Metals Focus

Technological Developments: Silver's Friend or Foe?

IPMI: European Chapter Seminar, November 2019

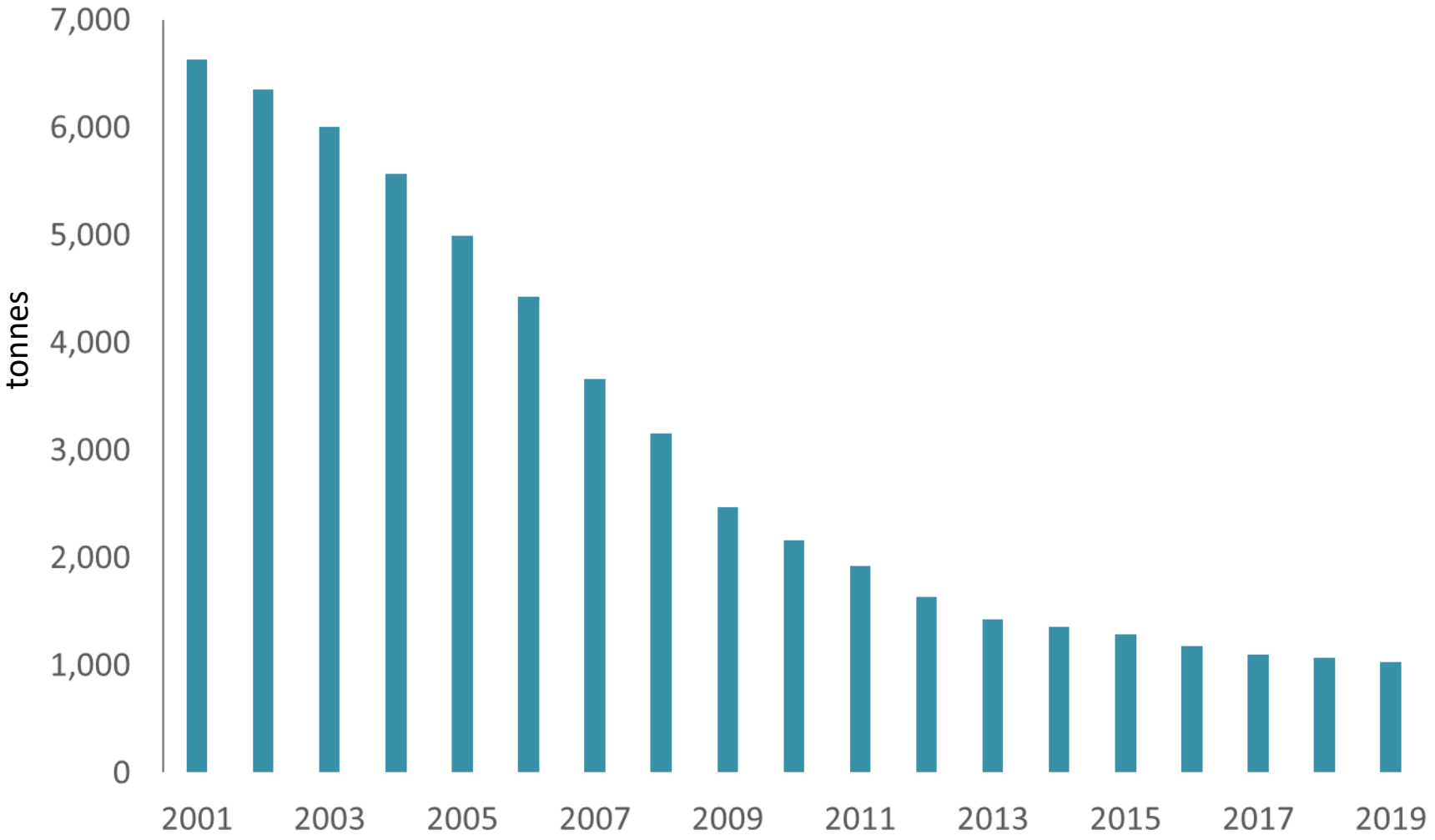
Introduction: the Four Phases of Technological Development

- Invention
  - The Romans and steam-power, or fusion reactors today
- Innovation
  - When inventions become commercially viable
- Diffusion
  - The widespread use of a technology
- Obsolescence
  - Today's early stages for internal combustion engines

The Outline of the Presentation

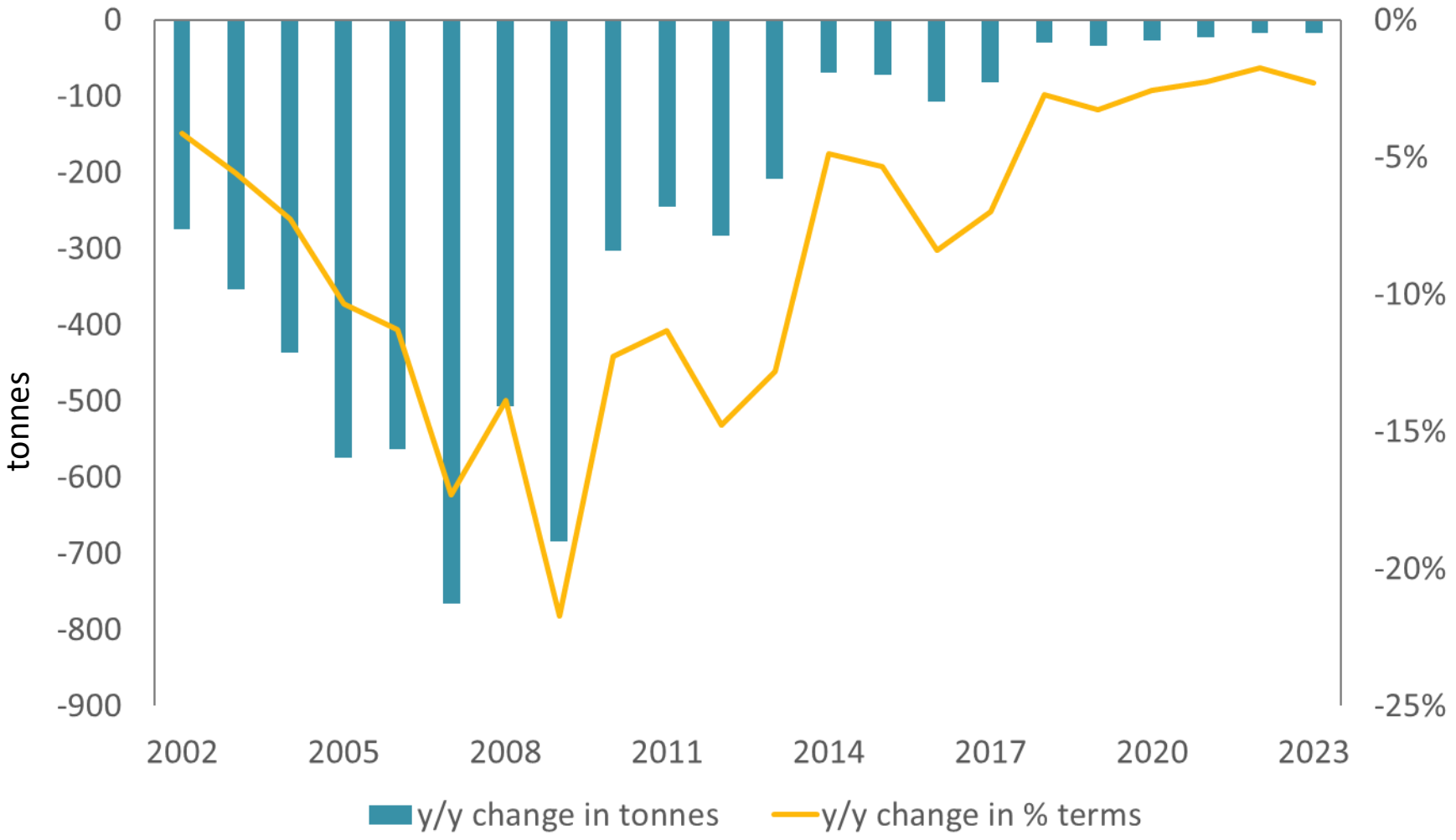
- Obsolescence
  - Losses so far for silver demand
  - Threats on the horizon
- Diffusion
  - What silver-bearing items are now established and stable
- Innovation
  - What new technologies have become viable
- Invention
  - What is waiting in the wings to emerge
- Conclusion – technology: a friend or foe for silver demand?

Obsolescence: the Photographic Implosion



Source: Metals Focus (2010-19), The Silver Institute/GFMS (2001-09)

Photographic demand losses: the storm passes



Source: Metals Focus (2010-23), The Silver Institute/GFMS (2001-09)

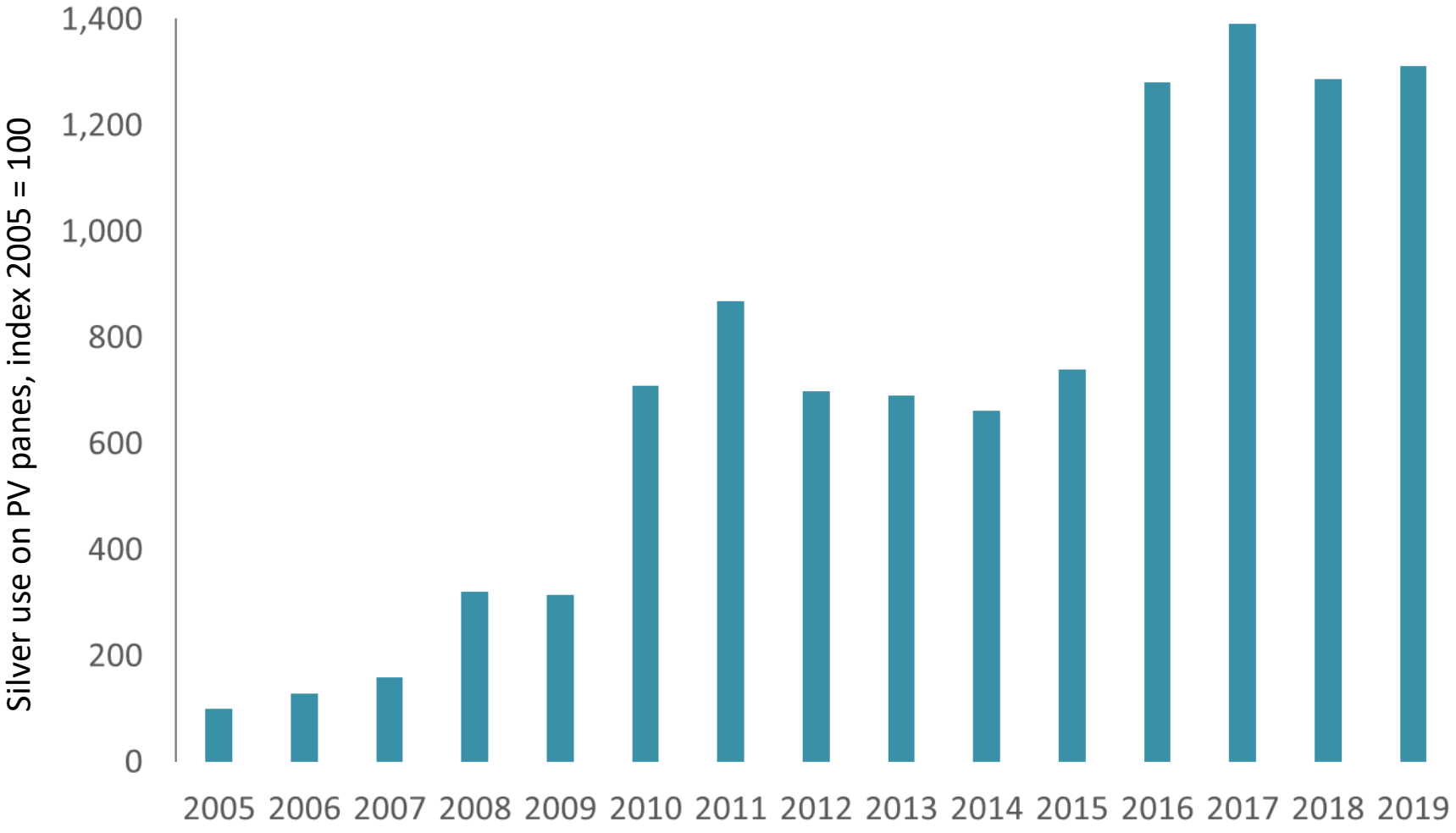
Obsolescence: Other Fields & Conclusion

- Solders – historic losses that echo photography
- Brazing alloys – some fields (e.g. HVAC) still in retreat
- Silverware:
  - taste to the fore as driver of western losses
  - stainless steel, decorative finishes & dishwashers negatives
  - western losses are old news
- Conclusion:
  - no major existing uses are in full scale retreat
  - none seen joining the list

The Diffused Technologies

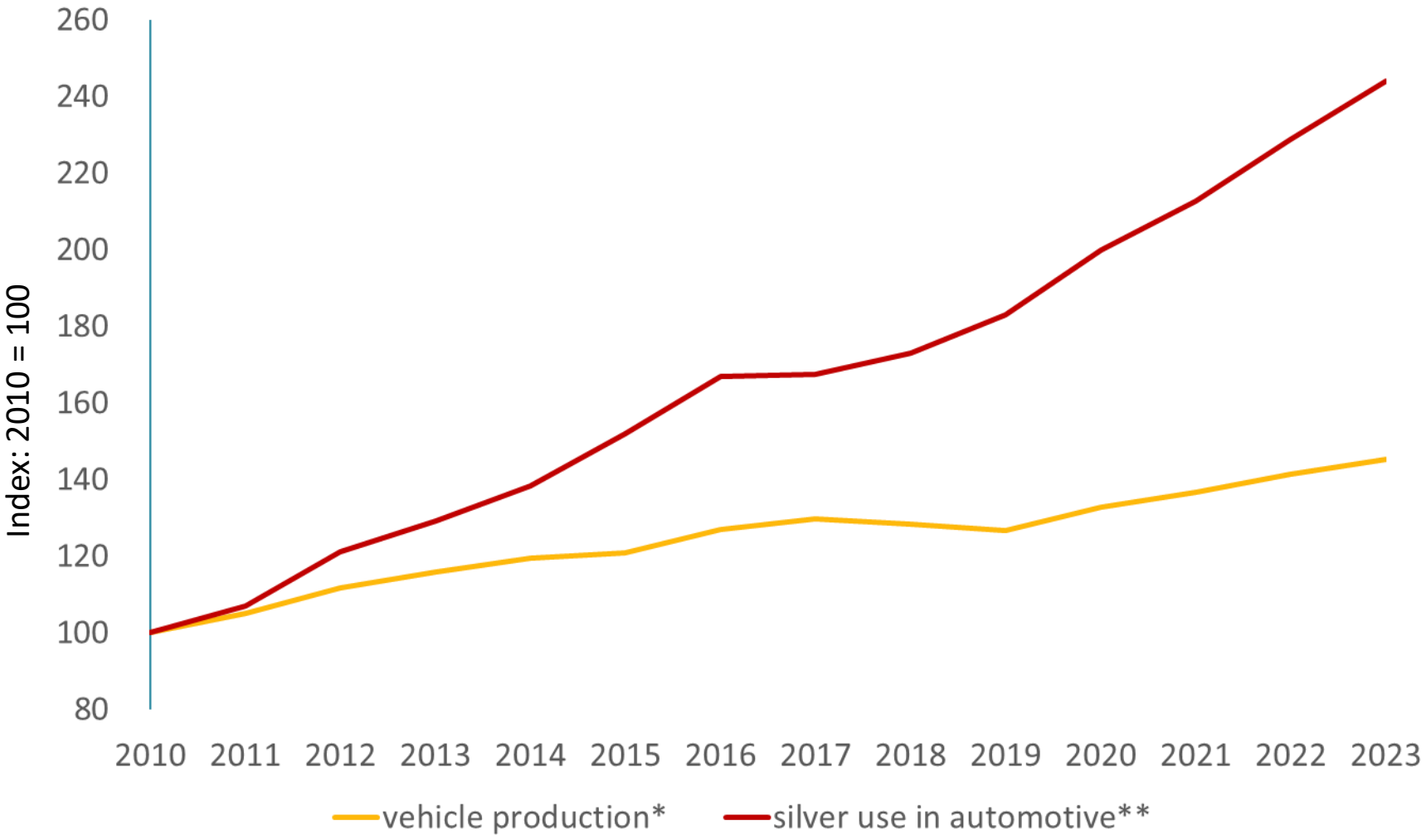
- Electronics – pastes, targets etc, going mostly to consumer goods, but also defence, aerospace & medical
- Electrical – wire, profiles, contacts and so forth for power distribution, switchgear
- Ethylene oxide catalysts
- Batteries – silver oxide mainly
- Brazing alloys – some fields stable e.g. industrial tools
- Automotive – conductive pastes for de-misting
- Nuclear power generation – end-use more undermined by environmental factors
- Conclusion – limited scope for technological change means demand gains more linked to global GDP growth

Innovation: photovoltaic the star of recent years



Source: Metals Focus

Automotive offtake: the new star in emerging uses?



Source: Metals Focus, Precious Metals Commodity Management LLC, LMC Automotive.
* passenger and light commercial. ** excludes conductive pastes in demisting applications.

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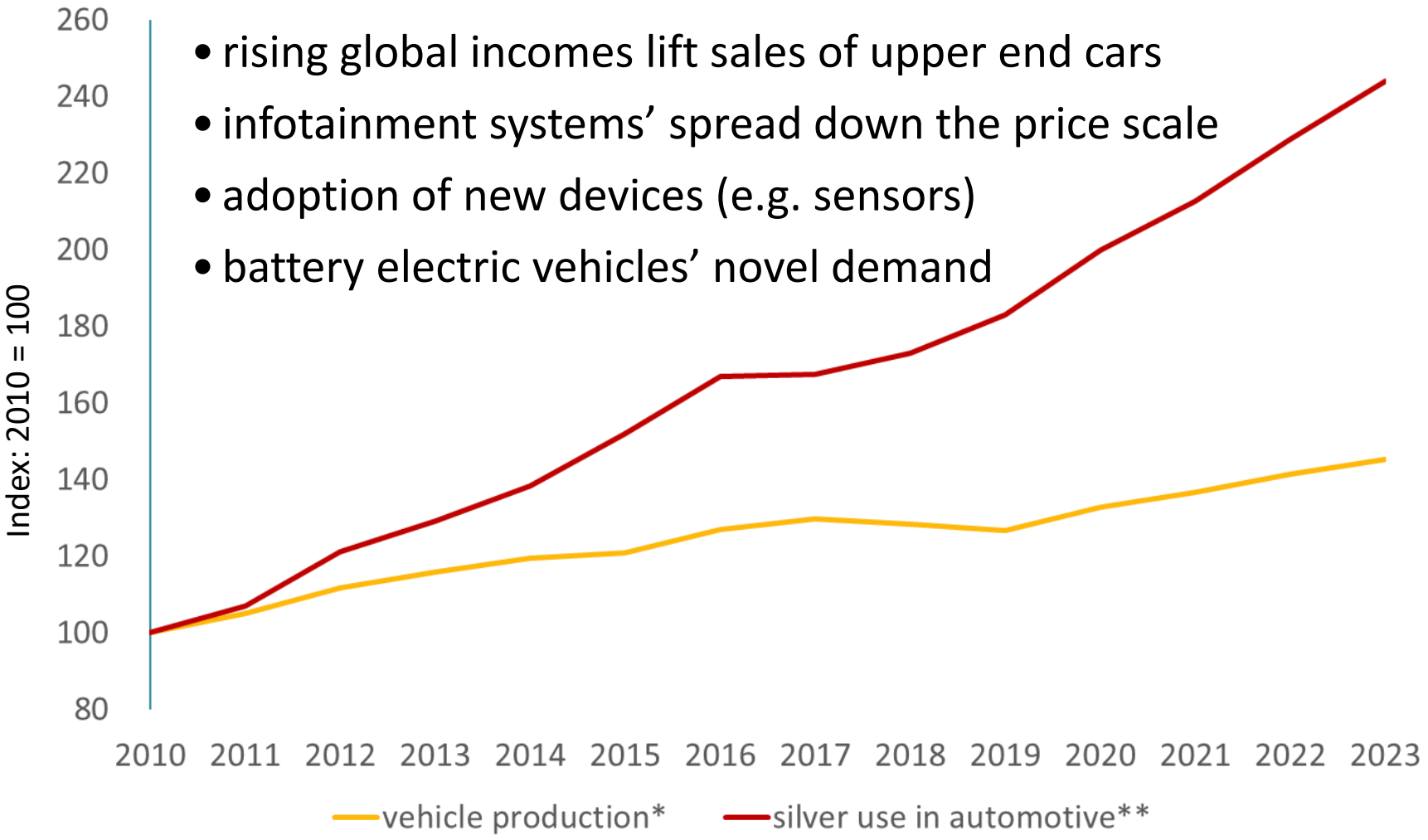

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Innovation: Other Emerging Technologies

- 5G – infrastructure and hand-held devices
- Solar – concentrated solar power
- Wind turbines – within units and connectors
- Batteries – renewables' storage = ancillary offtake
- Wearables – smart watches / fitness monitors
- Bonding wire – silver core to now plated alternatives
- Antibacterial uses – medical, wood preservatives
- Conclusion – a long list to compliment established end-uses and to build on PV demand plateau

Invention: what's on the horizon?

- Wearables – moving beyond watches
- IOT – ever greater number of uses, loadings < wearables?
- Induction chargers – mobile phones and automotive
- AI road signage
- Silver wires in touchscreens – displacing ITO
- Silverware and jewellery – new anti-tarnish alloys
- Second generation powders – e.g. silver:copper
- Cold sintering – capital costs vs lower silver use
- Inkjet printing – variable design benefits
- Photovoltaic – silver in pastes replaced
- Conclusion – clear potential exists but threats numerous

Summary: technology – friend or foe?

- Obsolescence - not a significant drag on total demand
- Diffusion - established areas solid and in the majority
- Innovation - offers clear scope to drive rise in total demand
- Invention - exciting potential but negatives exist
- Conclusion:
  - innovation > obsolescence
  - technology = a friend to silver demand
- Caveat - technological change a very fluid area

Conclusion: The Impact on Forecast Silver Demand

- thrifting & substitution still present but less damaging than before as easy wins gone, newer areas less price elastic and forecast rally less steep
- new areas' potential mean industrial demand to grow for next 5 years despite price rise and potential economic slowdown

Source: Metals Focus, World Bank, IMF.
* constant 2010 US$.

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