



Energy Transitions - Learning from the Great Depression

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IAEE Milan, July 26, 2023

Objective

To explain the cause and proceedings of the 1930s Great Depression from a biophysical economic perspective – and draw lessons for the current low carbon transition.

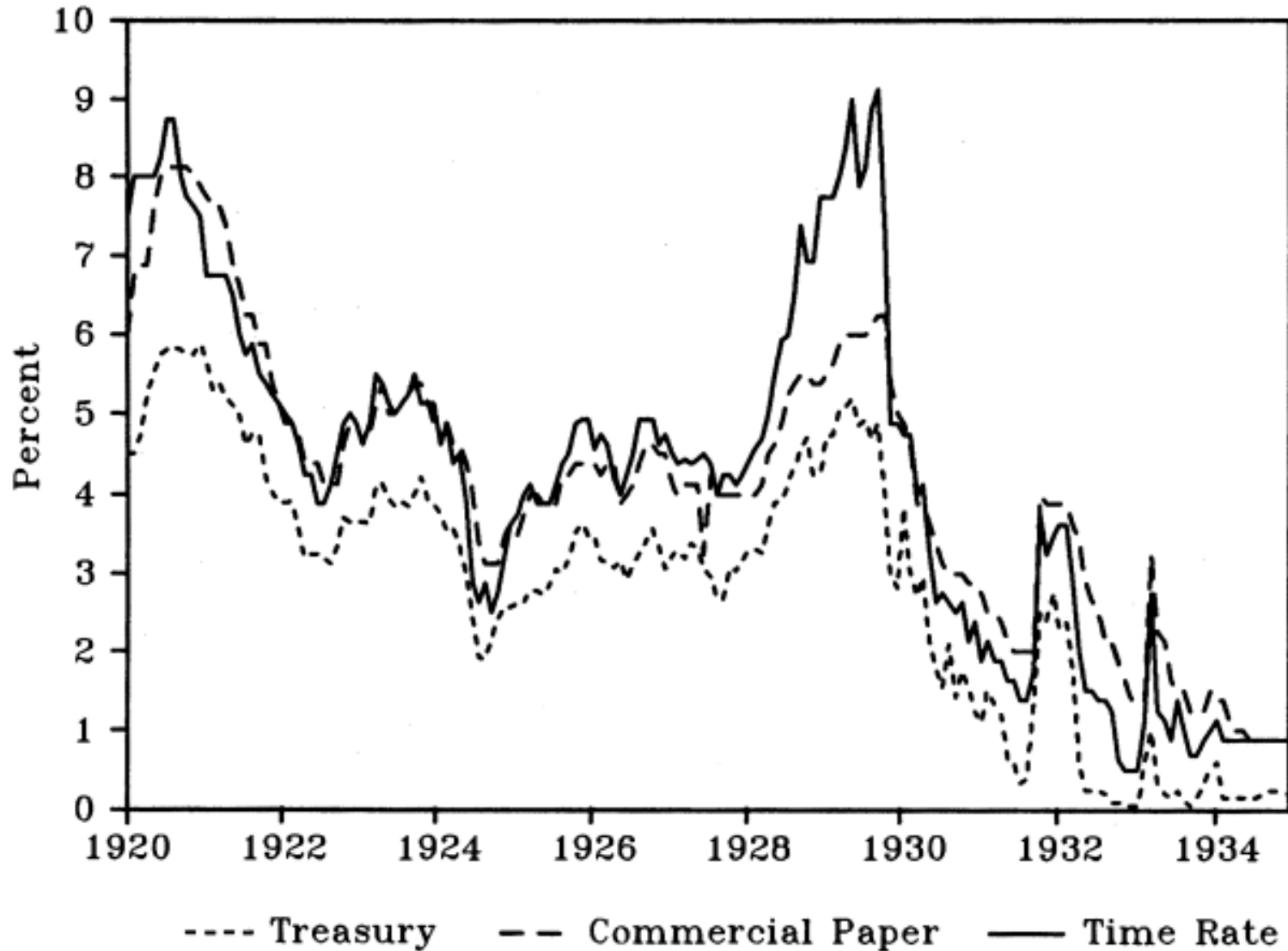




“To understand the Great Depression is the Holy Grail of macroeconomics”

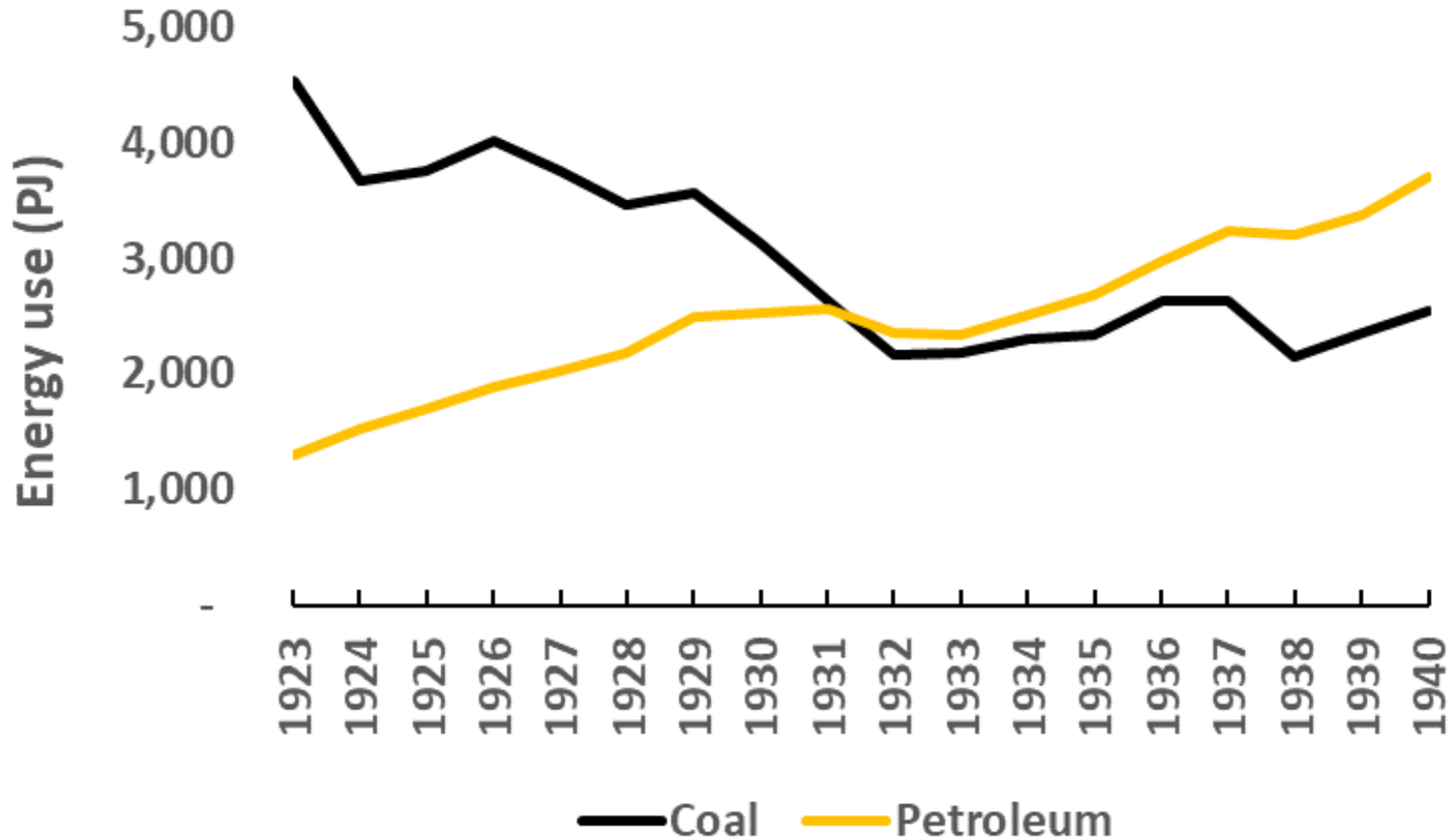
(Bernanke, 2000)

US Interest rates 1920-1934



(Rappoport & White, 1994)⁴

Energy Transitions



US Ground Transportation Fuel Use, 1923-40

Biophysical Economics



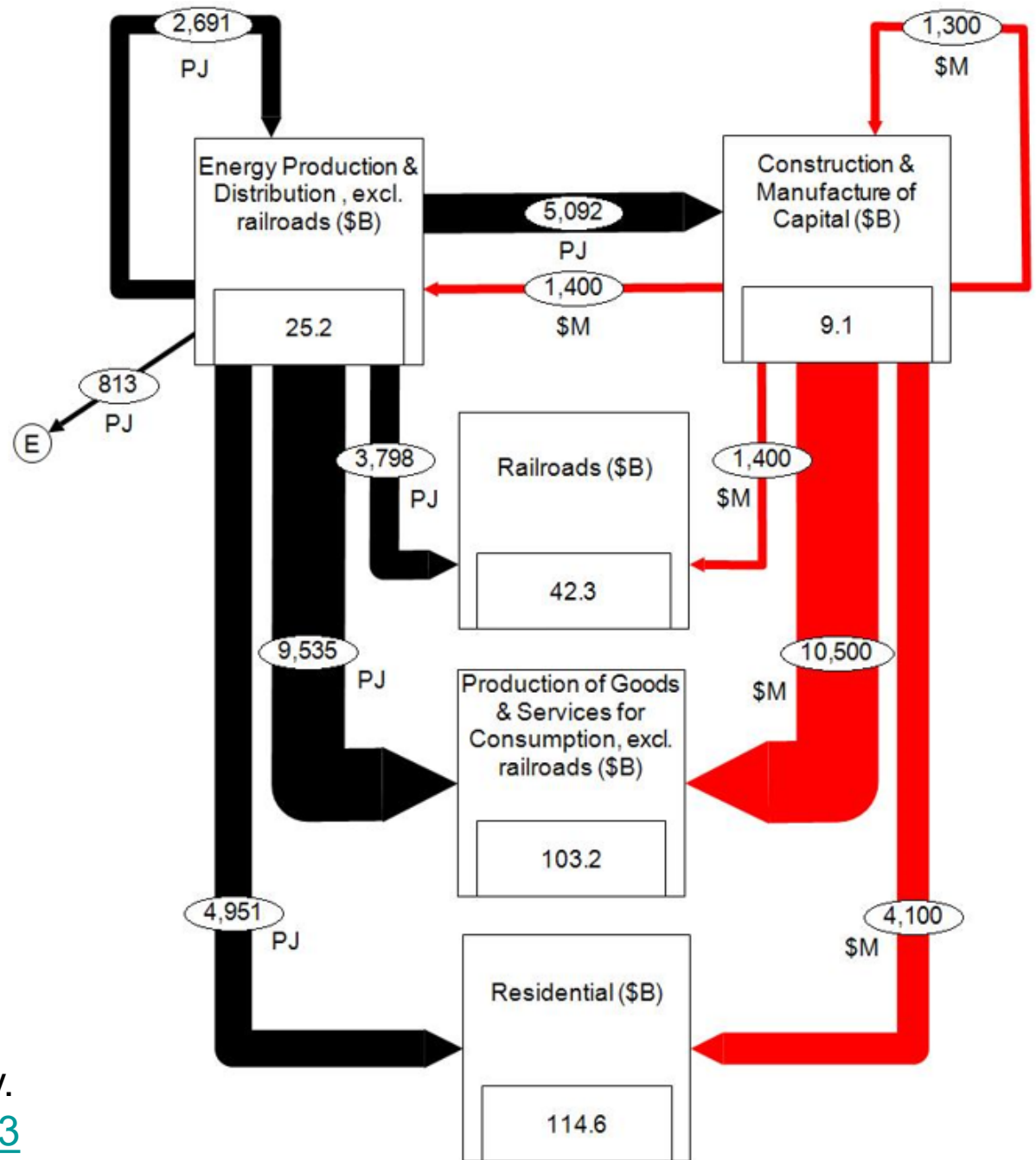
Georgeescu-Roegen

Economies are subject
to the Laws of Physics

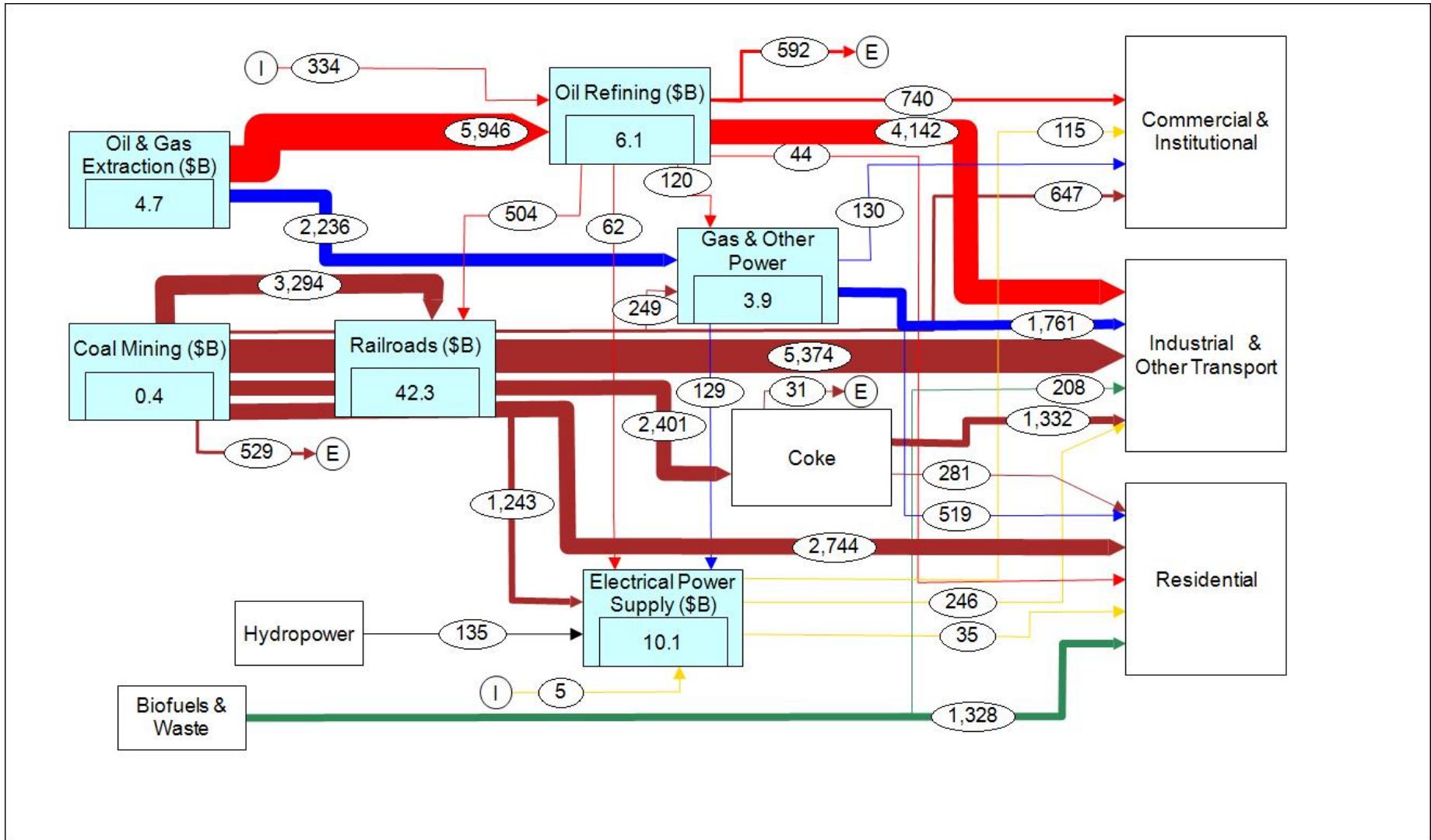
Others: Ayres, Cleveland, Daly,
Fischer-Kowalski, Hall, Odum, +...

Energy and capital in the US economy, 1929

Kennedy, C. A. (2023)
 Biophysical economic interpretation of the Great Depression: A critical period of an energy transition.
 Journal of Industrial Ecology.
<https://doi.org/10.1111/jiec.13404>



US Energy flow, 1929



(Energy in PJ; capital assets in \$ billion)

Hegemonic railroads

In 1929, US railroads:

- were 24% of non-residential capital stock.
- supplied 70 - 76% of energy
- and ~70% of energy for capital formation.

The US economy's main energy delivery system – coal carried by railcars – was hamstrung

Devine (1925):
shortage of rail cars
limits the supply of coal

Hultgren (1942):
“car supply fixes a limit
to the general
expansion of industry.”



Lock-in to the incumbent socio-technological regime



In 1929, 46% of refined petroleum products were carried by rail oil cars.

Oil Discoveries, 1929

“U.S. commercial crude stocks peaked at a staggering 545 million barrels, following the discovery of a series of huge new oil fields in Oklahoma, Texas, the rest of the Southwest and California.”

Kemp (2015)



New York Times, Oct. 22, 1929

STANDARD OIL CUTS CALIFORNIA PRICES

**Reduction of 50 to 75 Cents a
Barrel Attributed to Big
Overproduction.**

OTHERS TO FALL IN LINE

**Shell Company Announces It Will
Meet New Rates—Union Oil
Expected to Act Also.**

New York Times, Oct. 24, 1929
(Black Thursday)

**PRICES OF STOCKS CRASH
IN HEAVY LIQUIDATION;
TOTAL DROP OF BILLIONS**

PAPER LOSS \$4,000,000,000

**2,600,000 Shares Sold
in the Final Hour in
Record Decline.**

MANY ACCOUNTS WIPED OUT

New York Times, Oct. 29, 1929

STANDARD OIL CUTS BIG CRUDE STORAGE

**New Jersey Company Announces
Reduction of 20,000,000 Bar-
rels, or 22%, in 2½ Years.**

REVERSES PREVIOUS POLICY

**Future Held No Longer Uncertain
and Utilization of Stocks
Financially Desirable.**

Holding that the future supply of crude oil was no longer an uncertainty, the Standard Oil Company of New Jersey yesterday announced a reversal of the long established policy of storage of crude oil against a possible shortage. The announce-

New York Times, Oct. 29, 1929
(Black Tuesday)

**STOCK PRICES SLUMP \$14,000,000,000
IN NATION-WIDE STAMPEDE TO UNLOAD;
BANKERS TO SUPPORT MARKET TODAY**

Key elements of the Great Depression

1. Change of energy carrier
2. Change of transportation mode
3. Sudden discovery of new energy resources
4. Hegemonic control over energy/transport system
5. Lock-in of socio-technological regime



Heavier EVs Mean Heavier Car Carriers, So The Trucking Industry Is Fighting For Higher Weight Limits

The Great Slump of 1930 (Keynes, 1930)

“We have involved ourselves in a colossal muddle, having blundered in the control of a delicate machine, the workings of which we do not understand.”

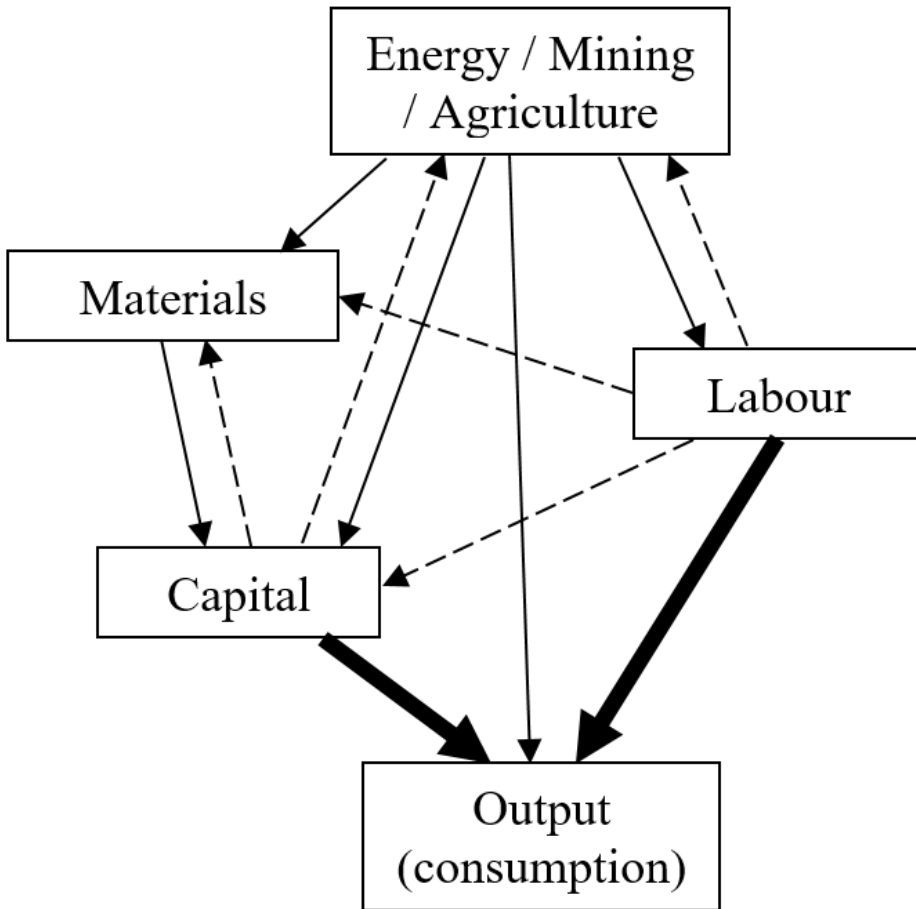
Avoiding Investment in Fossil Fuel Assets

The background of the slide features a hand holding a globe. The globe has the chemical formula 'CO2' and three downward-pointing arrows on it. Surrounding the globe are several circular icons: a solar panel with a sun, an electric car, a factory with smokestacks, wind turbines, and a hand holding a small plant. The overall theme is environmental and climate change.

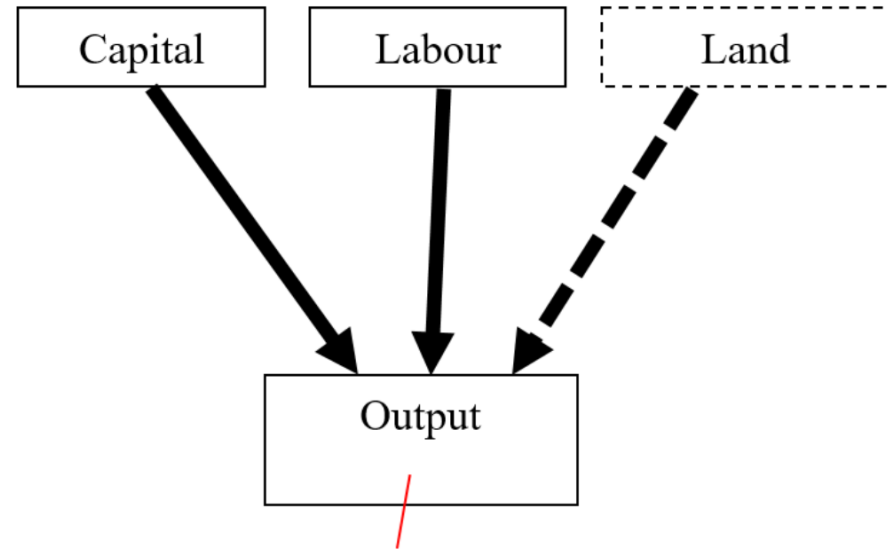
Christopher A. Kennedy, Martin Sers, and Michael I. Westphal

Extra slides

Two World-views



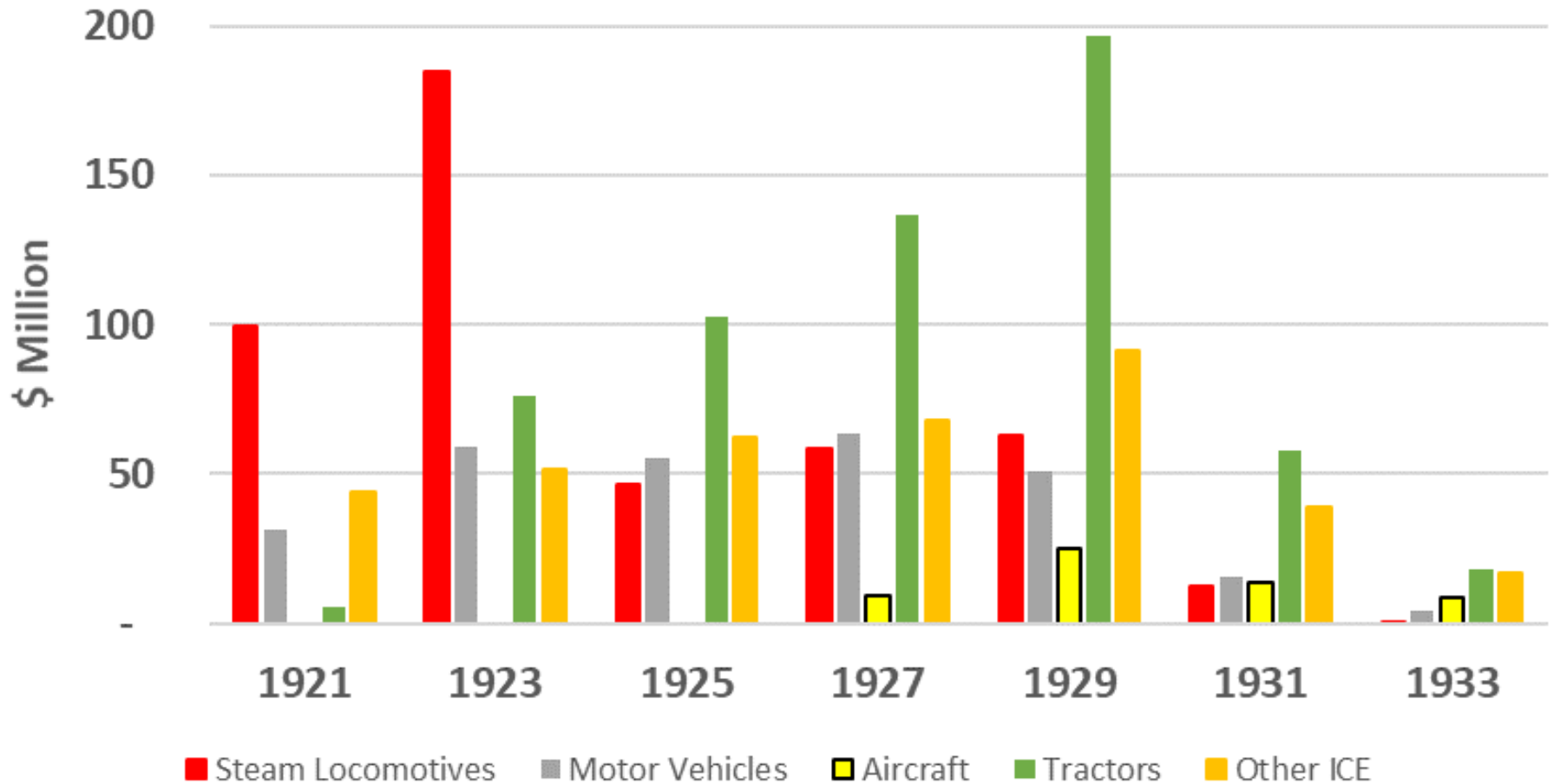
Physical sciences



'Energy' and 'Mining'
are just two small sub-
sectors of output,
amongst many

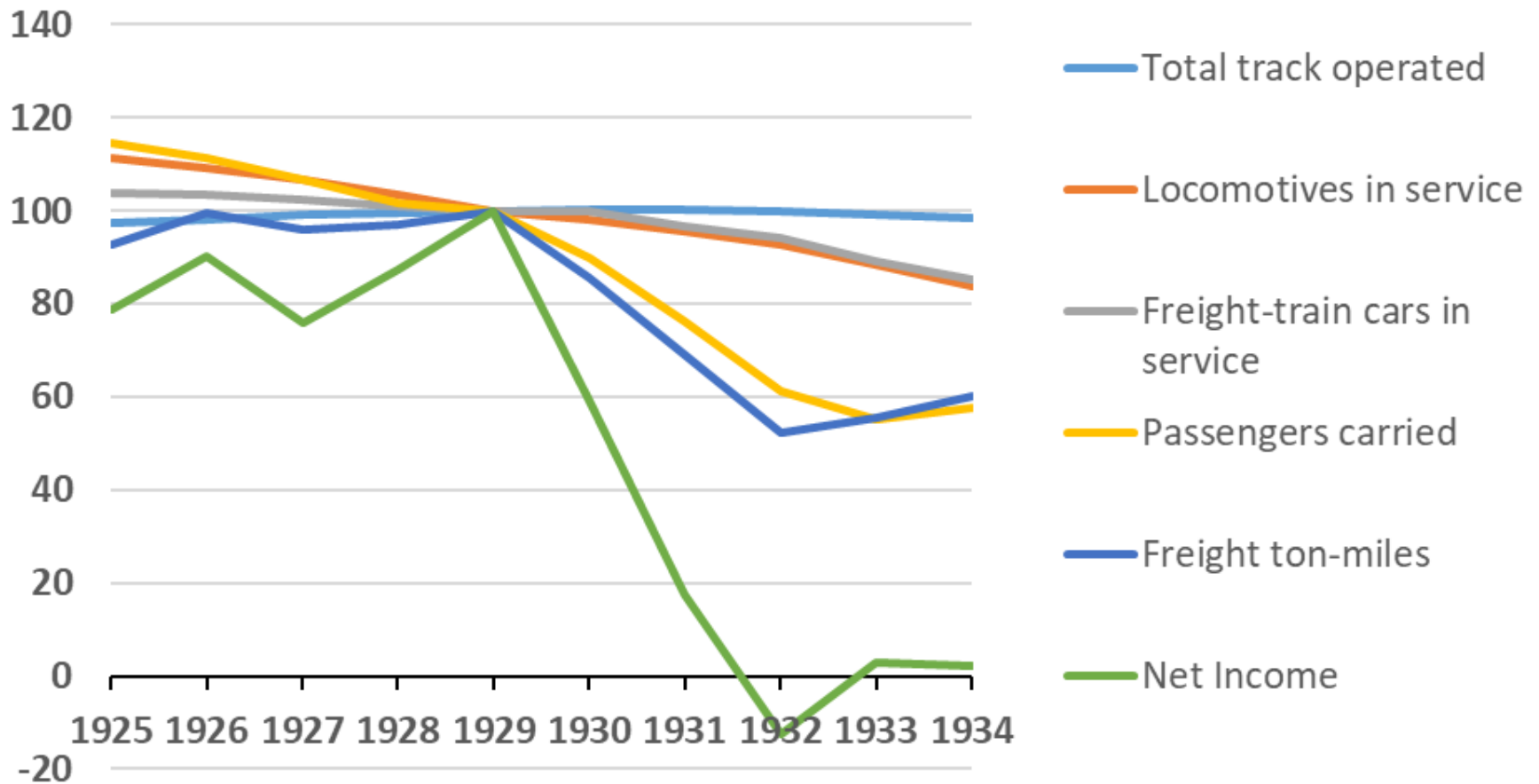
Social sciences

Investments in Engines, Tractors and Locomotives, 1921 to 1933



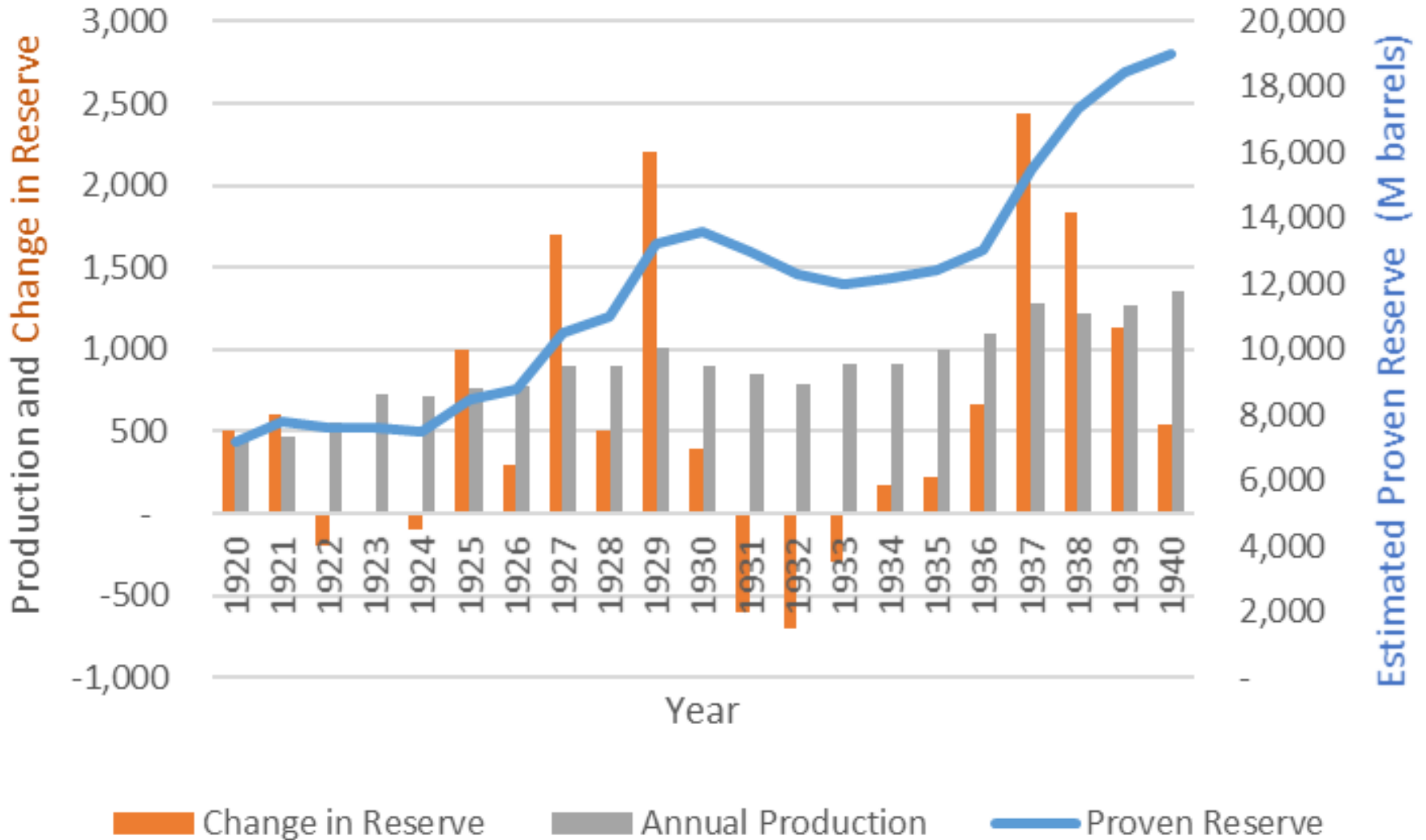
(US Census Bureau, 1930 & 35)

Railroad Performance (Indexed)

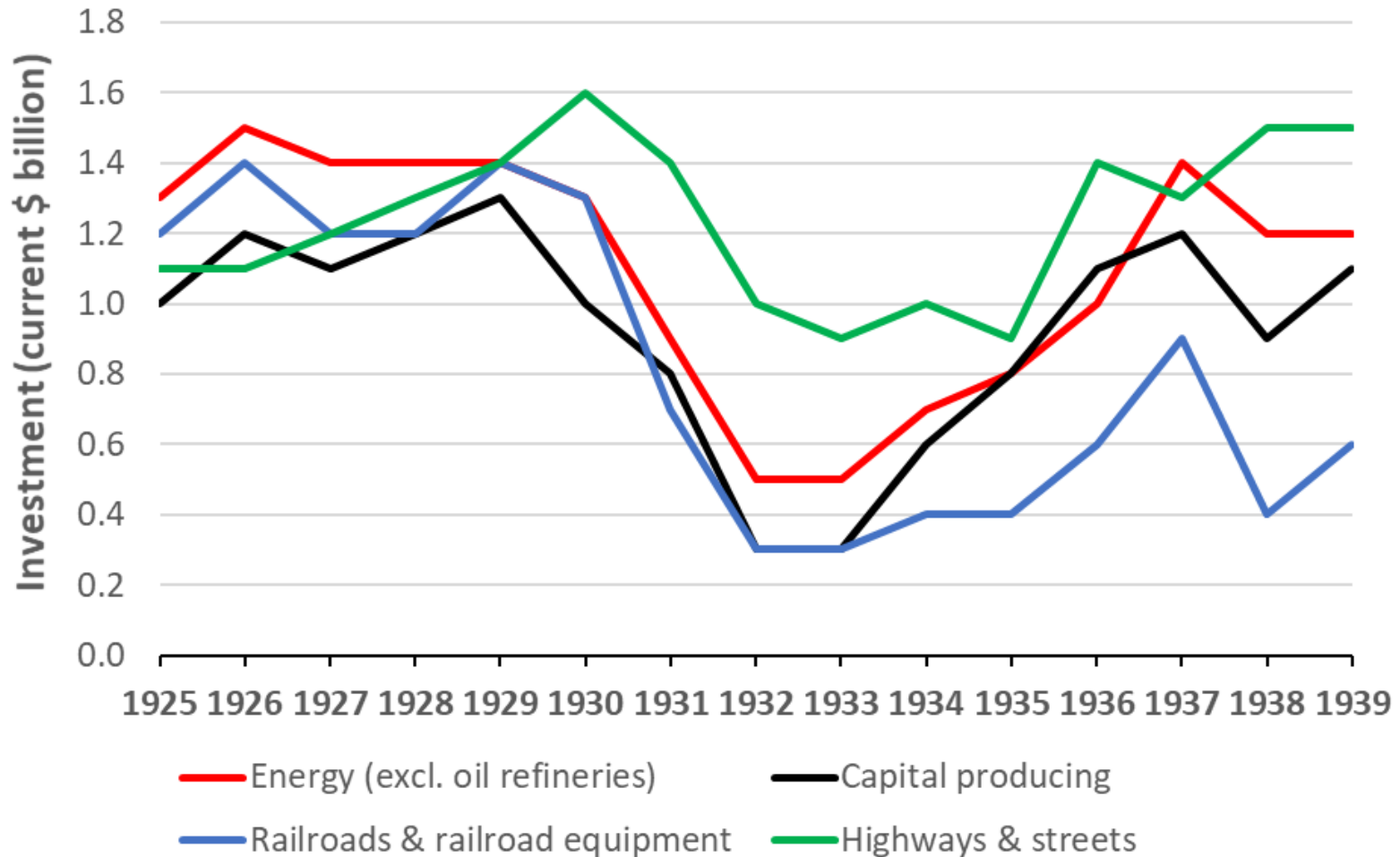


(1929 = 100)

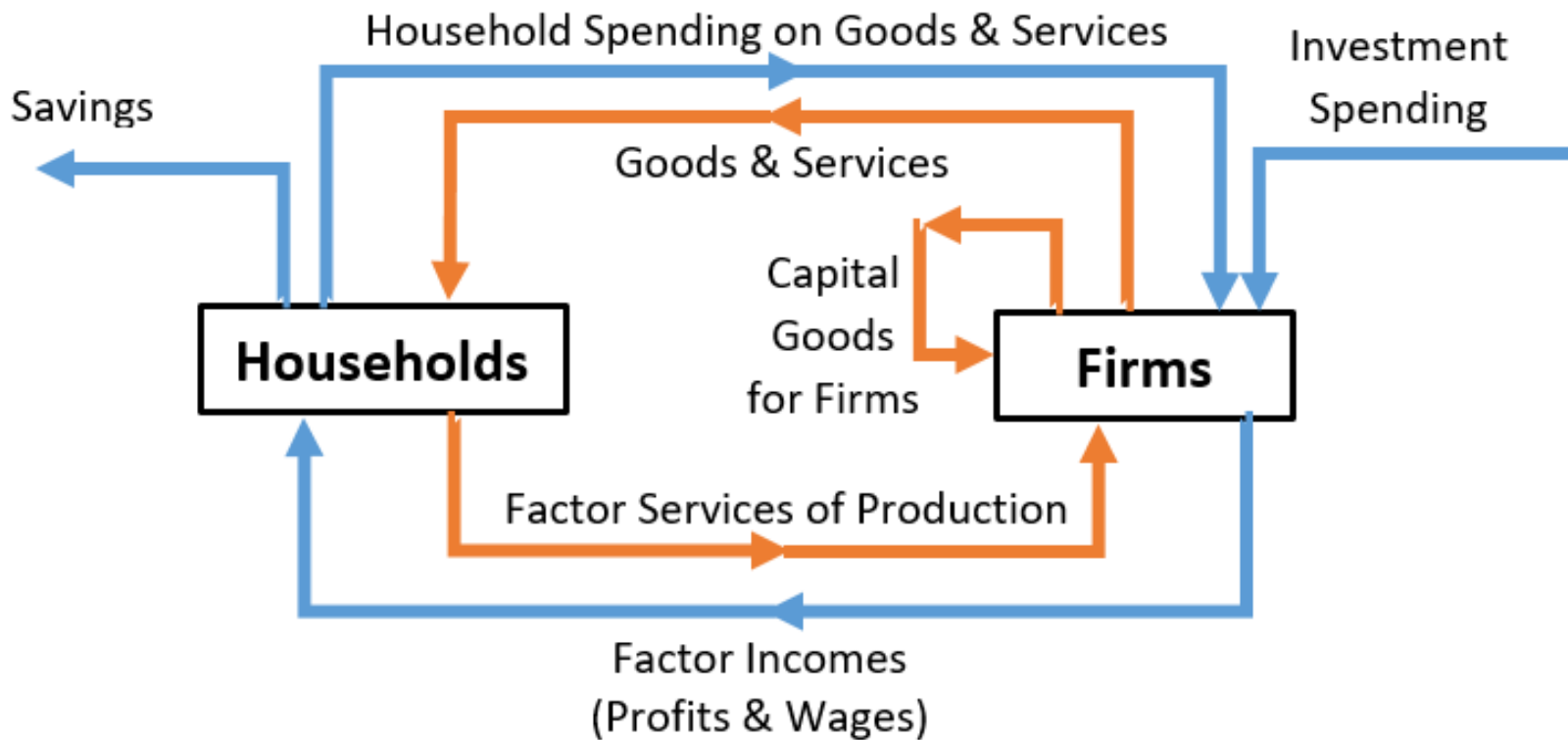
US Oil Reserves 1920-40



US Capital investments, 1925-39



(US BEA, Kennedy, 2023)



Basic circular flow of macroeconomics

(adapted from Fig. 19-4 of Begg, Fischer & Dornbusch, 1987)