# Was Allen right?

*Energy prices in Great Britain and Sweden in historical perspective*

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# Classical Economists

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  - Three factors: $Y = K + L + Ln$
  - $K$ and $L$ could be reproducible
  - $Ln$ is finite

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  - *Ln* is finite

# Debate around Coal

- Clark and Jacks [2007] emphasise the possibilities of England (+Wales) to do the Industrial revolution without coal
  - Firewood as substitute
  - Institutions are the main causes of the IR
- The *classical* explanation [Wrigley, 1962, 2010] has been reinforced by the cliometrics analysis [Allen, 2009; Rourke and Fernihough, 2014]
  - [Allen, 2009] exposes that the energy/labour ratio is lower in England than in the rest of Europe $\rightarrow$ incentive to invest in saving labour machinery
  - [Rourke and Fernihough, 2014]

# 5 stylized facts of the Industrial revolution

Voth [2003]

- Slow productivity and output growth
- Stagnant living standards
- Rising labour input
- Structural change
- Rapid demographic growth

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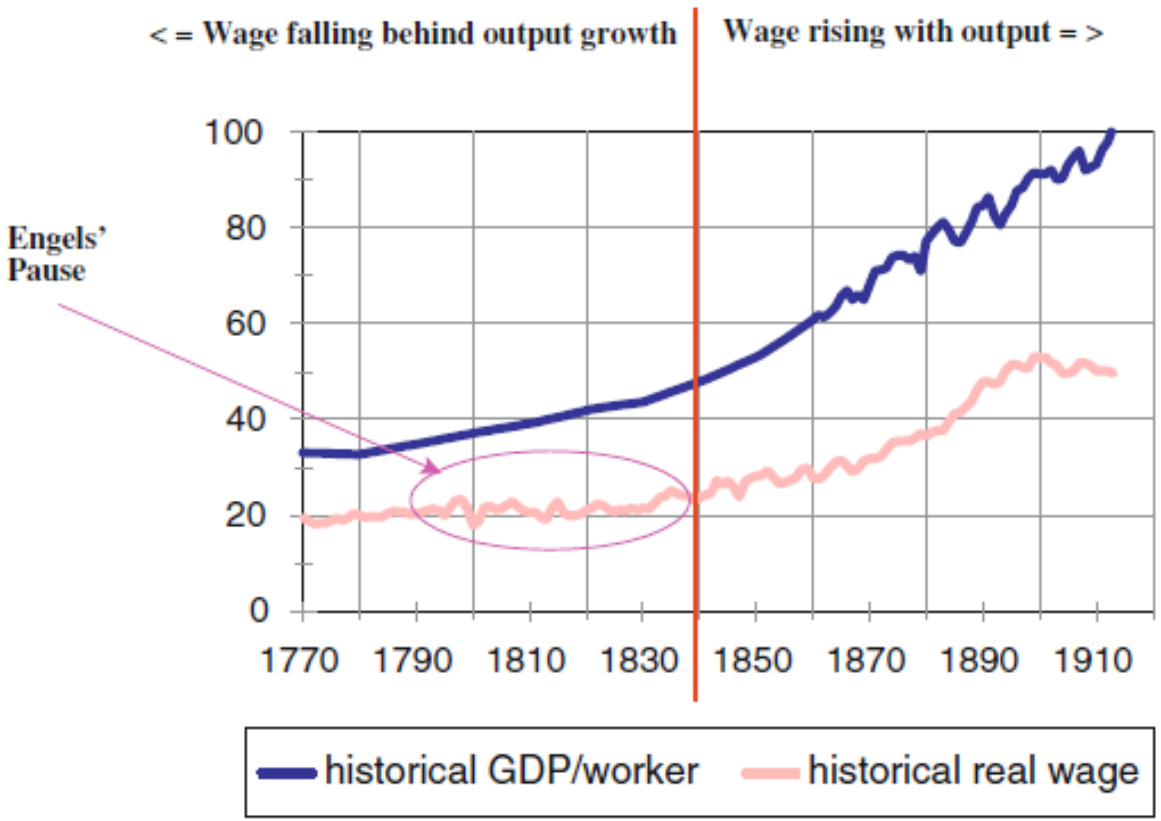
# Slow growth

## Output and productivity growth

| | Feinstein (1981) | Crafts (1985) | Crafts & Harley (1992) | Antras & Voth (2003) |
|---|---|---|---|---|
| **Output** | | | | |
| 1760-1800 | 1,1 | 1 | 1 | |
| 1801-1831 | 2,7 | 2 | 1,9 | |
| 1831-1860 | 2,5 | 2,5 | 2,5 | |
| **Productivity** | | | | |
| 1760-1800 | 0,2 | 0,2 | 0,1 | 0,27 |
| 1801-1831 | 1,3 | 0,7 | 0,35 | 0,54 |
| 1831-1860 | 0,8 | 1 | 0,8 | 0,33 |

# Stagnant living standards

GDP per worker and wages



# Rising labour input

GDP per capita and working hours (weekly)

| **Developing Countries (1985)** | | | **European countries pre-1913** | | |
|---|---|---|---|---|---|
| Country | GDP per Capita | Hours/ Weekly | | GDP per Capita | Hours/ Weekly |
| Sri Lanka | | 47,4 | Germany 1820 -30 | 937 | 75 |
| Ecuador | 1150 | 44,0 | Germany 1870 -80 | 1300 | 72 |
| Korea | 2260 | 49,0 | UK 1856 | 1888 | 65 |
| Thailand | 1020 | 48,6 | UK 1856 | 2610 | 56 |
| Egypt | 620 | 56,0 | France 1856 | 1379 | 72 |
| Kenya | 300 | 42,0 | France 1910 | 2734 | 60 |
| Bolivia | 440 | 44,9 | USA 1832 | 1048 | 67,8 |
| Chile | 1410 | 43,1 | USA 1880 | 2247 | 60,5 |
| Uruguay | 1500 | 43,4 | | | |
| Paraguay | 1130 | 47,0 | | | |
| Costa Rica | 1270 | 43,0 | | | |
| Poland | 2020 | 38,3 | | | |
| Portugal | 2220 | 38,8 | | | |
| Average | 1208,5 | 45,0 | Average | 1768 | 66 |

# Structural change

| | | 1700 | 1760 | 1840 |
|---|---|---|---|---|
| | **Employment (male)** | | | |
| **Agriculture** | Great Britain | 61,2 | 52,8 | 28,6 |
| | European average | 72 | 66,2 | 54,9 |
| **Industry** | Great Britain | 18,5 | 23,8 | 47,3 |
| | European average | 12,6 | 16,9 | 25,3 |
| **Services** | Great Britain | 20,3 | 23,4 | 24,1 |
| | European average | 15,4 | 16,9 | 19,8 |
| | **Output** | | | |
| **Agriculture** | Great Britain | 37,4 | 37,5 | 24,9 |
| | European average | 51,4 | 46,6 | 37,2 |
| **Industry** | Great Britain | 20 | 20 | 31,5 |
| | European average | 19,3 | 21,3 | 25,2 |
| **Services** | Great Britain | 42,6 | 42,5 | 43,6 |
| | European average | 29,3 | 32,1 | 37,6 |
| | Income per capita (1970 US dollars) | 333 | 399 | 567 |

# Rapid demographic growth

Demographic growth, England and Wales

| Year | Population (Millions) | growth rate |
|---|---|---|
| 1700 | 5,50 | |
| 1750 | 6,50 | 0,33 |
| 1800 | 9,00 | 0,65 |
| 1850 | 17,90 | 1,38 |
| 1900 | 32,50 | 1,20 |
| 1950 | 43,60 | 0,59 |
| 2000 | 52,00 | 0,35 |

# High wage economy debate

## Main ideas by Allen

- The wages in Britain are comparative (and in relative terms) higher than the rest of the world
- The energy prices are cheaper than Europe because the existence of abundant coal mines [Allen, 2009]
- The energy/labour ratio is an incentive to invest in machinery

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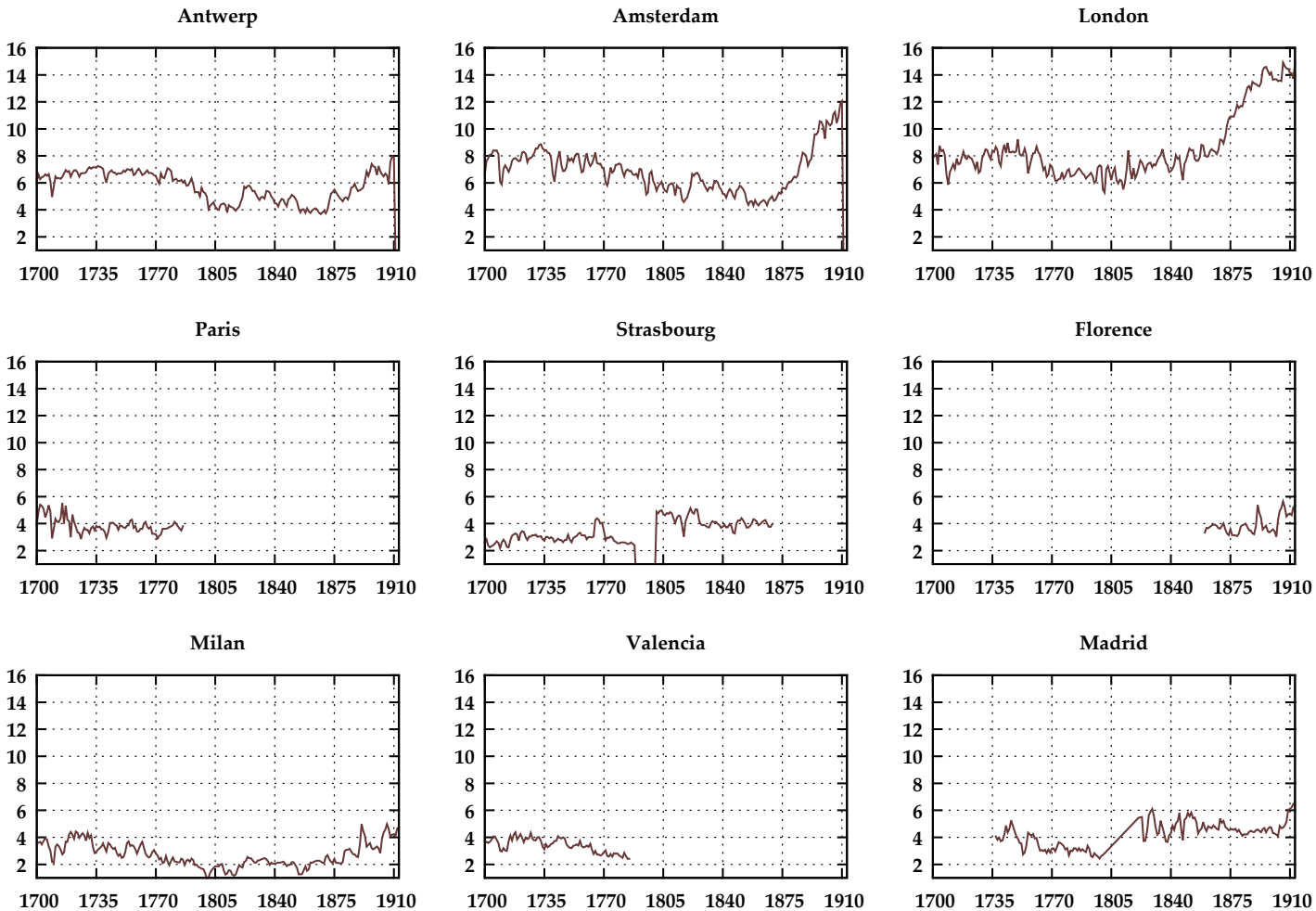
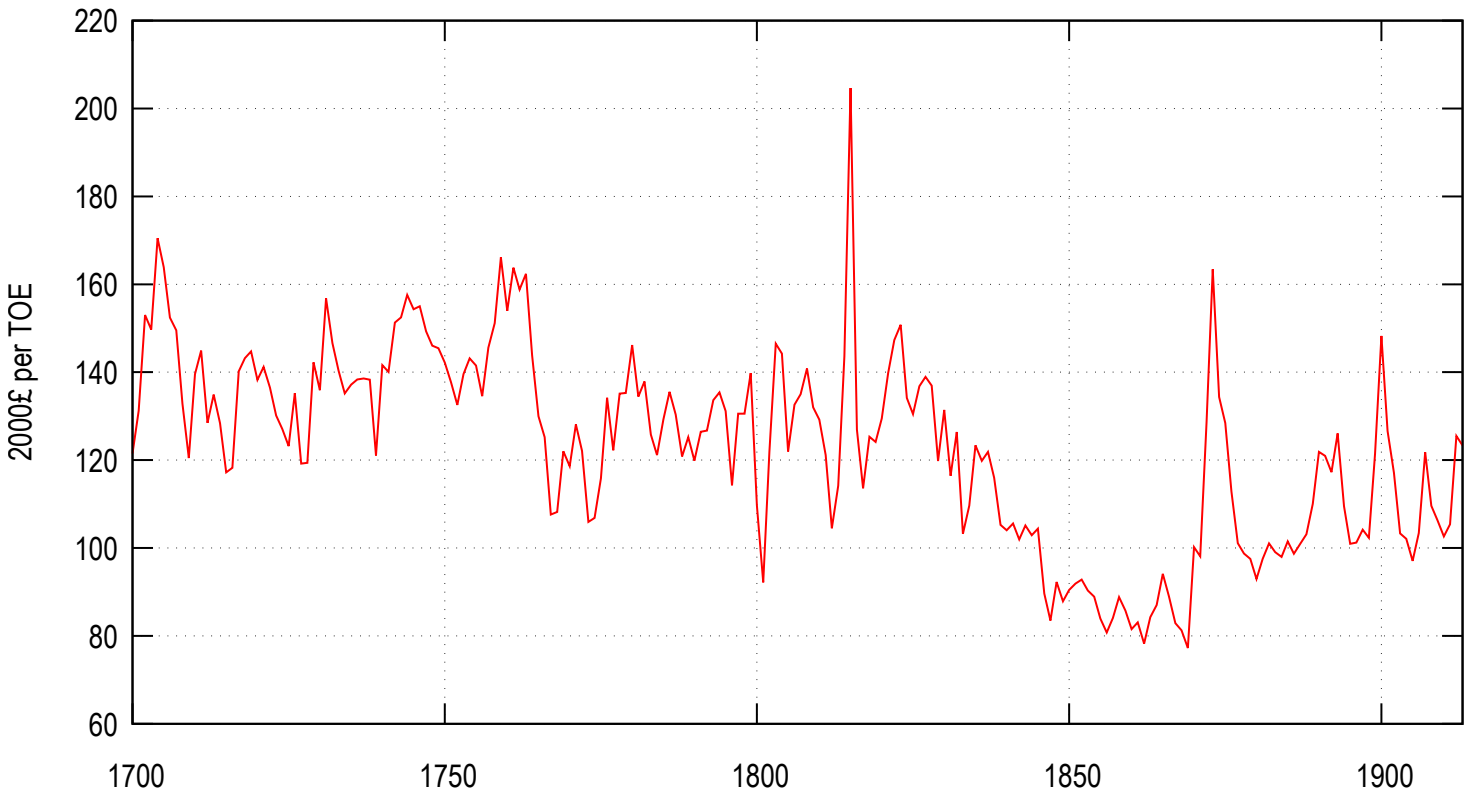
# Relative wages

## Daily salaries in silver grams. Several European cities

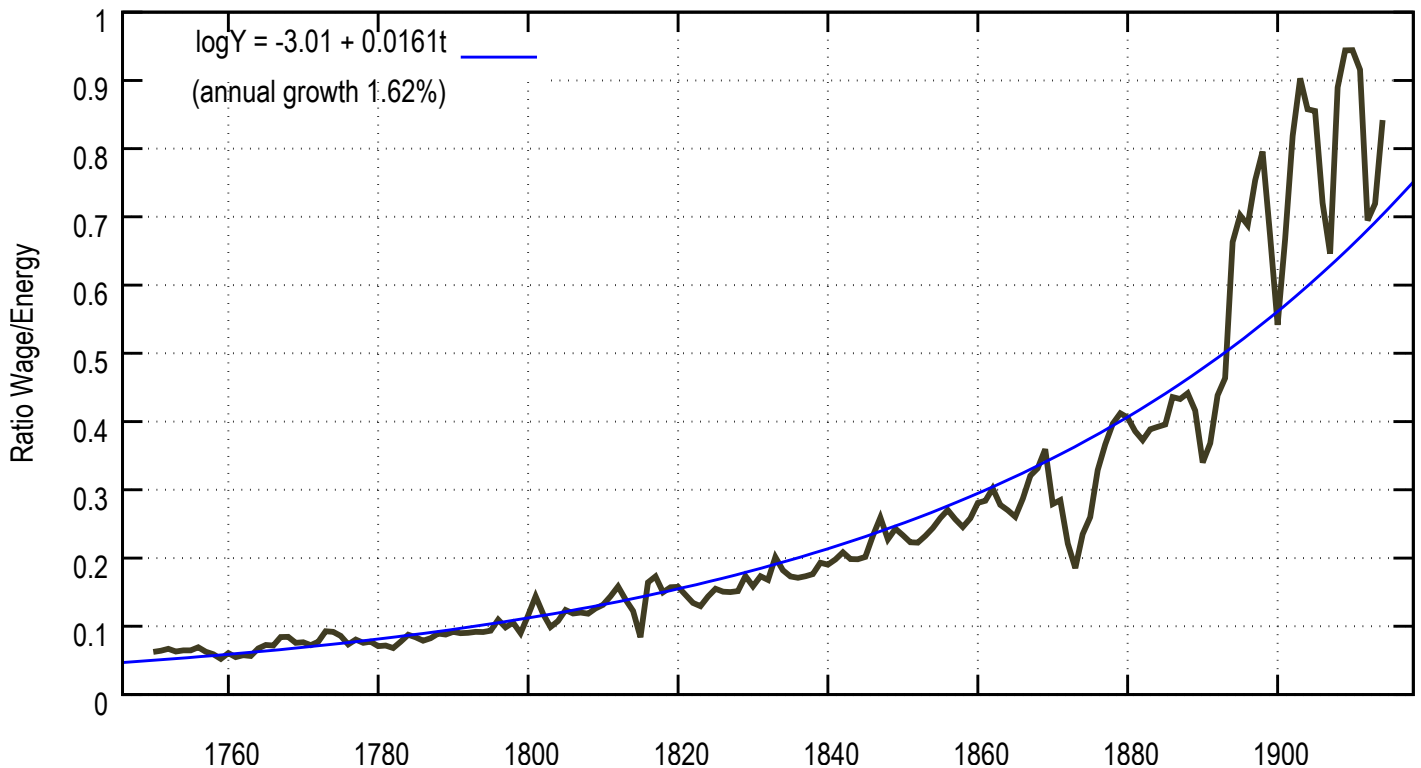


# Coal prices in Great Britain

## Coal prices £ 2000 in TOE



# Wage/Energy ratio in England. Daily salaries and Energy prices



- Data Reconstruction on prices since XVIth century
  - Firewood Consumption Lindmark & Olsson Spjut (2016), "Industrialization and the transformation of the organic energy system: revisiting Sweden 1800-1913", forthcomming
  - Söderberg, J. & Edvinsson,. R. (2010), The evolution of Swedish consumer prices, 1290–2008 (Prices are from Stockholm)
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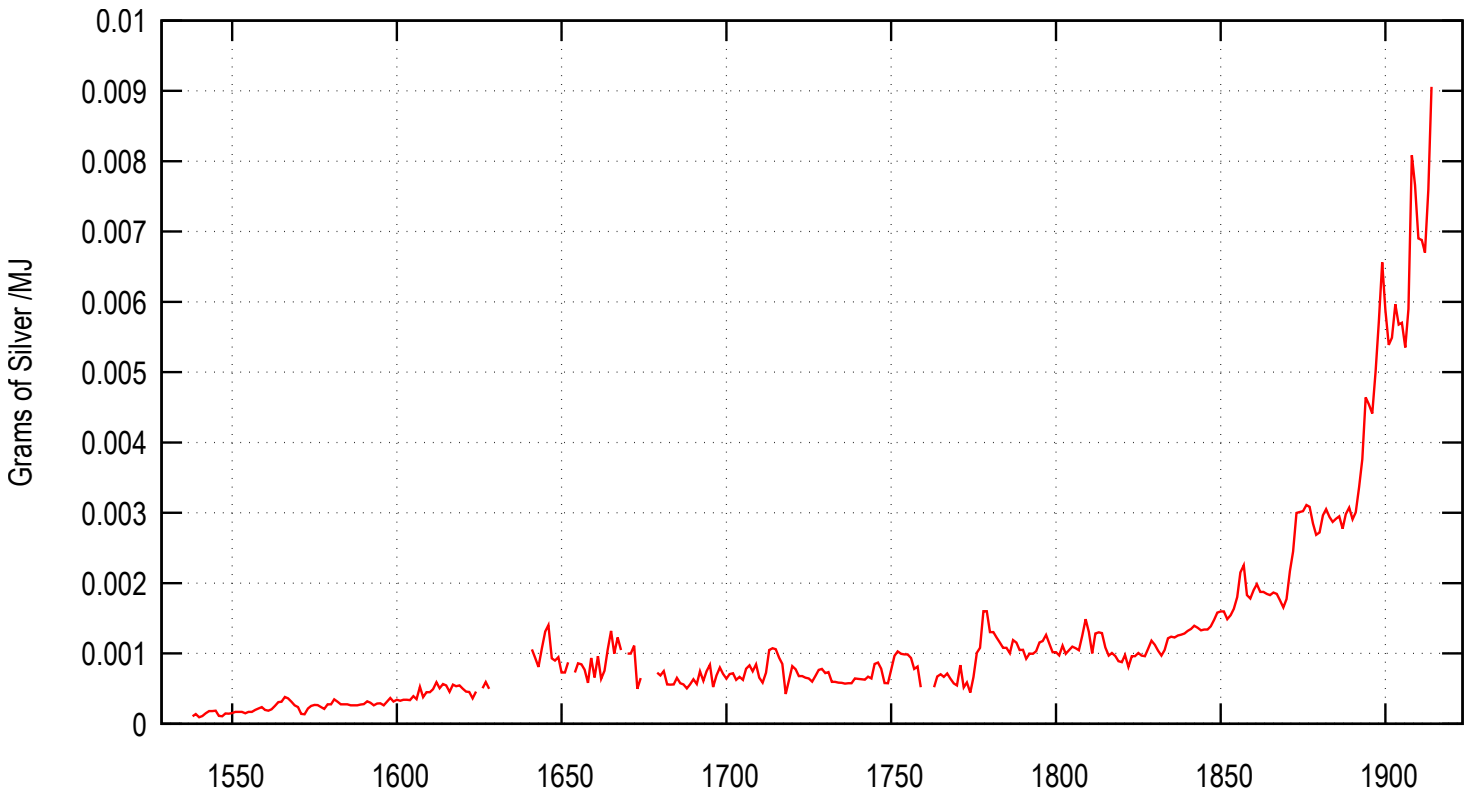
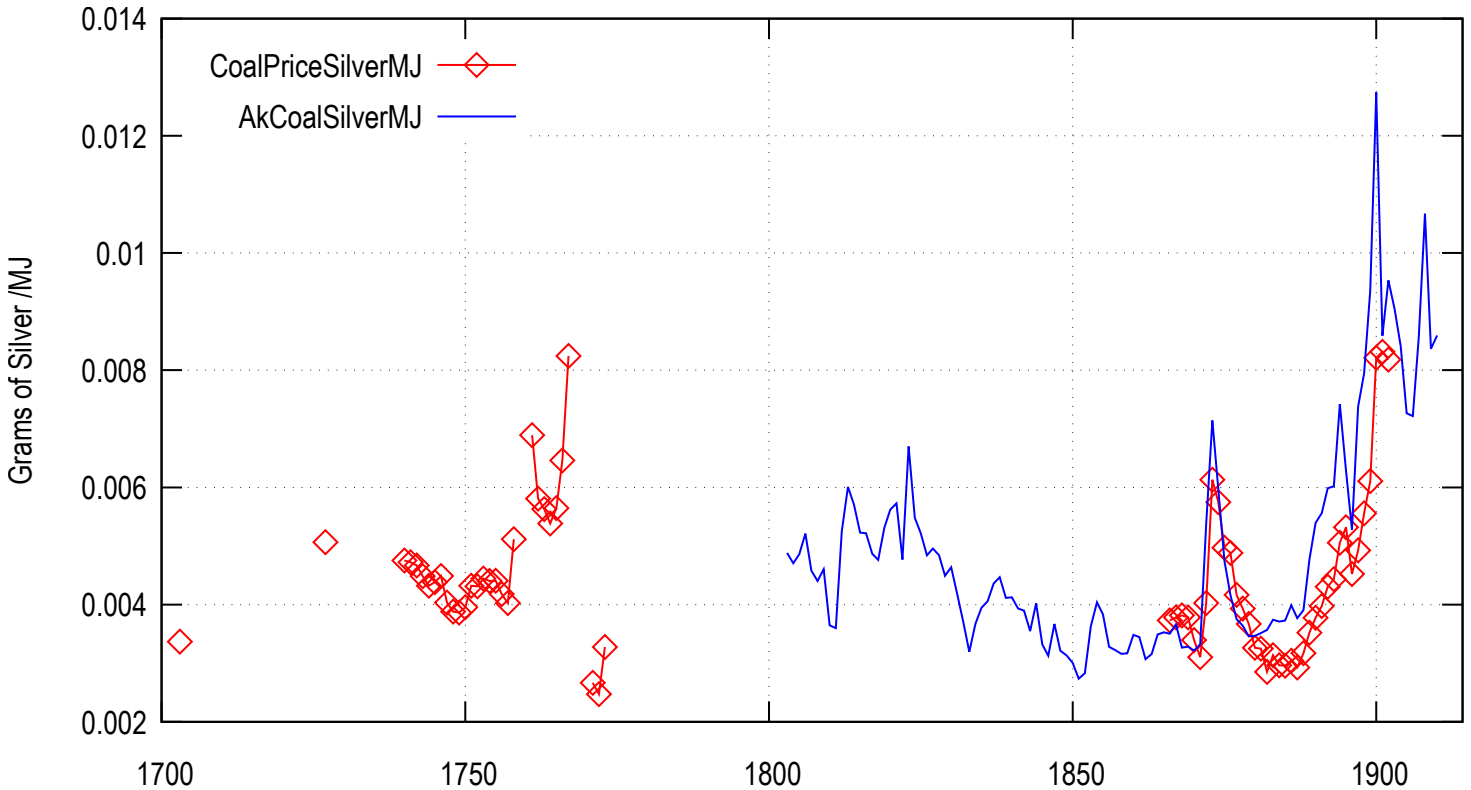
# Firewood price in the long run

Grams of silver per MJ



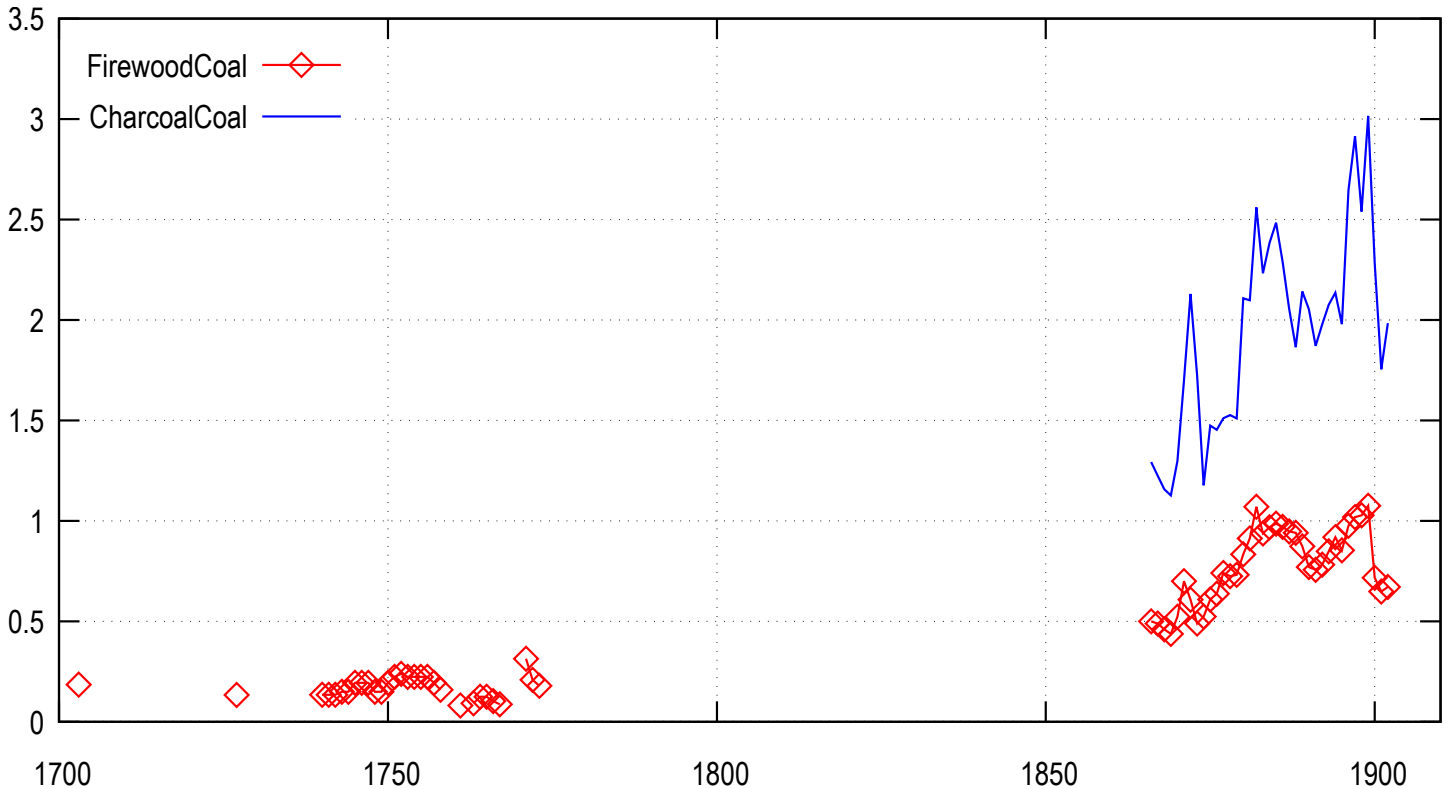
# Coal Price in the long run

## Coal prices in grams of silver/MJ 1700 - 1913



# Ratios between Firewood and Charcoal with Coal

Firewood/Coal and Charcoal/Coal grms of silver/MJ. 1700 - 1913



- The energy price plays a role in industrial revolution
- The role is not so clear in latecomers
- Energy matrix is important to understand the incentives
- Two Papers
  - Allen was right? Cobb - Douglas estimation including energy
  - Energy price elasticities in the long run. Capital and Energy by sectors

Allen, R. C. (2009). *The British industrial revolution in global perspective*. Cambridge: Cambridge University Press.

Clark, G. and D. Jacks (2007, April). Coal and the Industrial Revolution, 1700-1869. *European Review of Economic History 11*(1), 39–72.

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Voth, H.-J. (2003). Living standards during the industrial revolution: An economist's guide. *American Economic Review*, 221–226.

Wrigley, E. (2010). *Energy and the English industrial revolution* (Cambridge ed.).

Wrigley, E. A. (1962, August). The Supply of Raw Materials in the Industrial Revolution. *The Economic History Review 15*(1), 1–16.