CAN SOLAR ACTIVITY INFLUENCE THE OCCURRENCE OF RECESSIONS?

Mikhail Gorbanev

January 2015

Outline

- What are the sunspots, solar cycles, and solar maximums?
- Literature: Jevons and Chizhevsky
- Methodology: Series comparison; stacked cycles
- Findings: Recessions do occur more often around and after solar maximums!
- Projections for the solar maximum of 2014
- Issues for discussion

What Are the Sunspots, Solar Cycles, and Solar Maximums?

Solar activity fluctuates with approximate 11-year period known as the "solar cycle". The cycle is not exactly regular, and significant variations have been observed over centuries.

The cycles can be measured by counting the "sunspots" on the sun surface. Sunspots are temporary phenomena on the photosphere of the sun that appear visibly as dark spots compared to surrounding regions.

The period of elevated solar activity with the highest number of sunspots during the cycle is called "solar maximum".

Around solar maximums, various types of solar activity reach their maximums levels: radio activity, radiance, proton emission, solar wind, flares, coronal mass ejections (CME), etc.

Impact on Earth

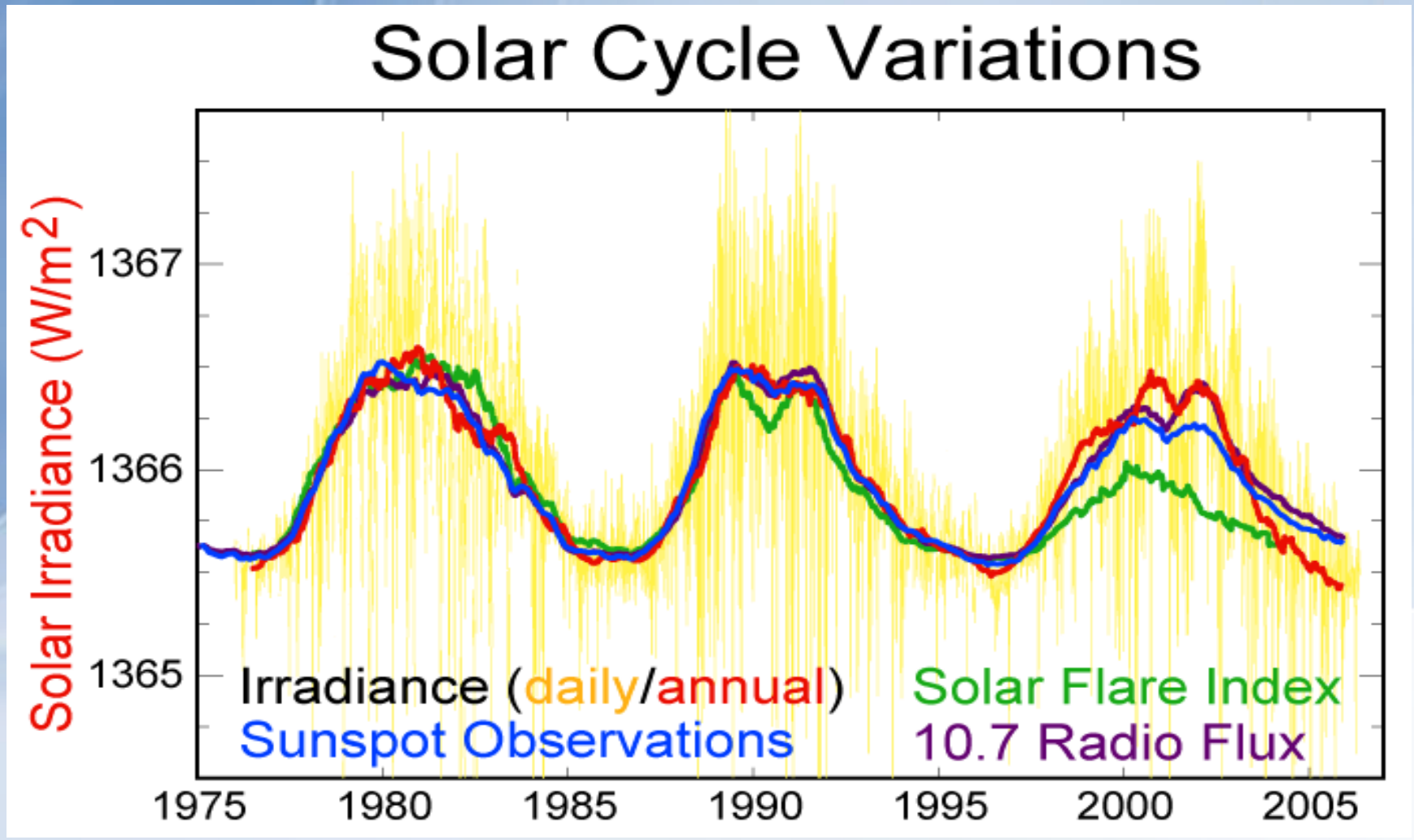
Physical impact: Disruptions of radio and telecommunications; fluctuations in the geomagnetic field ("magnetic storms"); electromagnetic impulses in power grids."Carrington event" in 1859 . CME in mid-2012.

Human health hazard: Geomagnetic storms caused by solar activity can affect people with cardiovascular health conditions and exacerbate psychological and mental illnesses.

Jevons (1875-79): "Commercial crises" in Europe in the XIX century occurred at intervals of 10-11 years, broadly matching the average solar cycle length. "Beautiful coincidence", link to bad harvests.

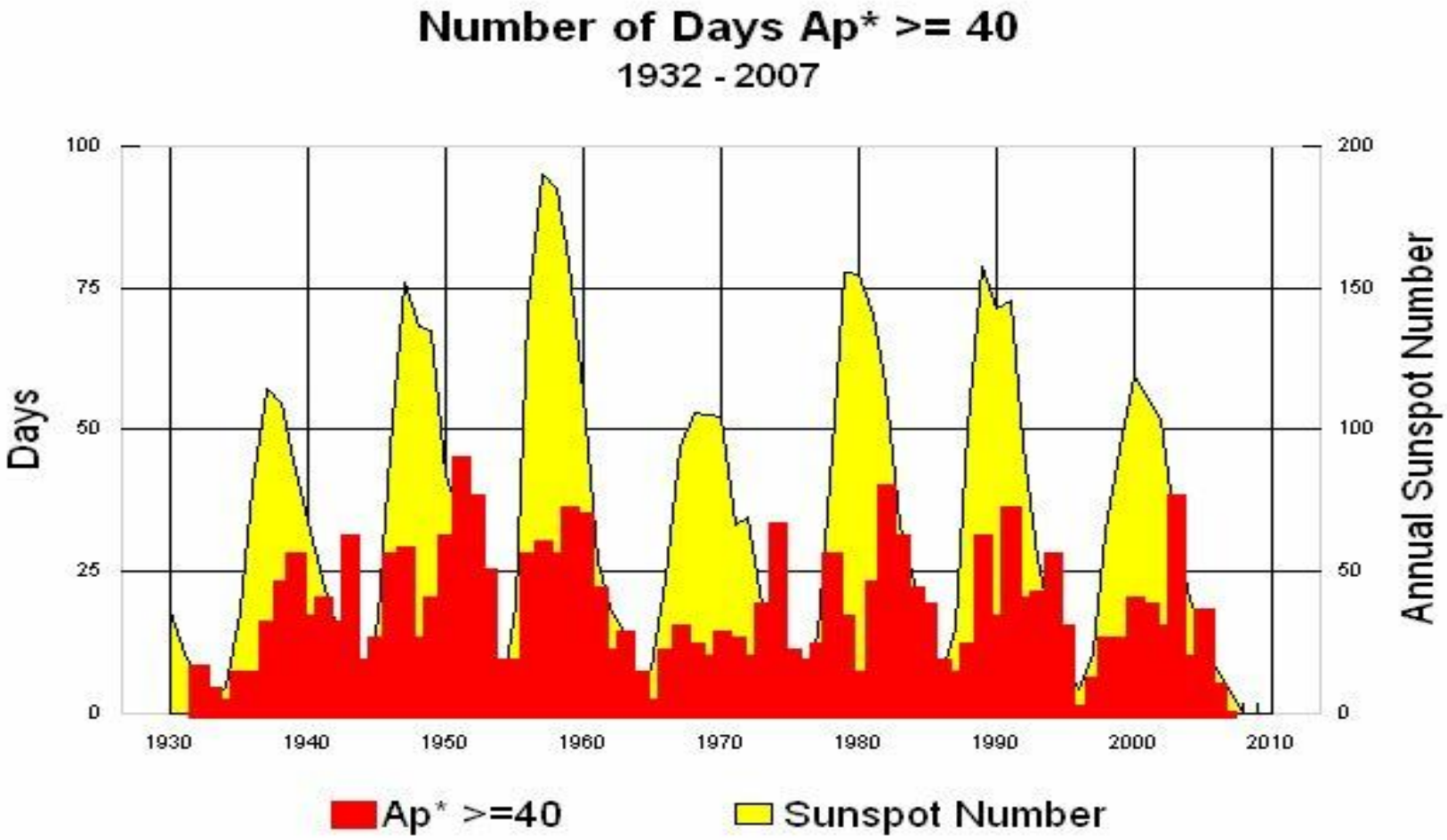
Chizhevsky (1924, 1938, 1976): A significant percent of revolutions and "the most important historical events" occur in the three-year periods around and after sunspot maximums.

Solar flare, radio flux and irradiance fluctuate along with the sunspot cycle



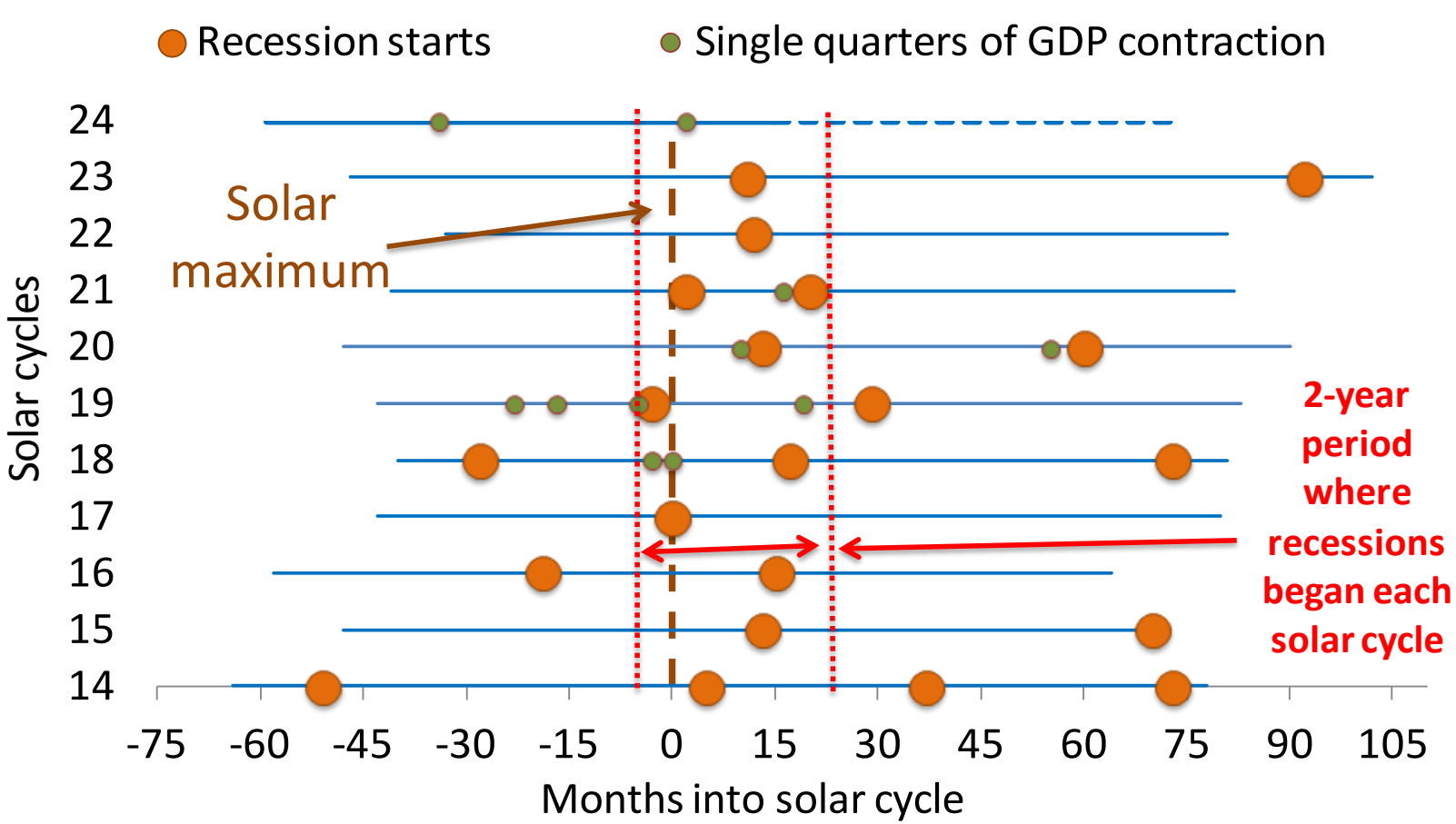
Source: Wikipedia, http://en.wikipedia.org/wiki/Solar_cycle

Solar activity causes cyclical fluctuations in the geomagnetic field



Source: NOAA, www.ngdc.noaa.gov/stp/geomag/apstar.html

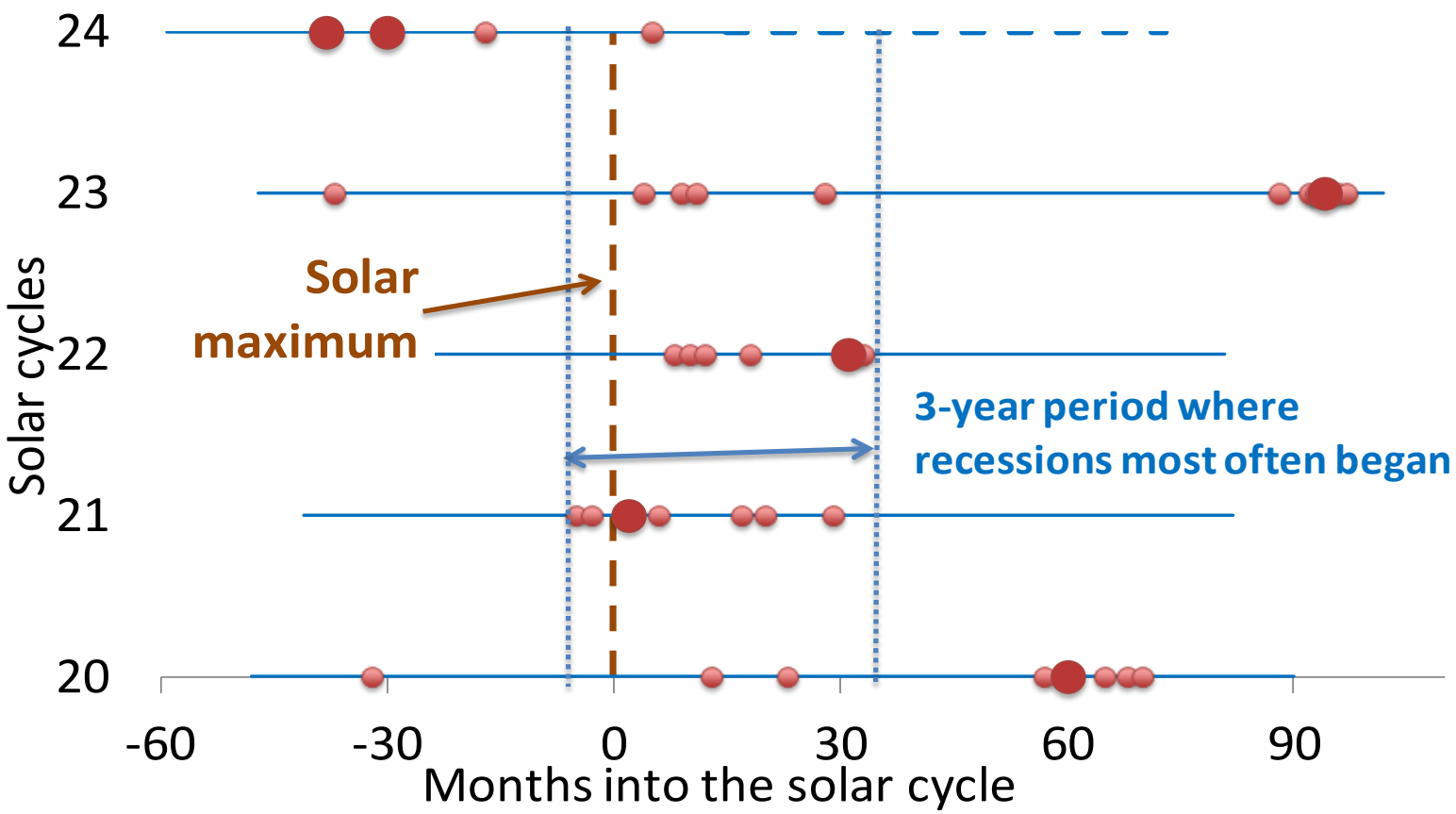
For over 100 years, each solar maximum overlapped with a recession in US economy



Sources: NBER; FRED; NASA; and author's calculations.

Since 1965, 3/5 of G7 recessions started in 3 years around and after solar maximums

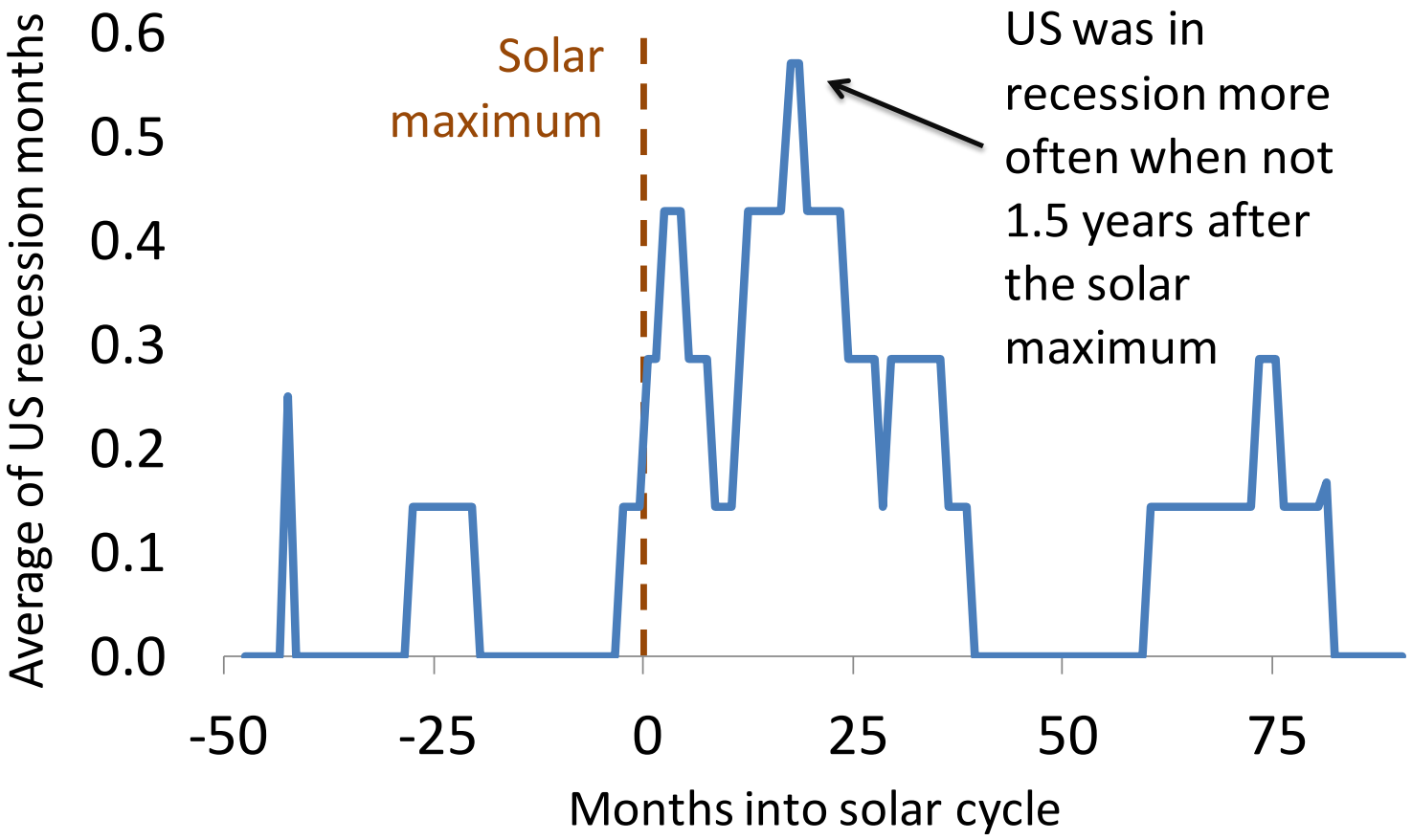
Figure 2. G7 Recession Starts in 1965-2014
(Solar cycles 20-24 centered on solar maximums. Larger markers for months when recession began in two countries)



Source: NBER; ECRI; NASA; and author's calculations.

Since 1933, US economy spent 1/3 of time in recession in about 3 years after solar maximums

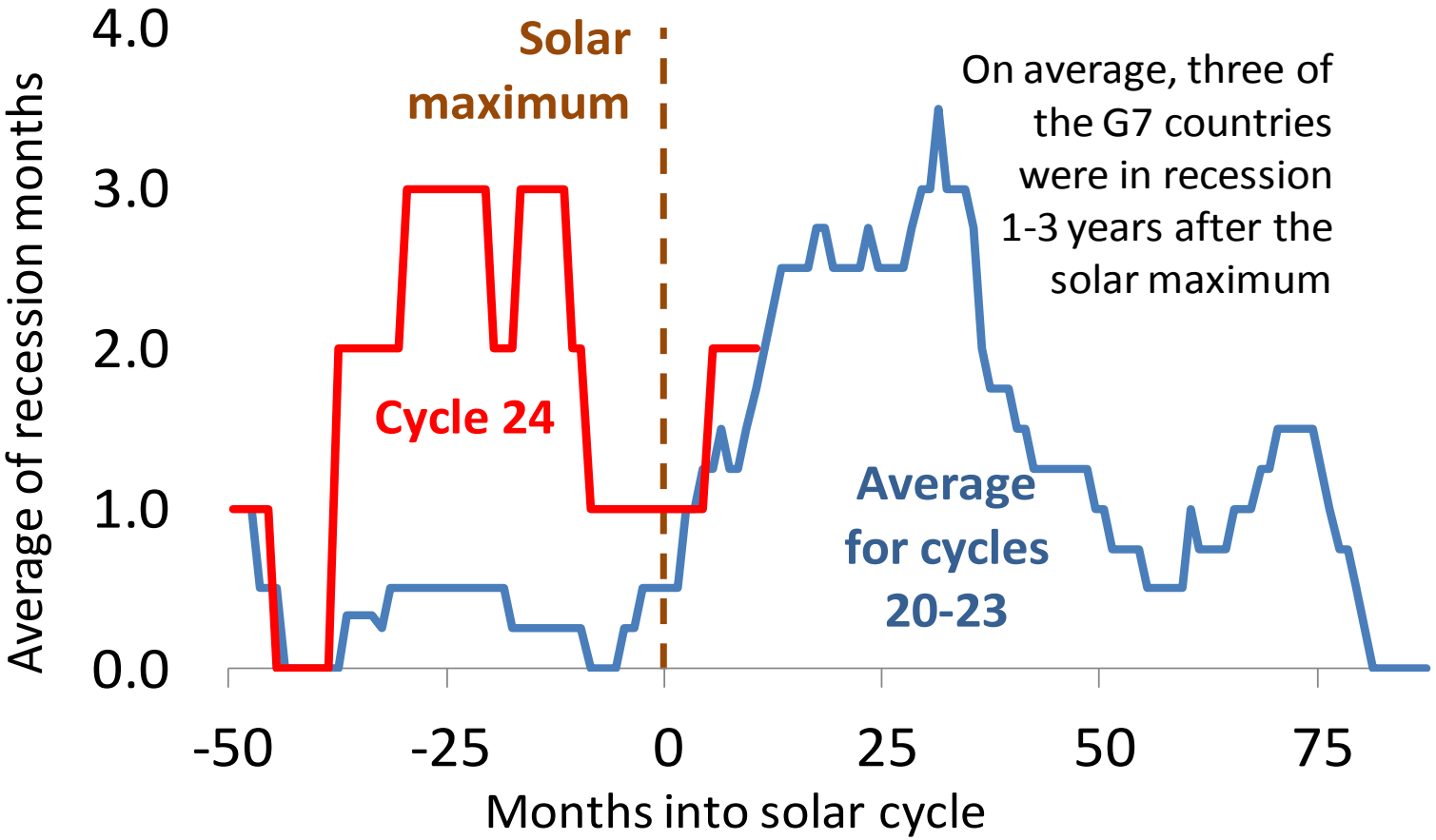
Figure 5. Average of US Recession Months in 1933-2008
(Solar cycles 17-23, centered along solar maximums)



Source: NBER; FRED; NASA; and author's calculations.

Since 1965, on average, 3 of G7 economies were in recession 1-3 years after solar maximums

Figure 6. Average of G7 Recession Months in 1965-2014
(Solar cycles 20-24 centered along solar maximums)

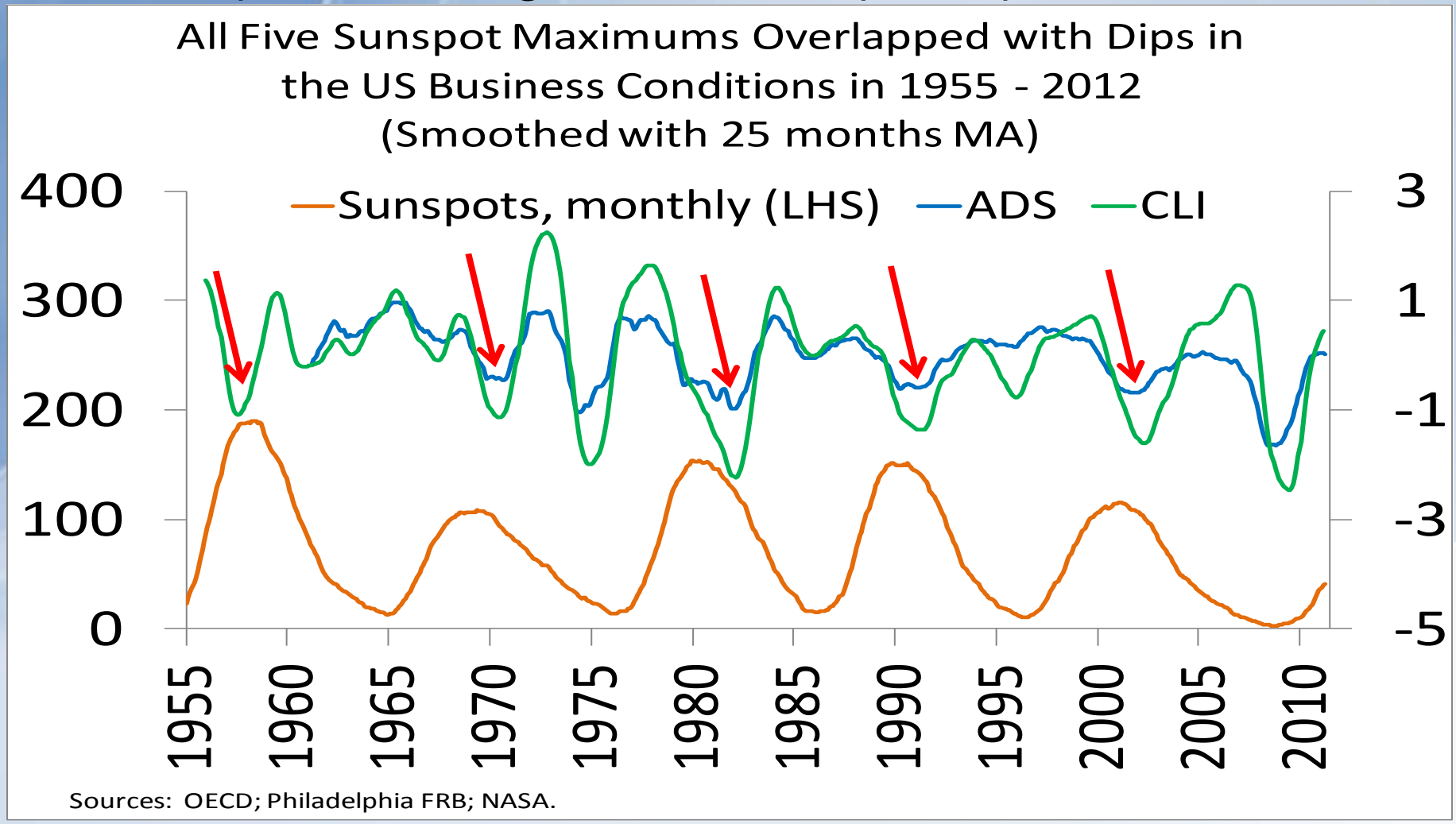


Source: NBER; FRED; ECRI; NASA; and author's estimates.

The US business conditions deteriorate around sunspot maximums

ADS: Aruoba-Diebold-Scotti Business Conditions Index

CLI: Composite Leading Indicator (compiled by OECD)



Entire OECD business conditions deteriorate too

CLI: Composite Leading Indicator (compiled by OECD)

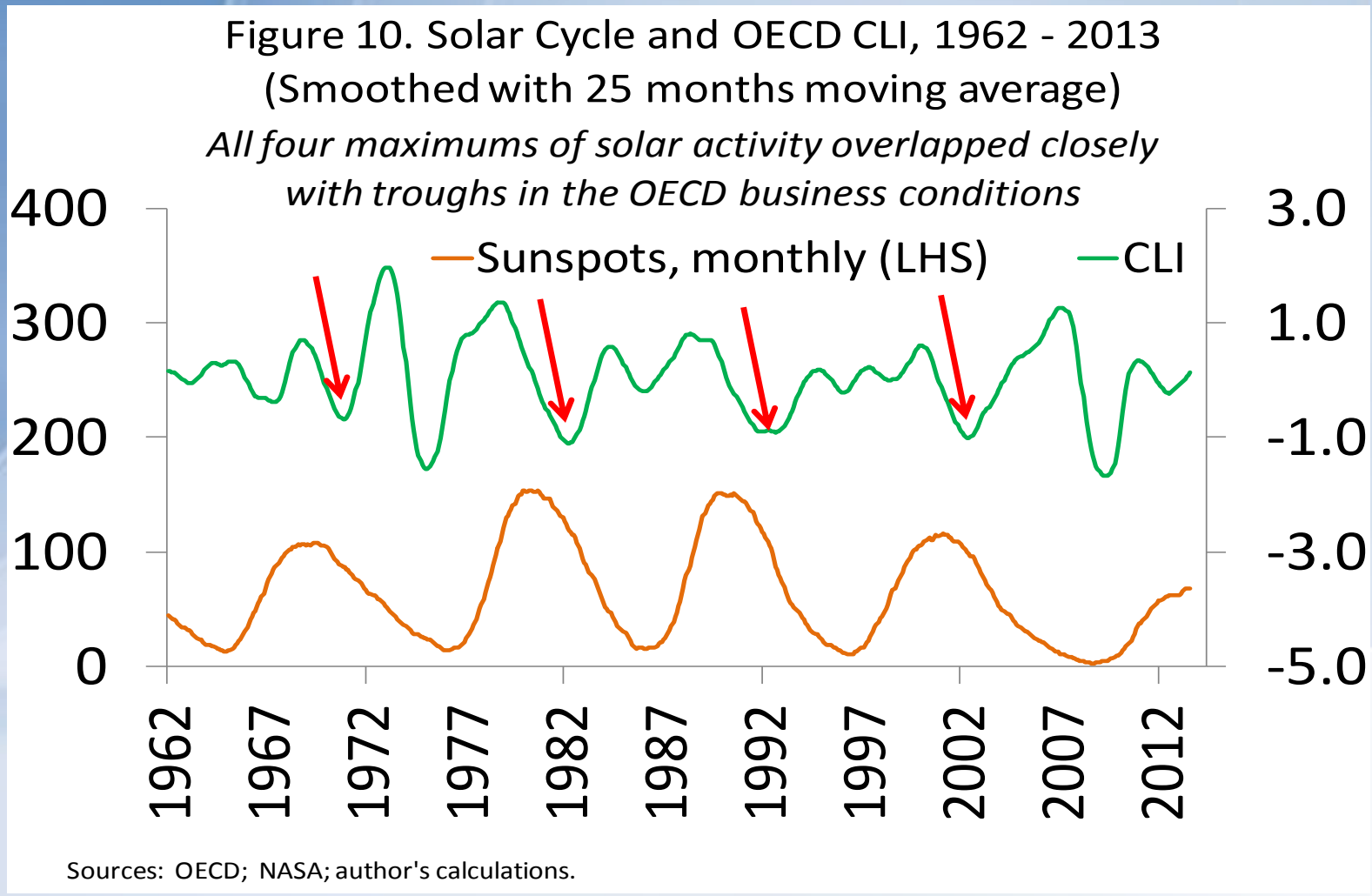
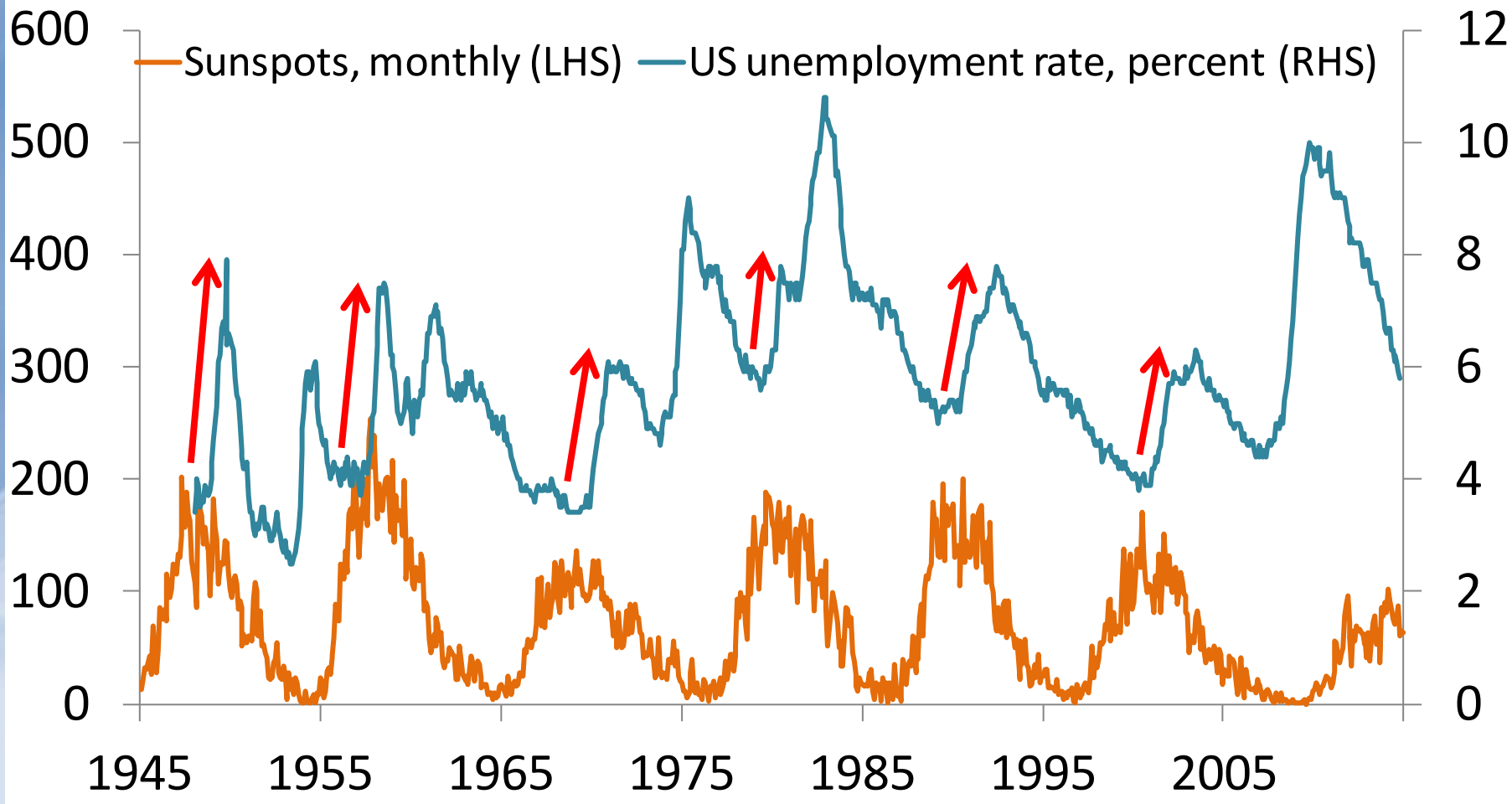


Figure 13. Solar Cycle and US Unemployment, 1948-2014

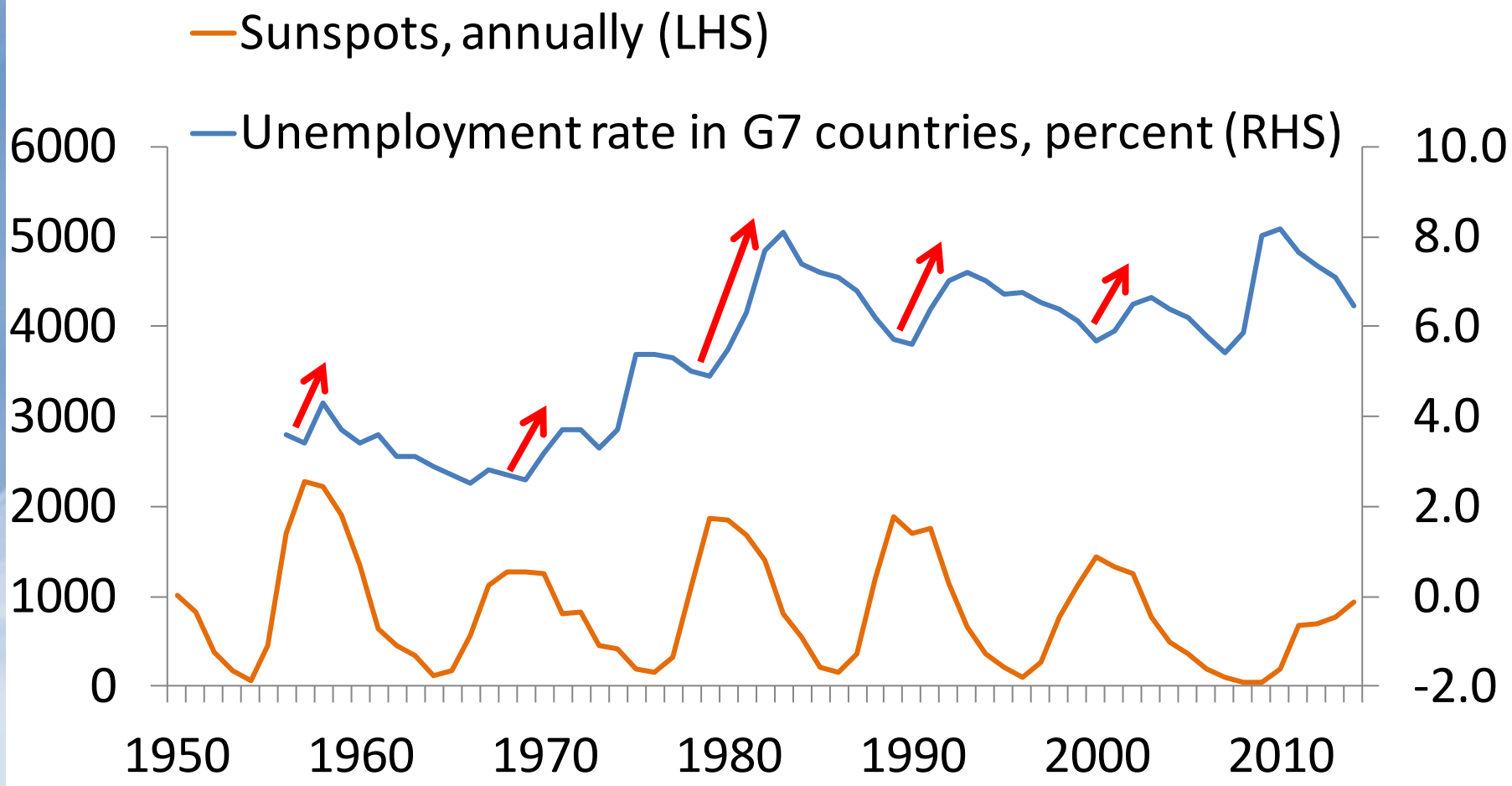
All six solar maximums overlapped with minimums of the US unemployment rate followed by its sharp increase



Sources: US Bureau of Labor Statistics; FRED; NASA.

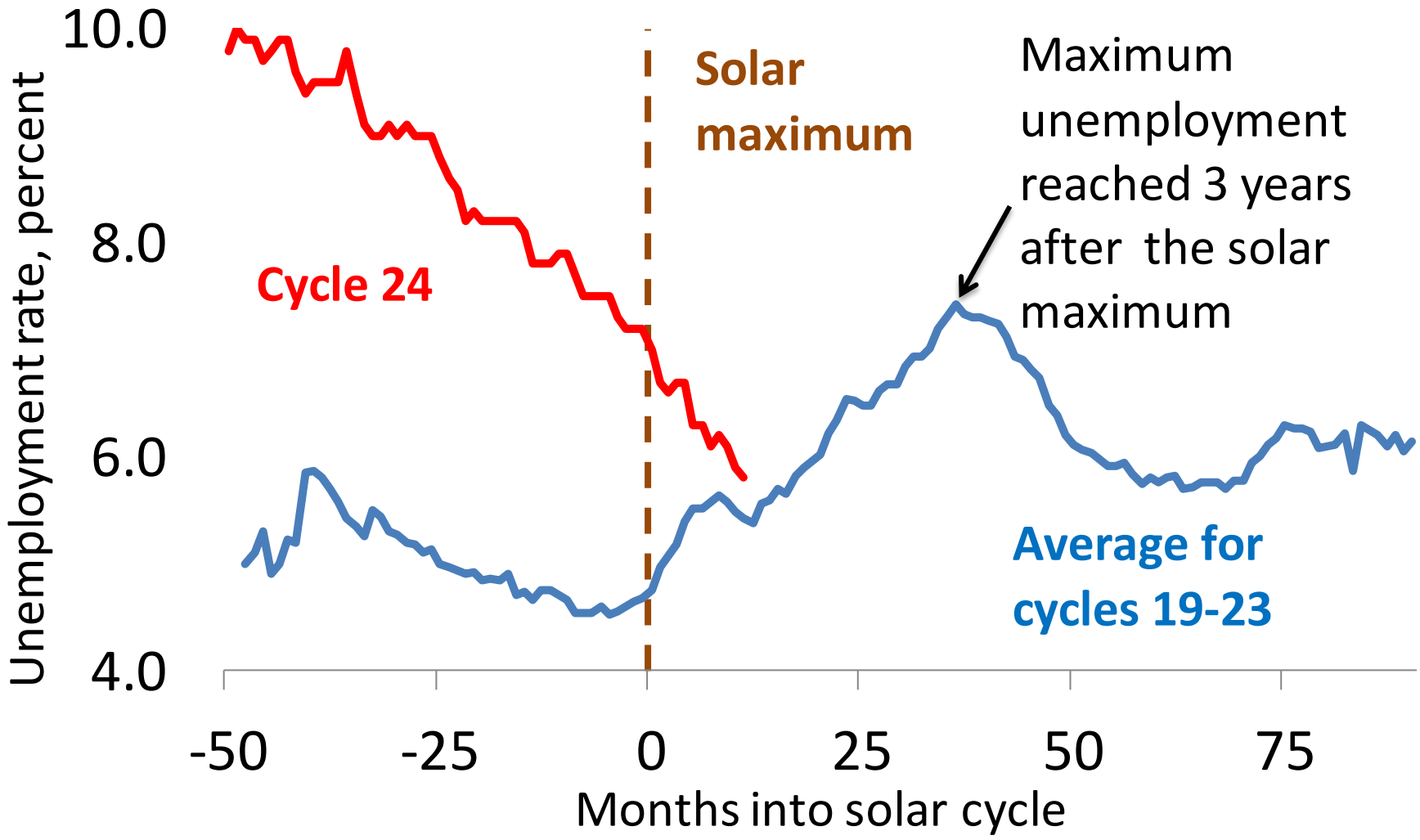
Figure 15. Solar Cycle and G7 Unemployment, 1956-2014

All five solar maximums overlapped with minimums of unemployment rate in G7 countries followed by its sharp increase



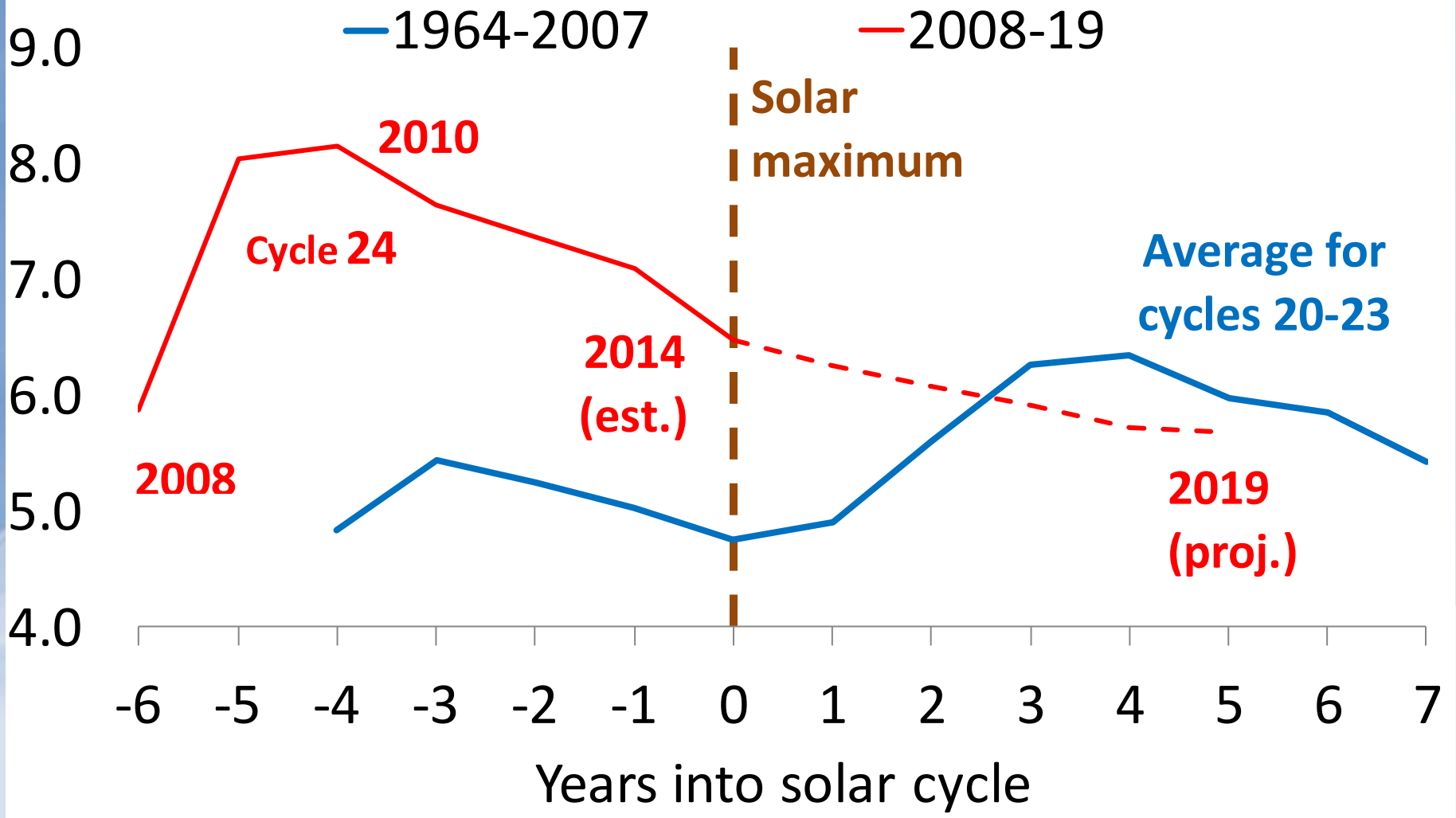
Sources: OECD; IMF *WEO*; NASA.

Figure 12. US Unemployment in 1954-2014
(Solar cycles 19-24 centered along solar maximum)



Source: US FED ; NASA; and author's calculations.

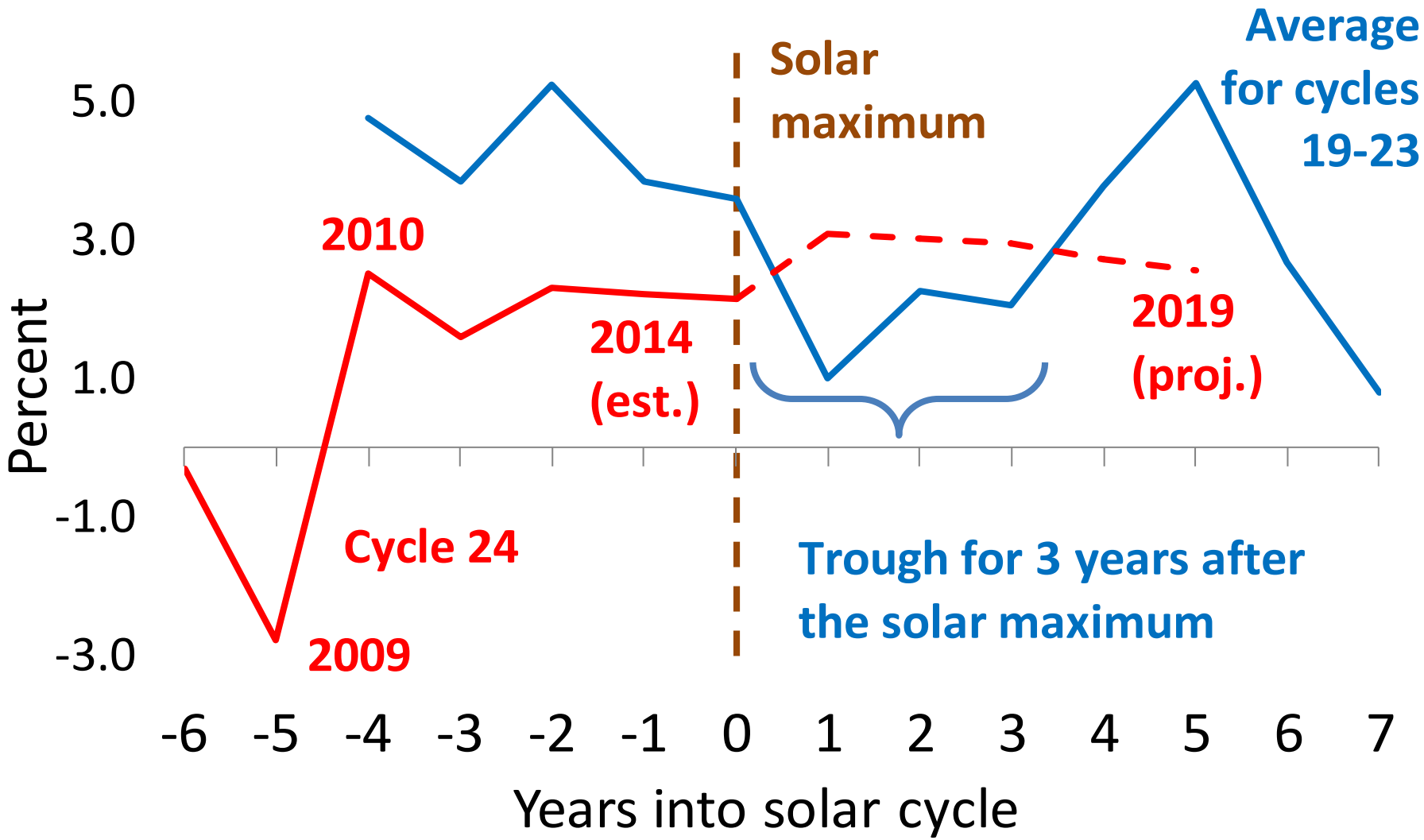
Figure 14. Unemployment in G7 Economies, 1964-2019
(Solar cycles 20-24 centered along solar maximum)



Source: IMF *WEO;* OECD; NASA; and author's calculations.

Figure 16. US GDP Growth in 1954-2014

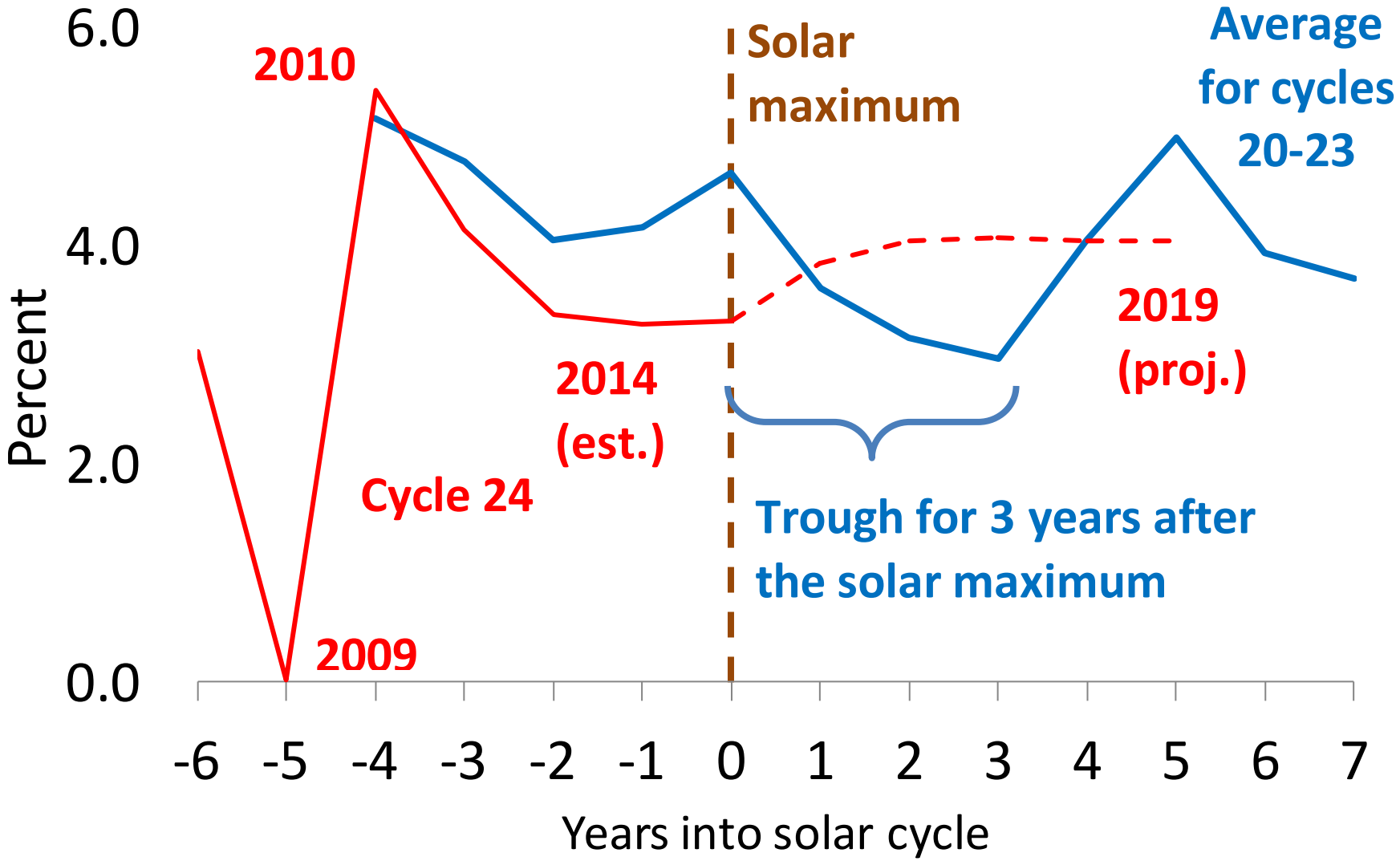
(Solar cycles 19-24 centered along solar maximum)



Source: Bureau of Economic Analysis; IMF *WEO* ; NASA; and author's calculations.

Figure 17. World GDP Growth in 1964-2014

(Solar cycles 20-24 centered along solar maximum)



Source: IMF *WEO* ; NASA; and author's calculations.

Issues for Discussion

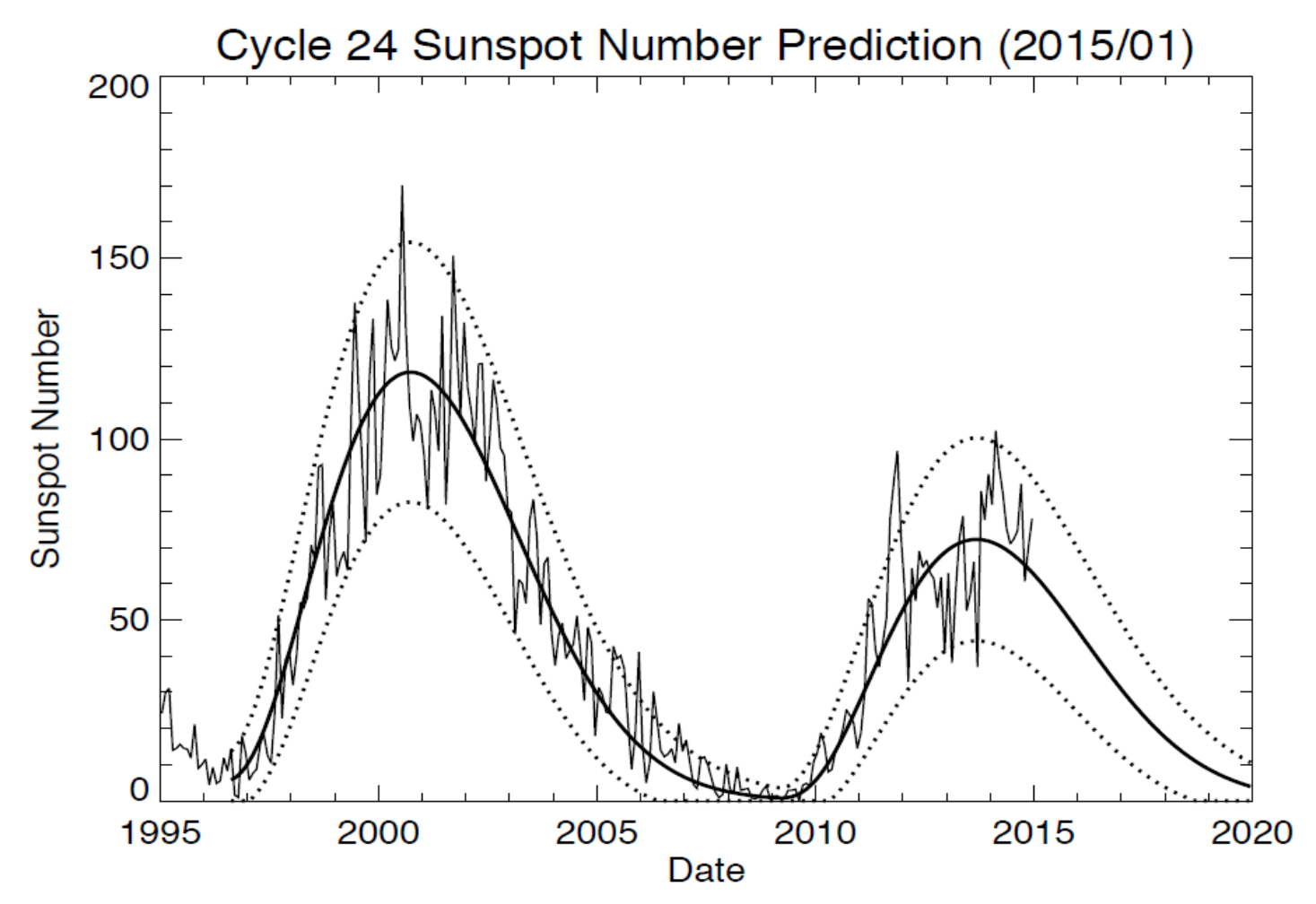
Does it all make sense?

How to design statistical tests?

Use in economic models?

Any value for projections and policy discussions?

According to NASA, the unfolding 24th solar cycle reached its maximum in April 2014



Source: NASA, solarscience.msfc.nasa.gov/predict.shtml