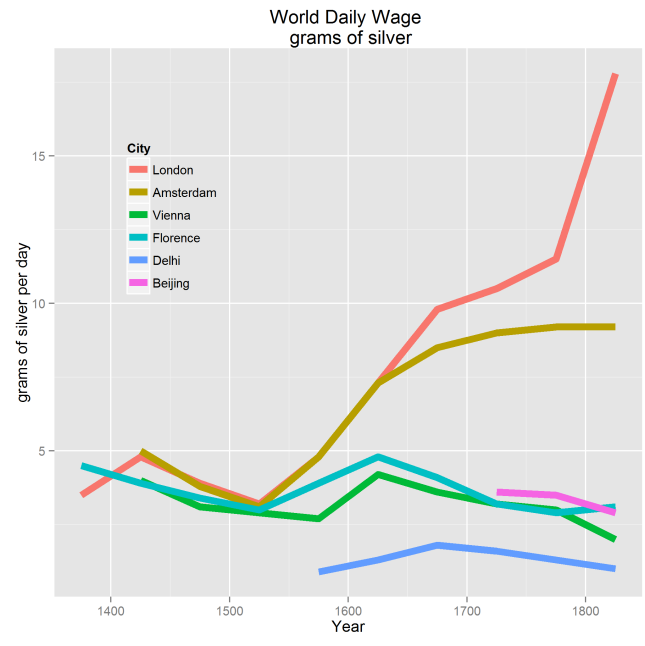
The RHS of (2) was so large, it induced a major positive aggregate supply shock and large income effects

Relevant price ratios induce behavioral changes ⇒ induced innovation

Figure: Sources (l to r) Nef, Allen, Allen







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What about institutions?

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- Is the juice worth the squeeze?
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  - Why a Bank of England if no borrowers?
- Especially, why Industrial Capitalism if no significant machines and capital is not required to chop down trees?

Chinese institutional revisionism ⇒ sufficient institutions

- Huang, Philip C. 1990. The Peasant Family and Rural Development in the Yangzi Delta, 1350-1988
- Wong, R. Bin. 1997. China Transformed: Historical Change and the Limits of European Experience
- Lee, James Z., and Cameron D. Campbell. 1997. Fate and Fortune in Rural China : Social Organization and Population Behavior in Liaoning, 1774-1873
- Li, Bozhong. 1998. Agricultural Development in Jiangnan, 1620-1850
- Pomeranz, Kenneth. 2000. The Great Divergence : Europe, China, and the Making of the Modern World Economy
- Rawski, Thomas G. 1989. Economic Growth in Prewar China. Berkeley: University of California Press.
- Brandt, Loren. 1989. Commercialization and Agricultural Development: Central and Eastern China 1870-1937. Cambridge: Cambridge University Press.
- Myers, Ramon H. 1980. The Chinese Economy Past and Present. Belmont, CA: Wadsworth.
- Xu, Dixin, and Zhengming Wu, eds. Chinese Capitalism, 1522-1840. New York: St. Martin's Press, 2000.

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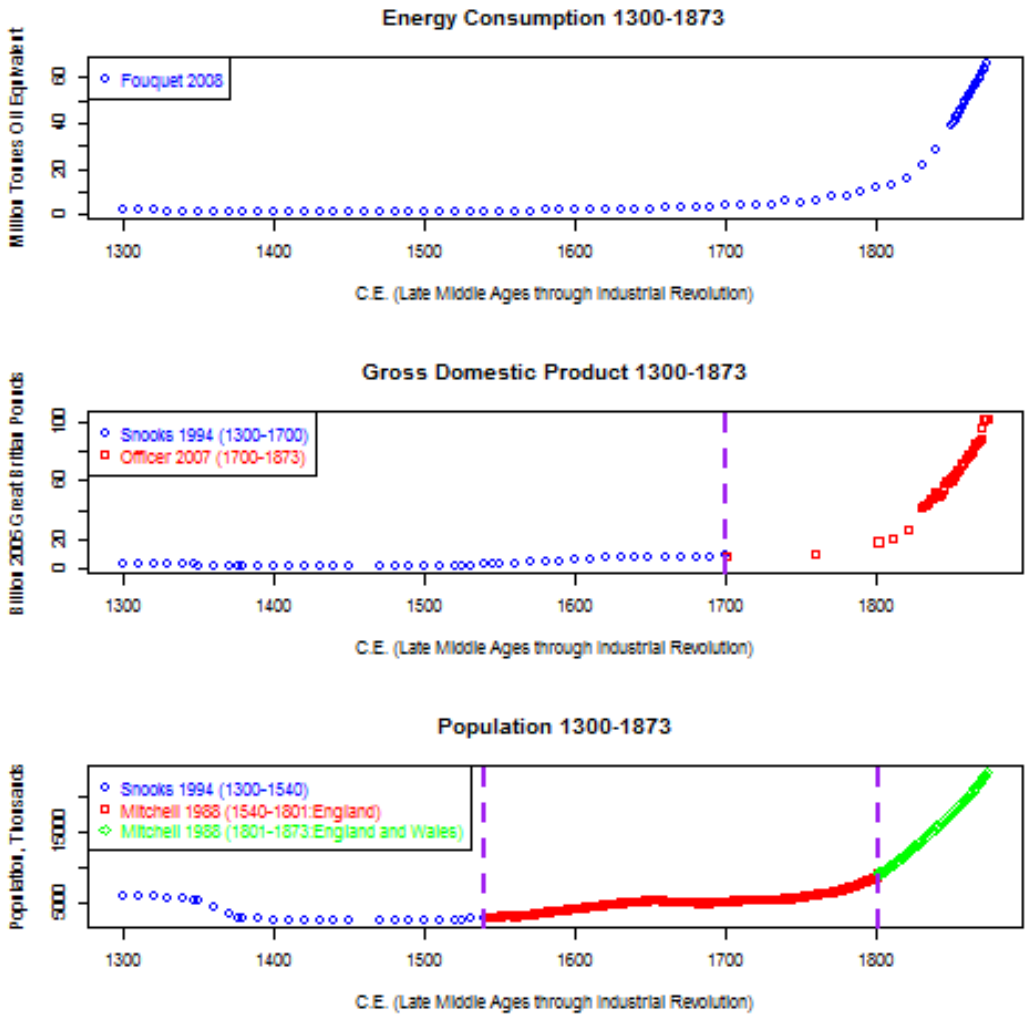
Thank you

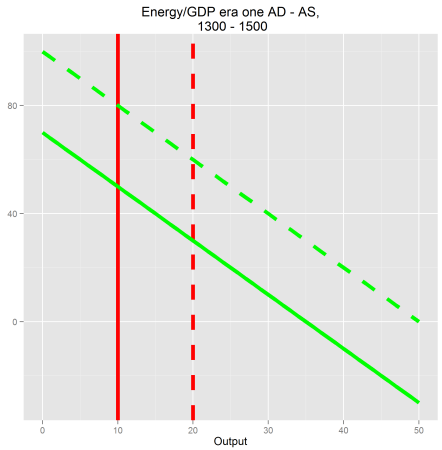
Taxonomy of EIR explanations

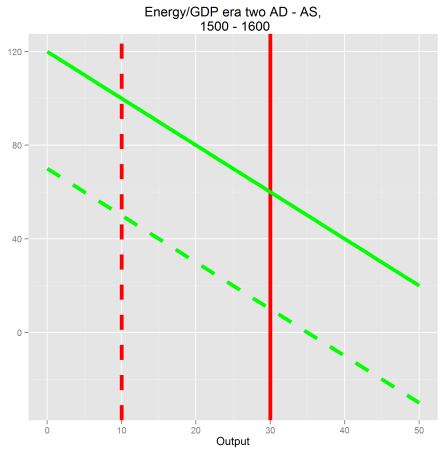
Label	Examples
English exceptionalists	Landes (1969), McCloskey (2010), Mokyr (1992,2010)
Partial culturalists	Cipolla (1966), Pomeranz (2001), Allen (2009)
Primarily energetic	Cottrell (1955), Wrigley (1988,2010), Malanima (2010)
Thermodynamicists	Georgescu-Roegen (1975), Ayres (2003), Garrett (2009)

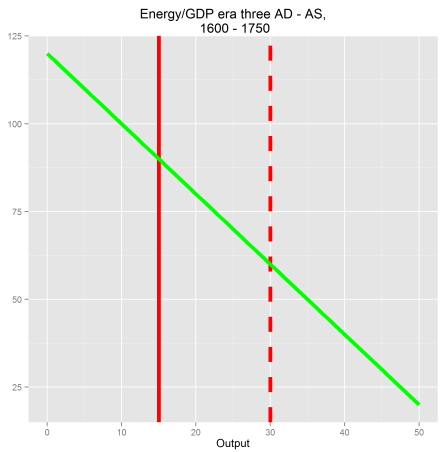
Author/time-span series of energy consumption, GDP, and population

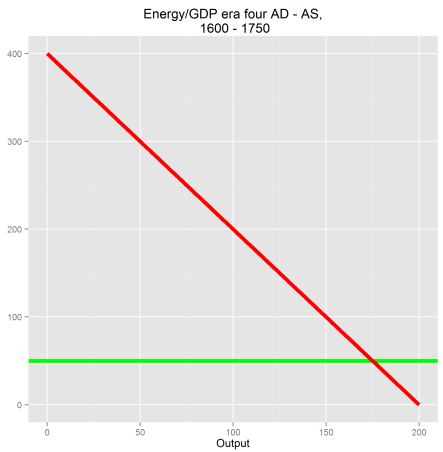


Aggregate Supply - Aggregate Demand
Four energy/GDP regimes

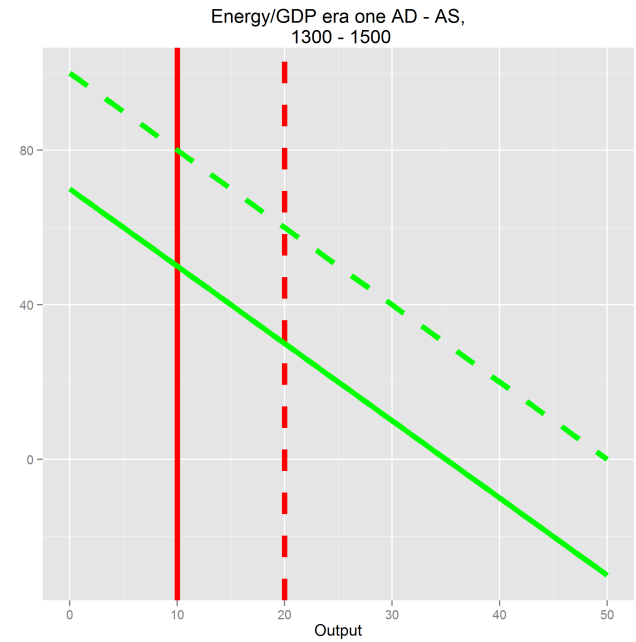


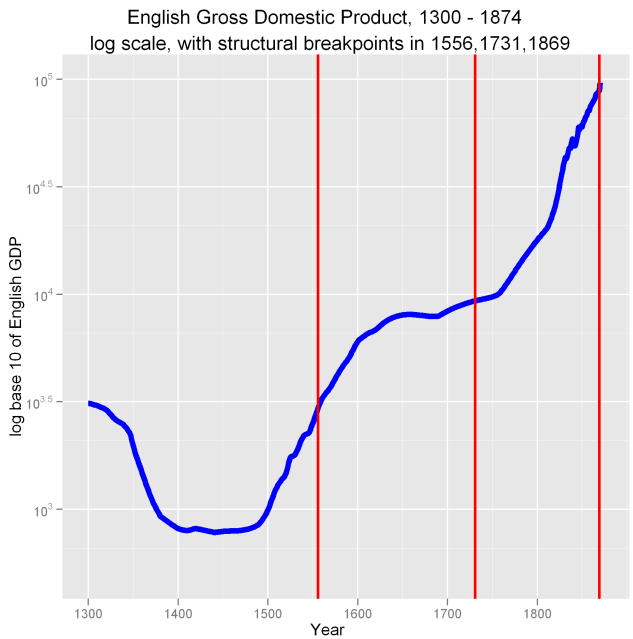


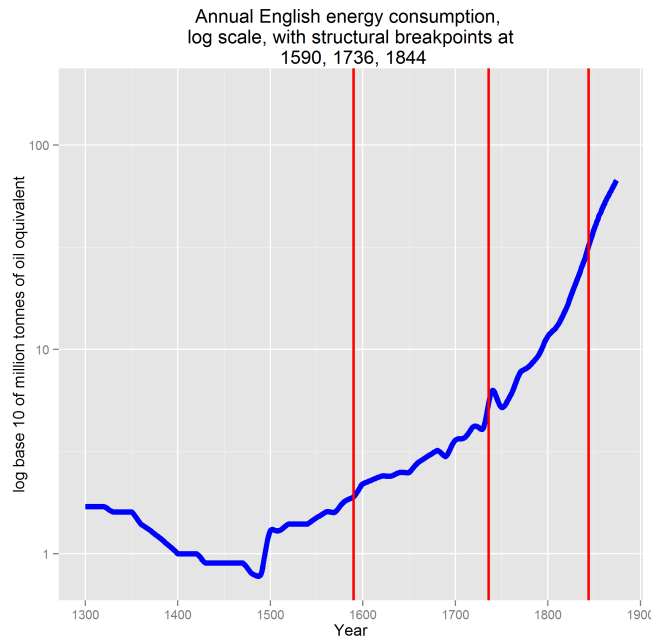




GDP/Energy regime one – 1300-1500







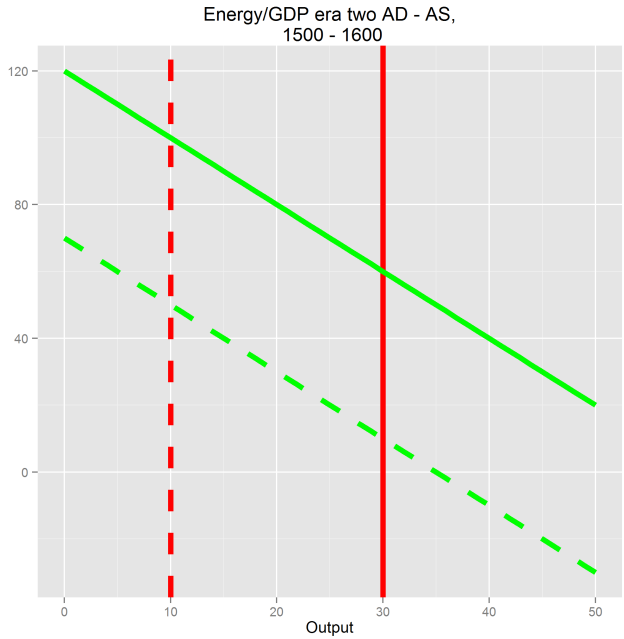
Black Death recovery – higher wage support, population recovery

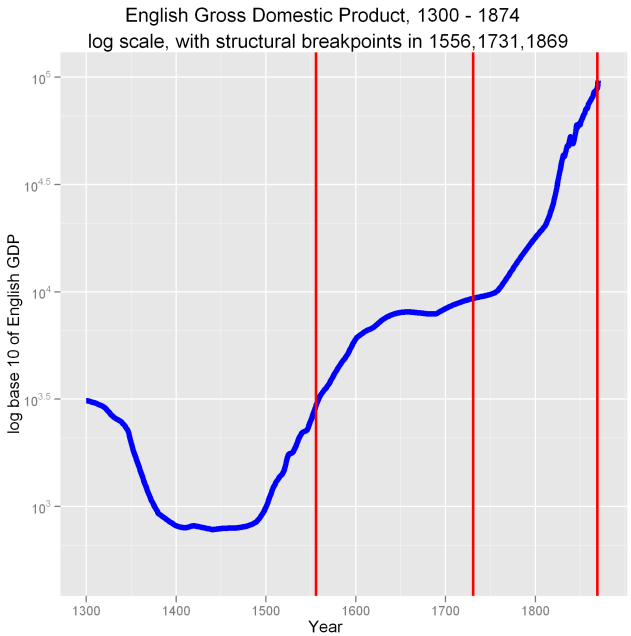
Medieval Warming Epoch – agricultural expansion, higher population

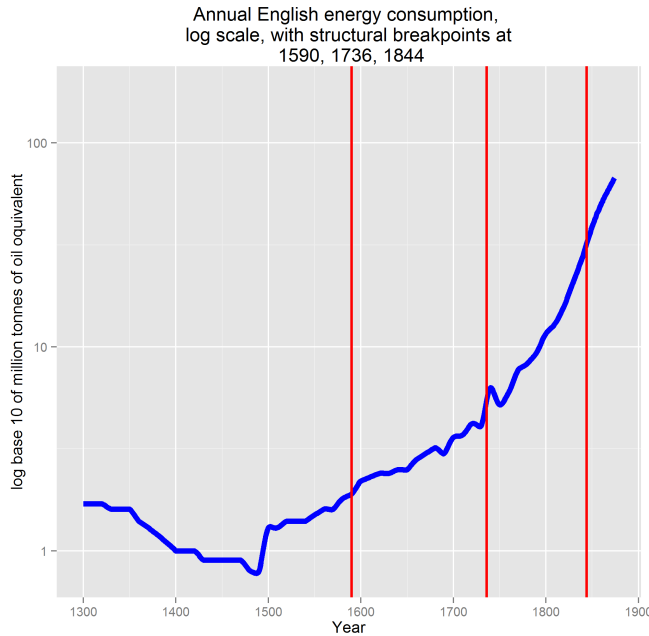
European Marriage Pattern – reduced nuptiality, higher real wage

Demand and supply expansion

GDP/Energy regime two – 1500-1600





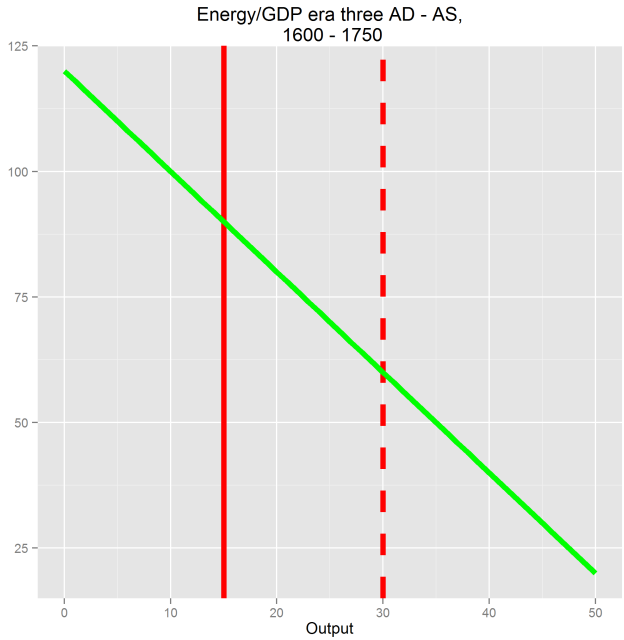


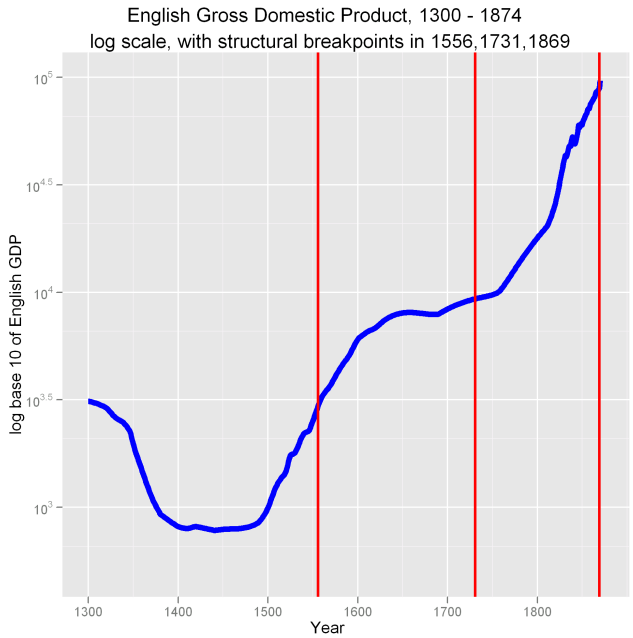
Benign climate – agriculture, real wage, population rise

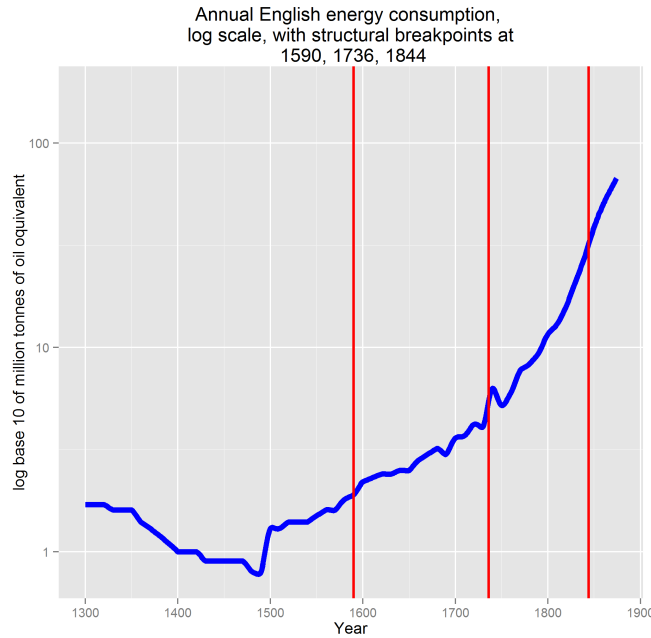
Beginning of first energy crisis – deforestation

Demand and supply expansion

GDP/Energy regime three – 1600-1750







Little Ice Age – agricultural shrinkage

Famine, Pestilence, Wars

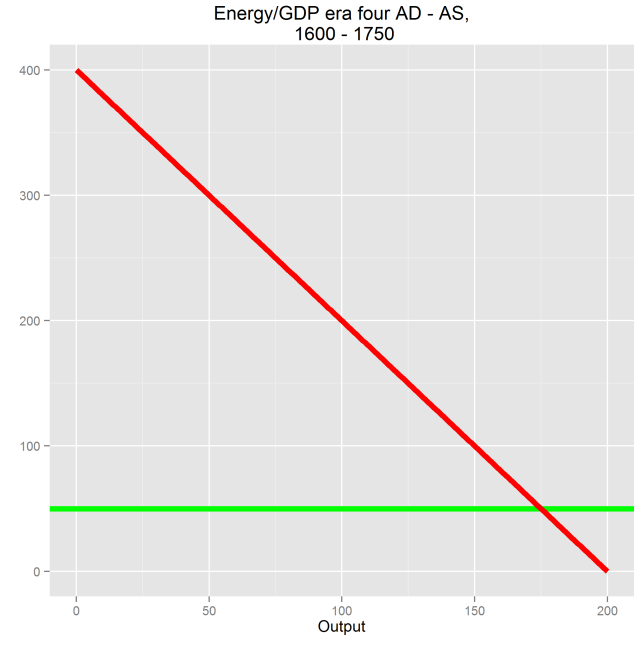
”Global Crisis” (Parker) – 30 percent global population decline

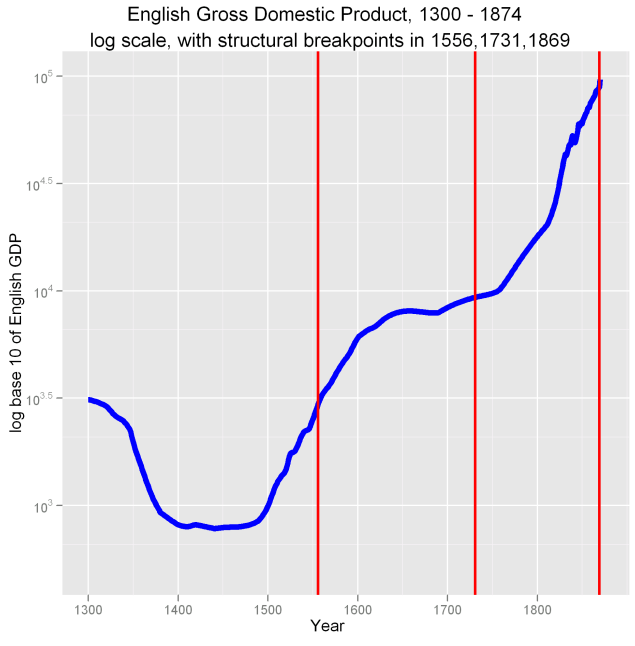
”General crisis” (Hugh Trevor-Roper)

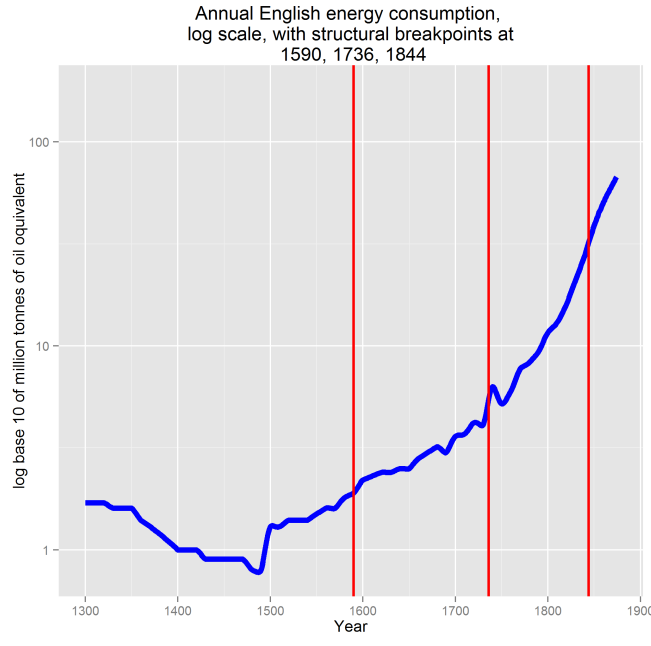
Demand and supply shrinkage

First energy revolution – substitute coal for wood

GDP/Energy regime four – 1750-1873







Second energy revolution – substitute steam power for labor power

Demand and supply expansion

Demand becomes the the system constraint

Modern economic growth

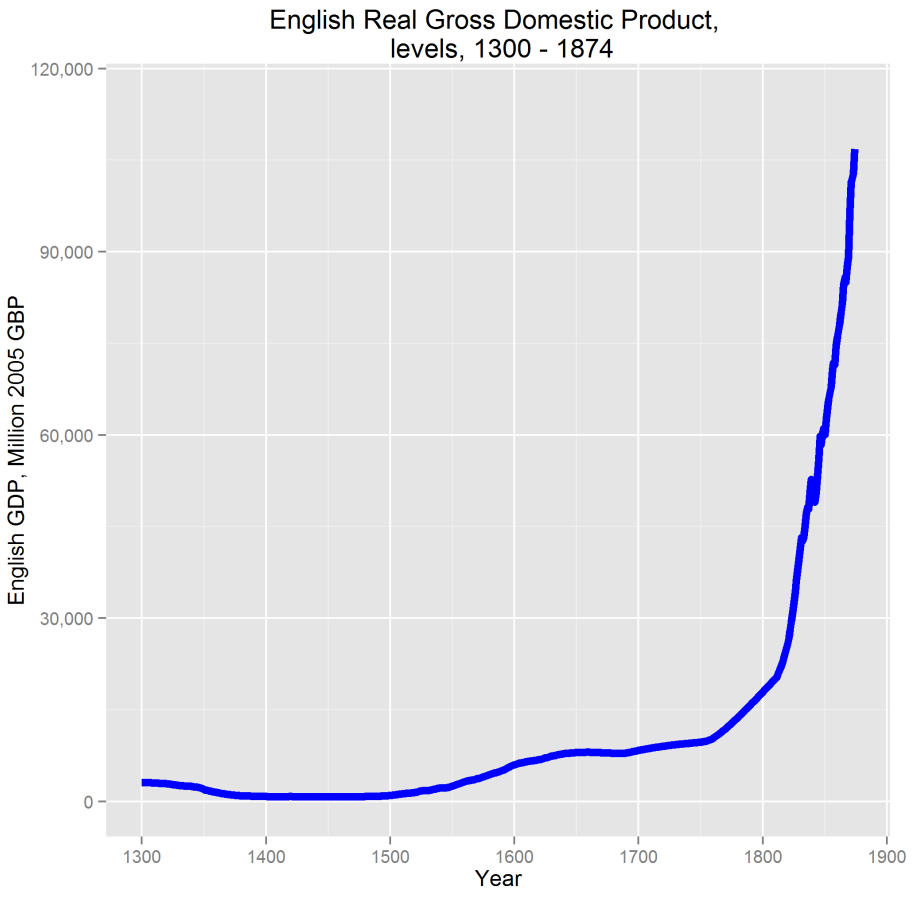
Desagulier manuscript

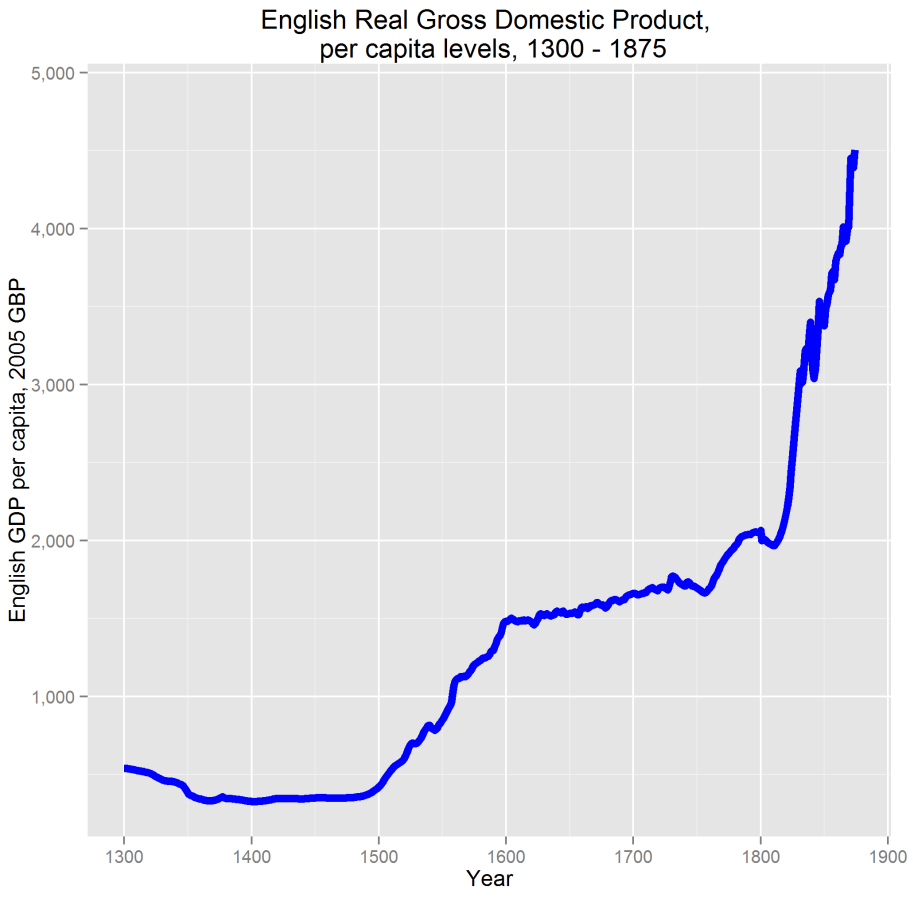
rection P *p*, and a Quantity of Water [illegible] be lifted up, and run out at P. This may be done 15 or 16 times in a Minute, becauſe each Man would pull down but 30 Pounds at a time, after the manner that People ring Bells. But as no Time is to be loſt, leſt the Mine be overflow'd by the Springs below, there muſt be 100 more Men to relieve theſe when they are weary. Now as it muſt be a rich Mine indeed whoſe Profit can afford to keep 200 Men at this Work; that

Ooo 2

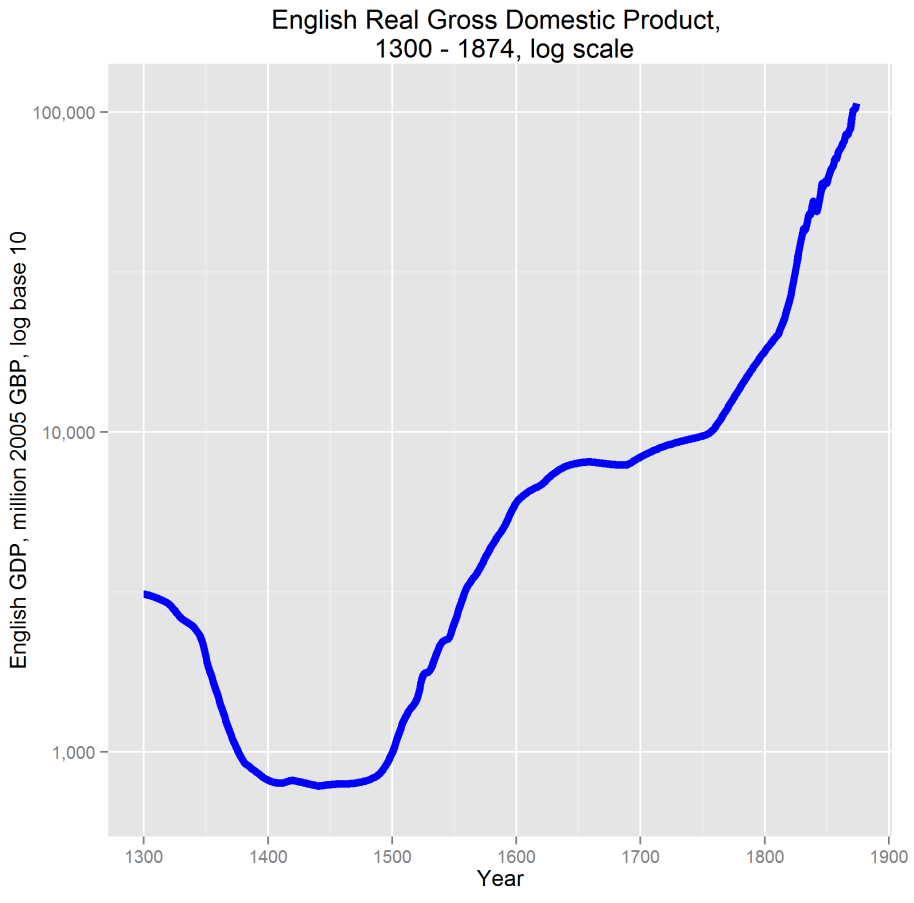
Lect. XII. Place 36. that Thought muſt be laid aſide. We'll conſider therefore what can be done by Horſes. As an Horſe is equal to five Men, we muſt work 20 Horſes at a time to raiſe the Water requir'd; and as Horſes muſt be reliev'd even more than Men, about 50 Horſes muſt be kept to carry on this Work conſtantly, and bring down the End of the Beam *b*, 16 times in a Minute, and make the number of Strokes requir'd in the Pump, the Weight of whoſe Rod after every Stroke will bring down the End *b* 2, by drawing along the Tangent *i* H. It is plain to any body, that tho' the Horſes may be had cheaper than Men, yet that will be a very expenſive way. For the next Contrivance, we'll ſuppoſe a Philoſopher to come, and find a means to bring down the End of the Beam, without Men or Horſes, in this manner. To the Chain H L he fixes a

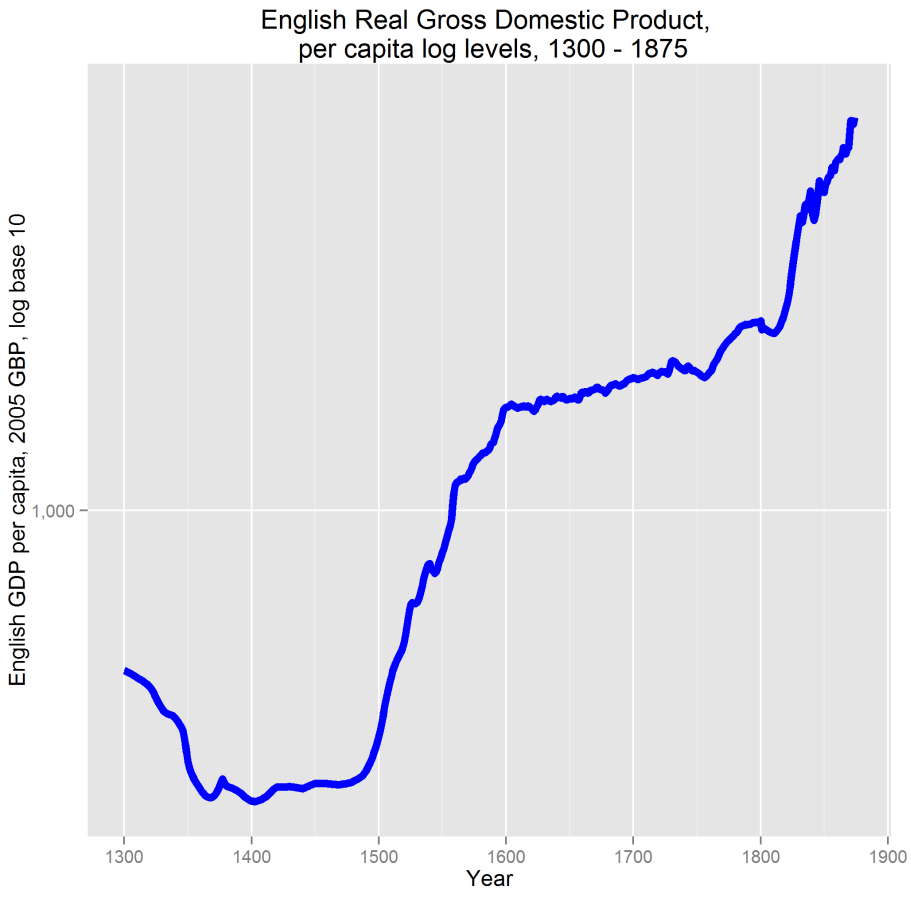
English real gross domestic product, levels and per–capita



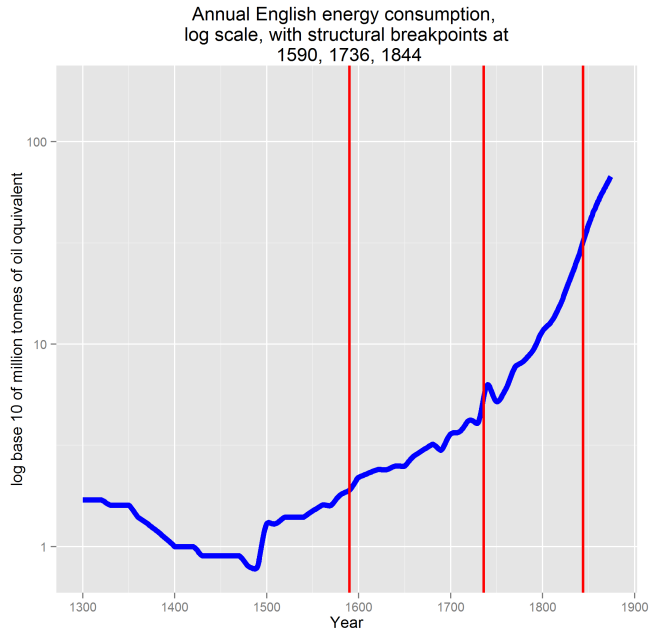


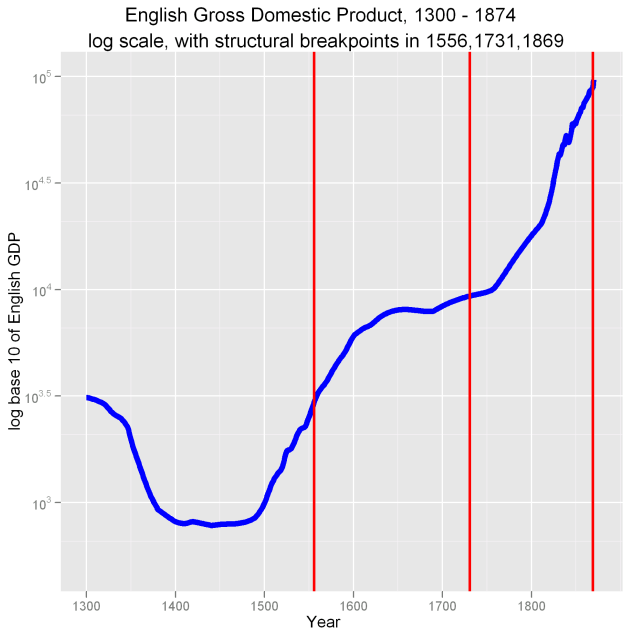
English real gross domestic product, log levels and log per–capita

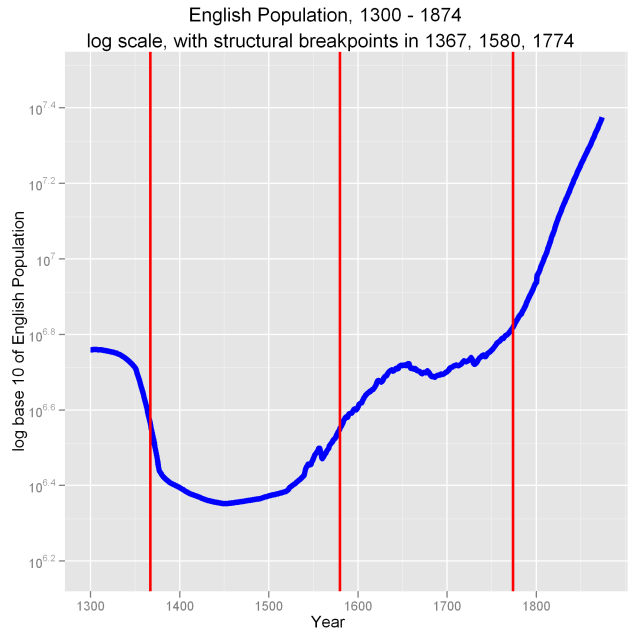




Structural break comparison



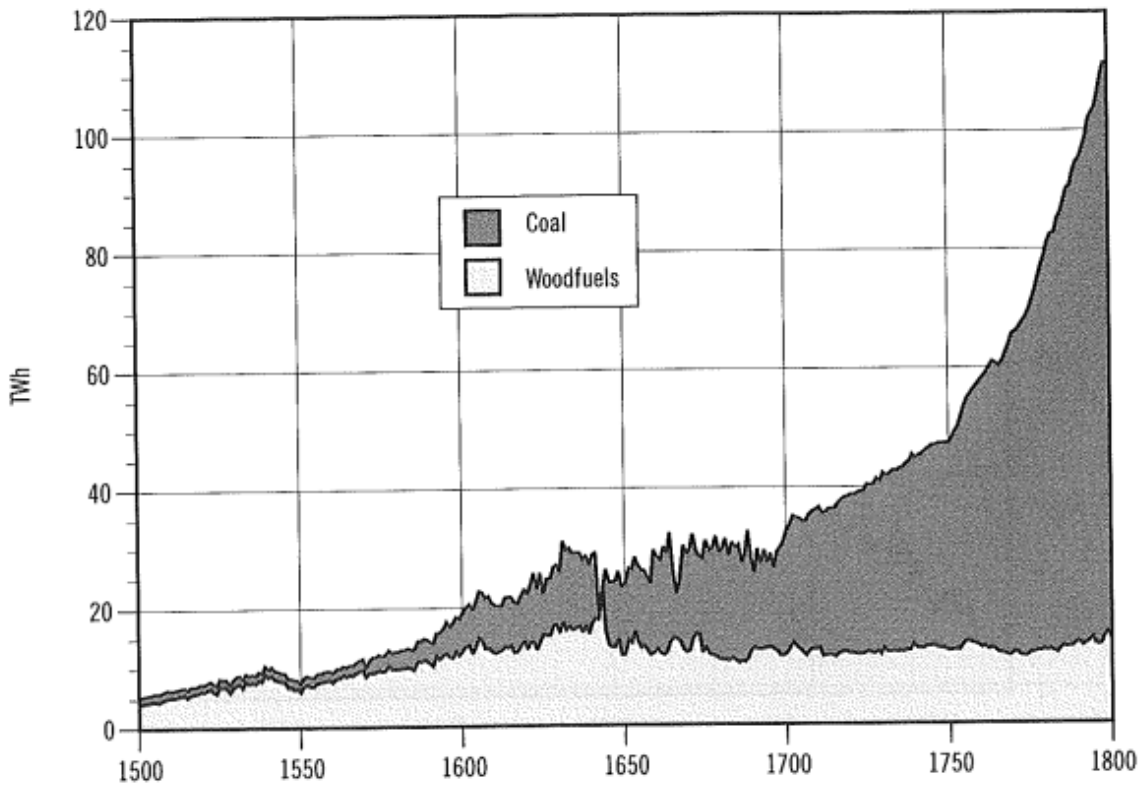




Coal and wood energy sources

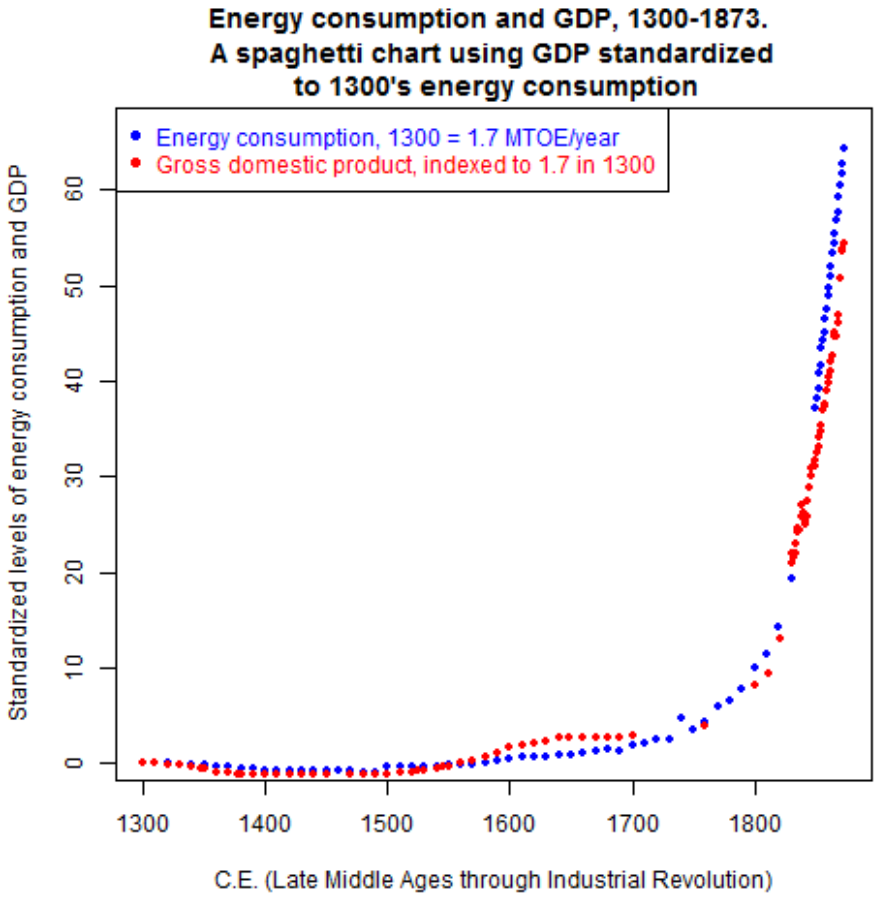
Source: Pearson & Fouquet

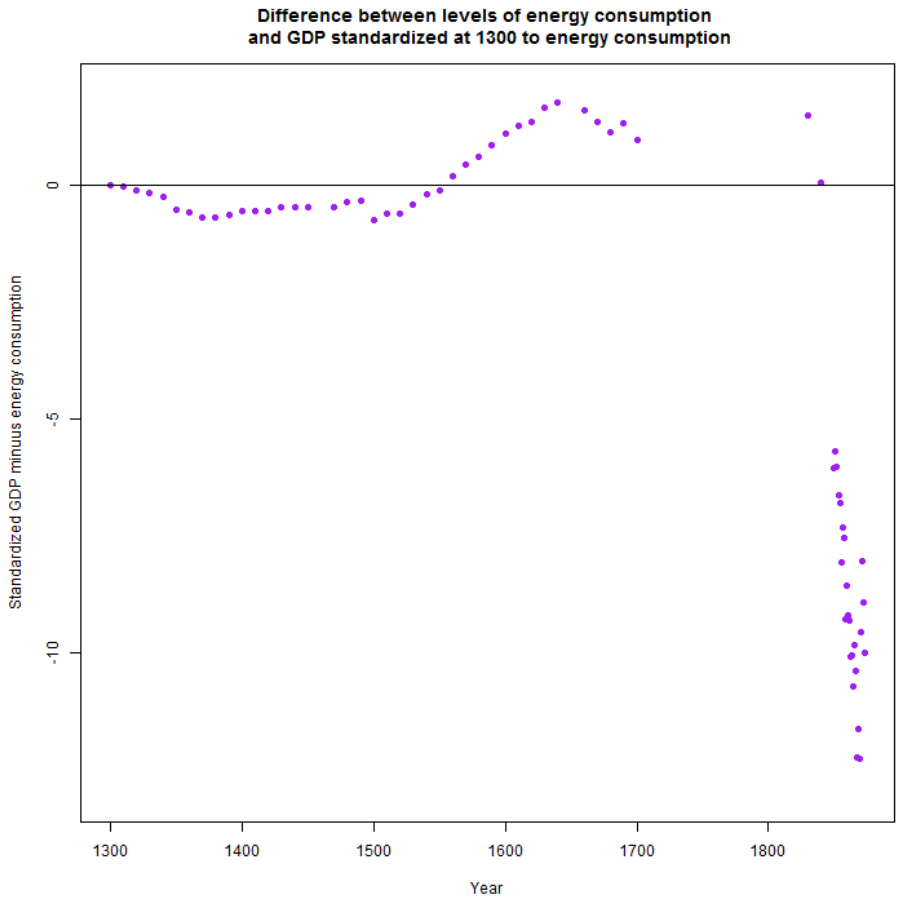
Figure 4: Energy consumption by final users (terawatt hours (TWh)), 1500–1800



Note: The consumption of candles is not visible in this graph: even by 1800, it was only equivalent to 0.5TWh, while in 1500 it was only 0.1TWh. As a percentage share, it is just visible between 1500 and 1700, with its maximum value being around 4% of energy used (see Figure 10).

Energy consumption vs. standarized GDP





Granger tests of energy/GDP dynamics

Era	Energy ~ GDP Pr(>F)	GDP ~ Energy Pr(>F)	AS/AD regime
1300 – 1500	0.0106	0.0003	EMP [1], Black Death: increasing wages, family income
1500 – 1600	0.1939	0.6126	Positive demand shock
1600 – 1750	0.3529	0.5185	Energy supply constraint
1750 – 1873	0.0024	0.1100	Positive supply shock: "virtuous" macro feedback cycle
1300 – 1873	0.0002	0.0361	Total study period

[1] European marriage pattern (Hajnal)

English wood energy supply constraint

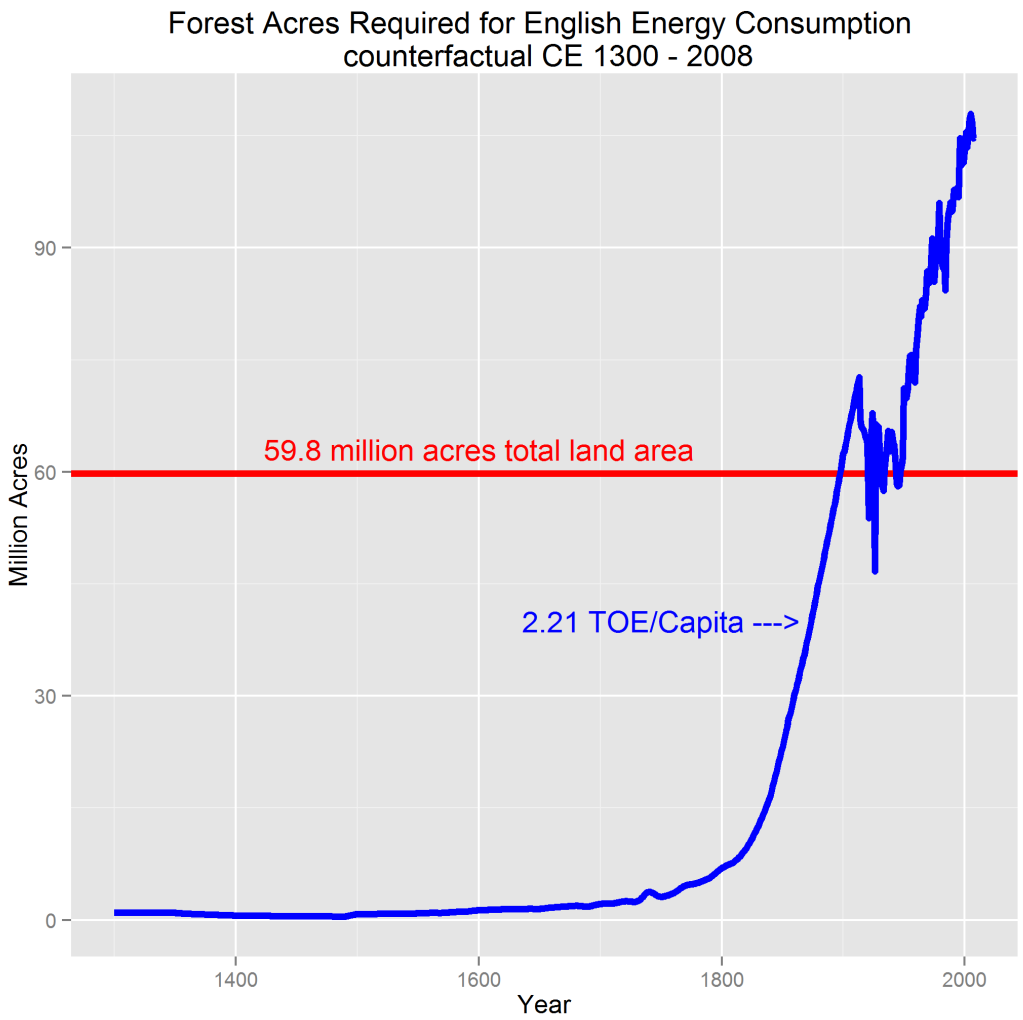


Figure: Standardized English energy intensity of GDP

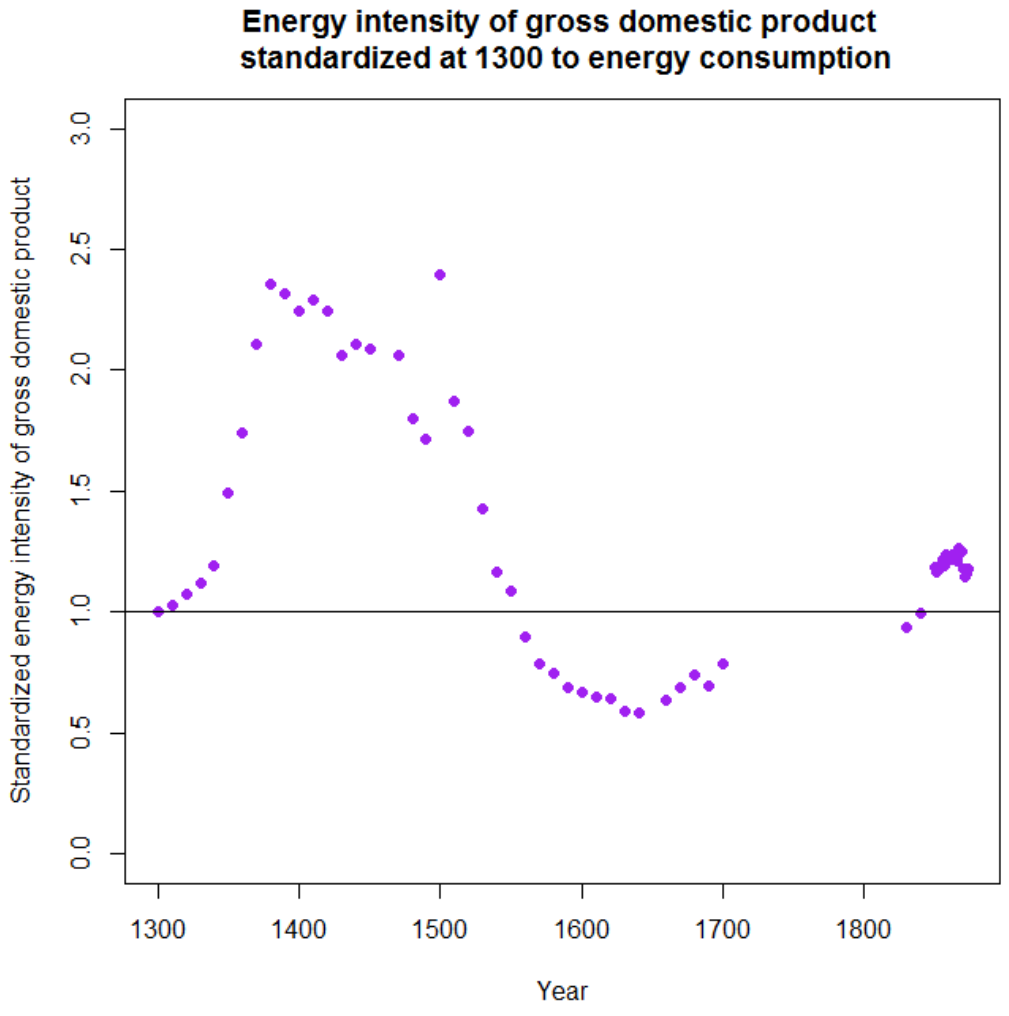


Figure: Log of GDP, with structural breaks

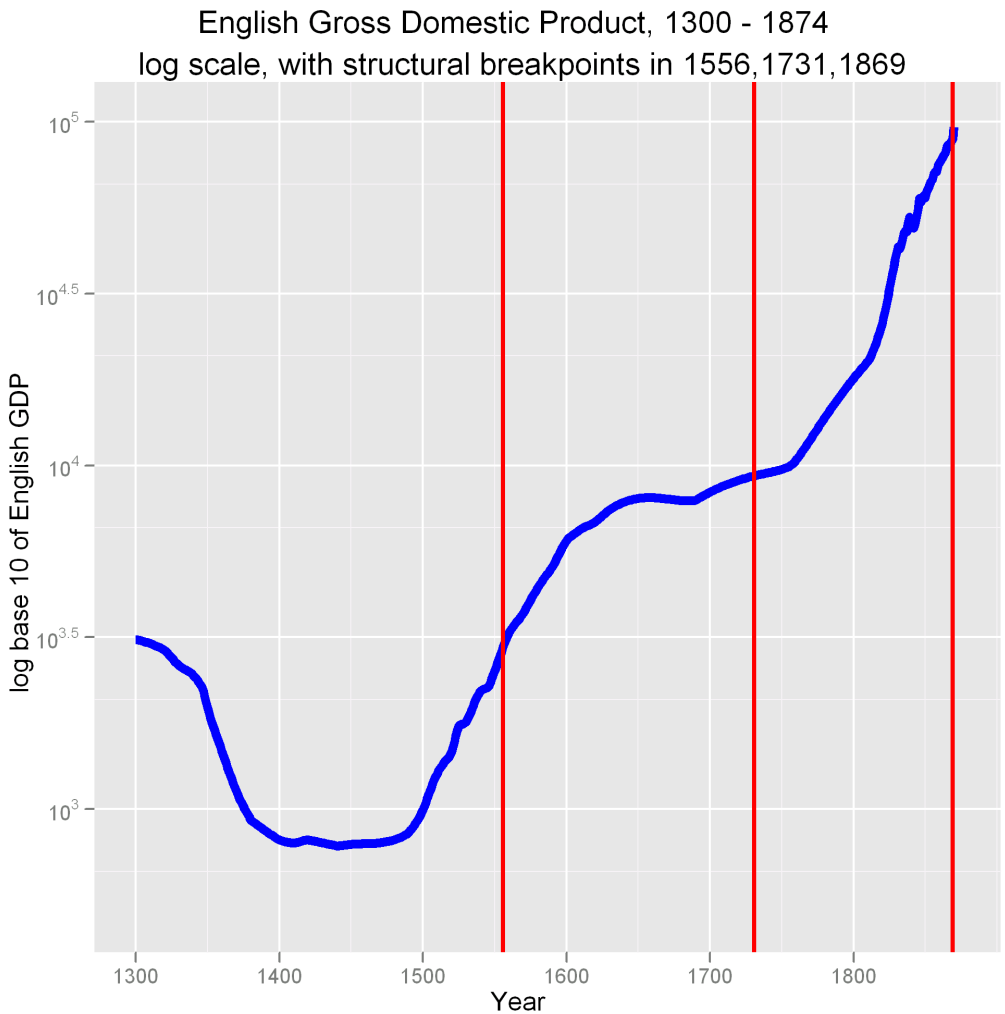
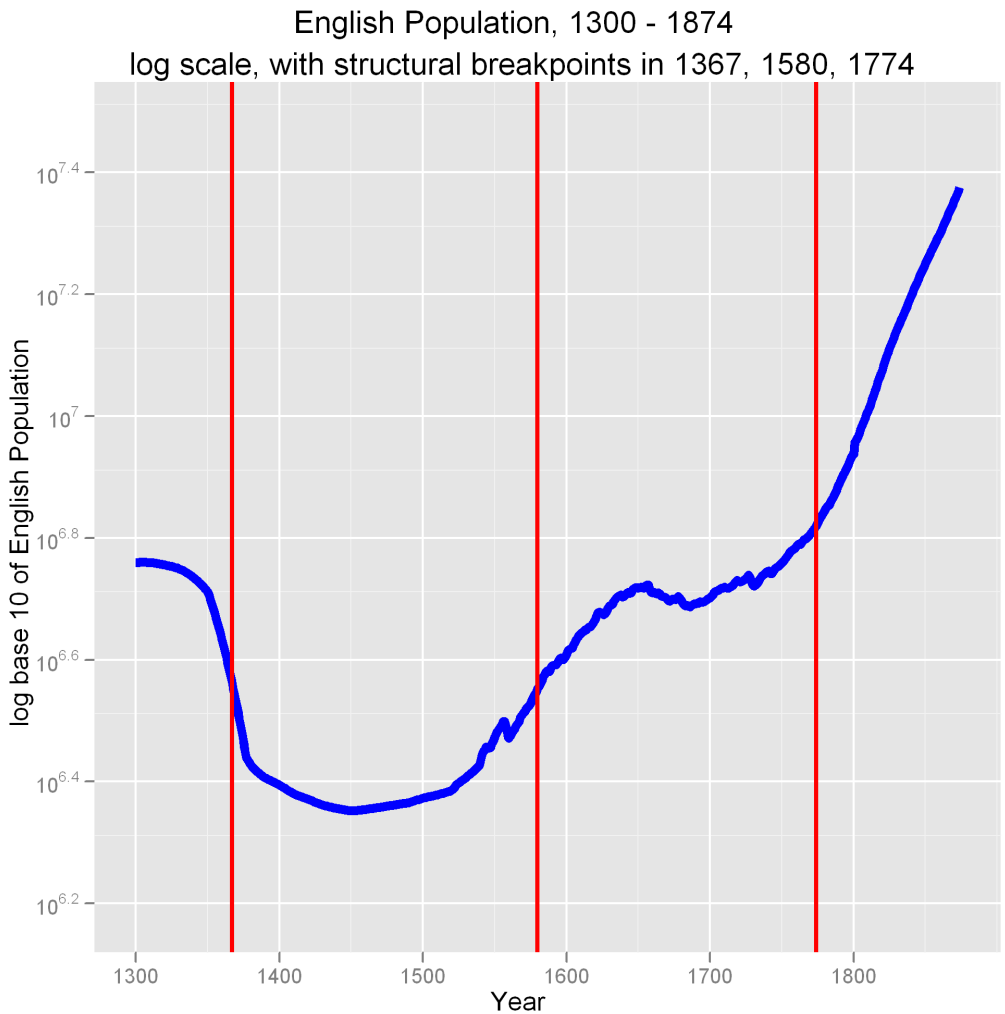


Figure: Log of population, with structural breaks



Data Sources

Data series	Year range	Geography	Source
Energy consumption	1300 – 1873	England/Wales	Roger Fouquet (2008)
Gross domestic product	1300 – 1700	England	Graeme Snooks (1994)
	1741 – 1873	England/Wales	Lawrence Officer (2009)
Population	1300 – 1540	England	Graeme Snooks (1994)
	1541 – 1800	England	B. R. Mitchell (1988)
	1801 – 1873	England/Wales	B. R. Mitchell (1988)

Table: growth rates by century

Year	1300	1400	1500	1600	1700	1801	1873	Total
GDP Million 2005 GBP	3114.7541	815.1288	994.4571	6031.953	8361.5911	18110	102811	
Century-over-century rate of growth		-0.738	0.220	5.066	0.386	1.166	4.677	32.008
Compounded annual rate of growth		-0.013	0.002	0.018	0.003	0.008	0.024	0.006
Energy consumption	1.7	1	1.3	2.2	3.6	11.6	66.1	
Century-over-century rate of growth		-0.412	0.300	0.692	0.636	2.222	4.698	37.882
Compounded annual rate of growth		-0.005	0.0026	0.005	0.005	0.012	0.024	0.006
Per-capita GDP 2005 GBP	542	329	421	1,484	1,663	1,999	4,392	
Century-over-century rate of growth		-0.393	0.282	2.521	0.121	0.202	1.198	7.108
Compounded annual rate of growth		-0.005	0.002	0.013	0.001	0.002	0.011	0.004

Table: Energy and GDP fit tests

Test	Statistic	p-value
Pearson's correlation	0.998	
Paired t-test	5.592	4.991e-07
Chi-square	2864	0.0004998

Engels – Socialism: Utopian and Scientific (1880)

III [Historical Materialism]

The materialist conception of history starts from the proposition that the production of the means to support human life and, next to production, the exchange of things produced, is the basis of all social structure; that in every society that has appeared in history, the manner in which wealth is distributed and society divided into classes or orders is dependent upon what is produced, how it is produced, and how the products are exchanged. From this point of view, the final causes of all social changes and political revolutions are to be sought, not in men's brains, not in men's better insights into eternal truth and justice, but in changes in the modes of production and exchange. They are to be sought, not in the philosophy, but in the economics of each particular epoch. The growing perception that existing social institutions are unreasonable and unjust, that reason has become unreason, and right wrong [1], is only proof that in the modes of production and exchange changes have silently taken place with which the social order, adapted to earlier economic conditions, is no longer in keeping. From this it also follows that the means of getting rid of the incongruities that have been brought to light must also be present, in a more or less developed condition, within the changed modes of production themselves. These means are not to be invented by deduction from fundamental principles, but are to be discovered in the stubborn facts of the existing system of production.