The Three Transportation Revolutions

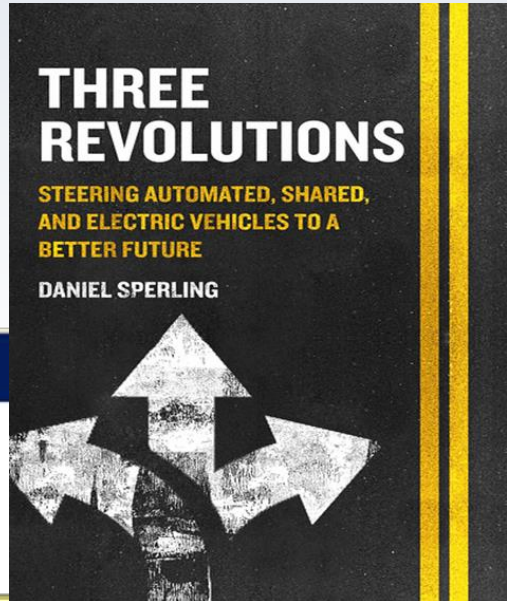
Daniel Sperling

Distinguished Blue Planet Professor and Founding Director
Institute of Transportation Studies
University of California, Davis

and

Board Member, California Air Resources Board

University of Hong Kong
18 October 2018



UCDAVIS UNIVERSITY OF CALIFORNIA

ITS UCDAVIS INSTITUTE OF TRANSPORTATION STUDIES

My Simple But Important Story

1. We are on the cusp of the biggest and most profound changes of the last 100 years in transportation.
2. These changes could lead to far more sustainable transportation, **<u>or not</u>**!
3. The speed and the nature of these changes will vary greatly across regions

First, about me ….UC Davis Institute of Transportation Studies

World's Premier University Center for Sustainable Transportation

- 60 faculty and Ph.D. researchers
- 110 graduate students
- 100+ publications/year

Engagement/Sponsorship

- 60+ Company sponsorships
- 15 Government agencies
- Environmental NGO participation

➢ **National Center for Sustainable Transportation** (w/Georgia Tech, USC, UC Riverside, and Univ Vermont)

Asilomar Conference on Transport and Energy (biennial since 1988)

China-U.S. ZEV Policy Lab

Local and global focus

Governor Schwarzenegger announces California's Hydrogen Highway at UC Davis

And a bit of history…

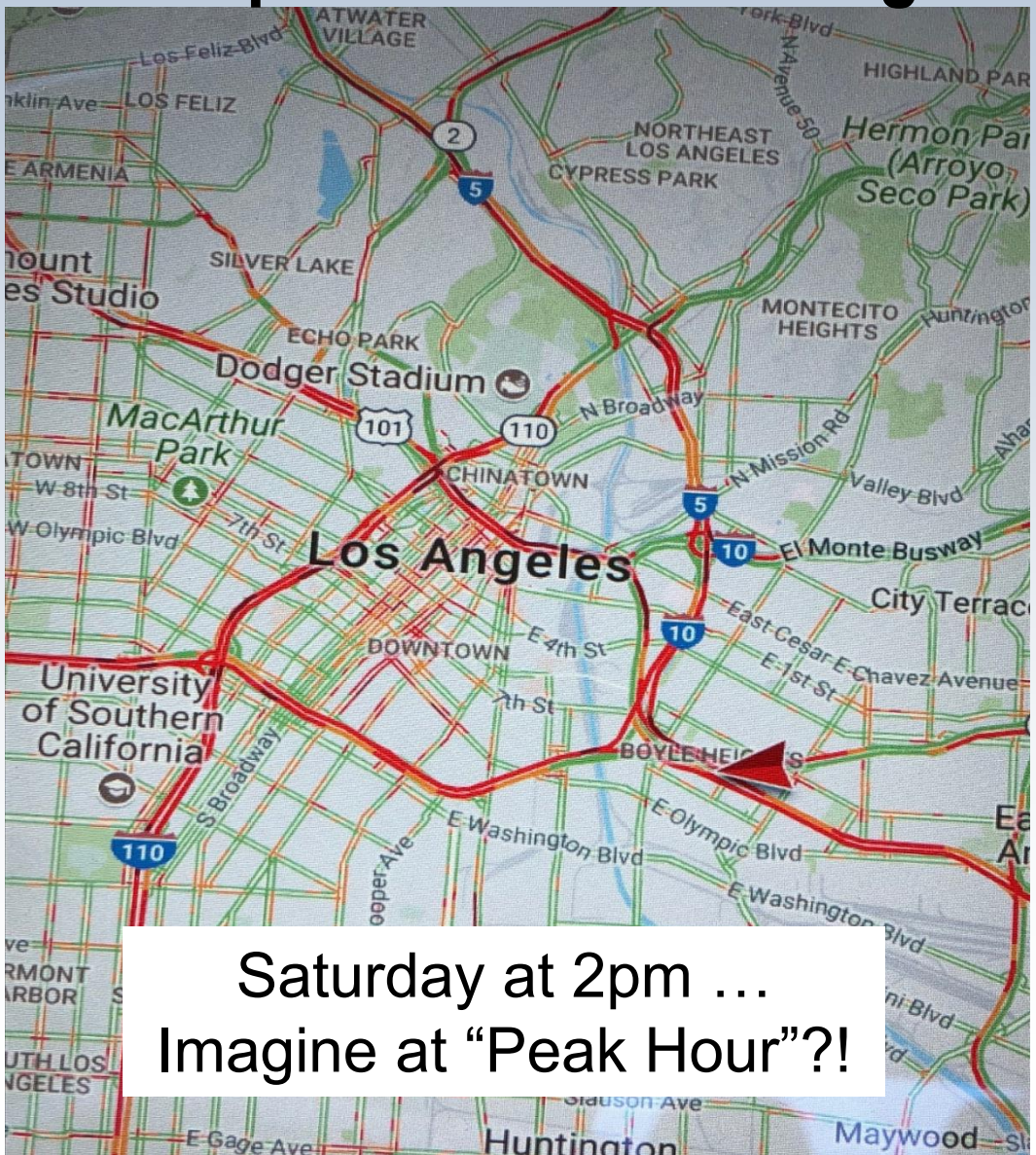
Los Angeles (California) Pioneered Car-Centric Cities and Lifestyles 100 Years Ago…. With Huge Economic, Environmental and Social Benefits.

I-105 & I-110 in Los Angeles

But Gone Too Far … It Is Not a Sustainable Model

My LA Epiphany

Transport Planners/Managers Have Largely Failed in Recent Decades



Saturday at 2pm …
Imagine at “Peak Hour”?!

- Transit <2% PKT (and shrinking)
- Carpool (HOV) lanes failed
- Single-occupant vehicle use increasing
- Congestion worsening
- Travel cost increasing
- GHGs increasing

Minimal “systems” innovation for 5+ decades

Previous Transport “Revolutions”

Movement of People

1. Streetcars (~1890)
2. Automobiles (Oil) (~1910)
3. Airplanes (~1930)
4. Limited access highways (~1930s…1950s)

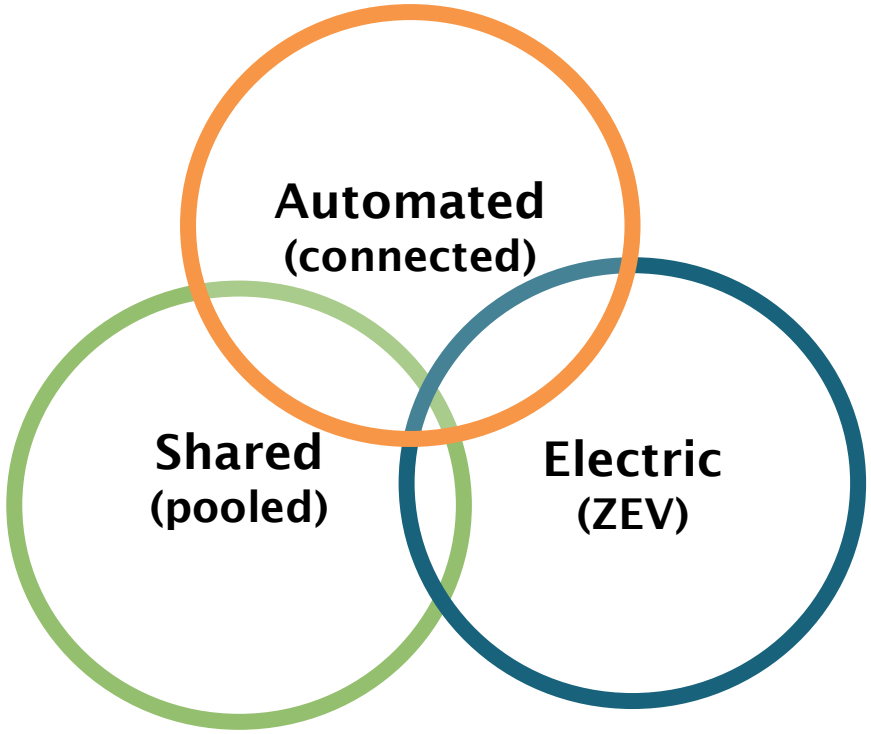
Movement of Goods

1. Canals (~1800)
2. Railroads (~1830)
3. Trucks (Oil) (~1910)
4. Airplanes (~1930)
5. Containers (~1950)

Electrification + Automation + Pooling/Sharing

… less cost, VKT, GHGs, pollution

… more accessibility/mobility



Electric Vehicles Will Dominate… Not If, But When

(battery electric, plug-in hybrid, and hydrogen fuel cell electric)

Rapid Expansion in EVs Expected, Led by China

- E-buses
  - increase from 370,000 in 2017 to 1.5M in 2030 (IEA)
- PEVs
  - increase from 3.7M in 2017 to 13M in 2030 (+24%/yr)
- China
  - PEVs increase from 2.2% of sales in 2017 (1/2 of global sales) to 25% in 2030

Source: Global Forecasts by International Energy Agency (May 2018)

AVs Will Also Dominate and Be Even More Disruptive… Hopefully With Large Public Benefits

Baidu working with Beijing Auto using open source strategy

Zoox (California start-up) with automated, shared, electric car (2020?)

Dana Hull/Bloomberg

Automated Car Leaders in US/Europe

Automated Car Leaders in China

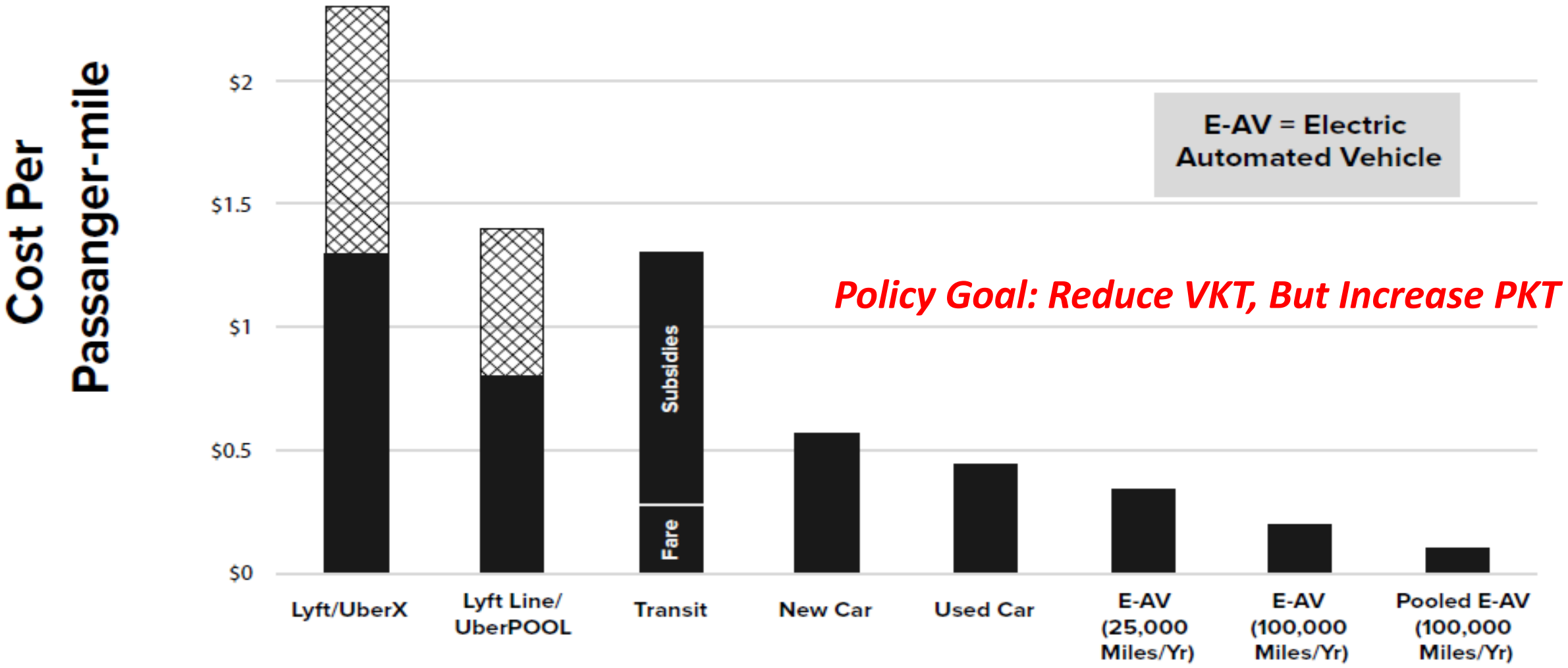
Chinese government's 2017 plan for automotive industry: 25% of new vehicles will be partially automated (Level 2/3) by 2025, with fully automated (Level 4) starting to enter market.

Key Uncertainty

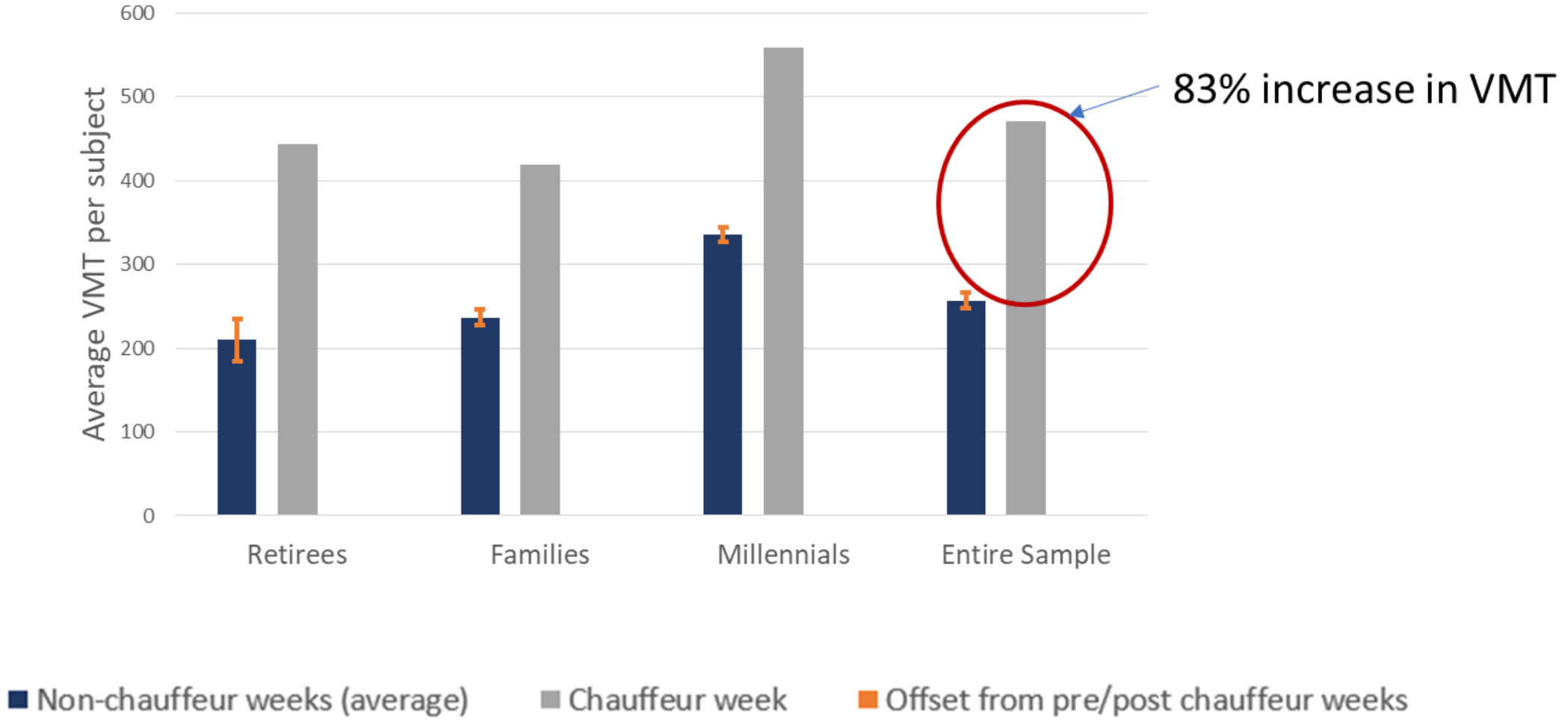
Personally Owned or in a Mobility Service (pooled)?

Good news: Goal of Didi, Uber, and Lyft is:

Pooling + Electric + Automated (= Very Cheap Mobility)



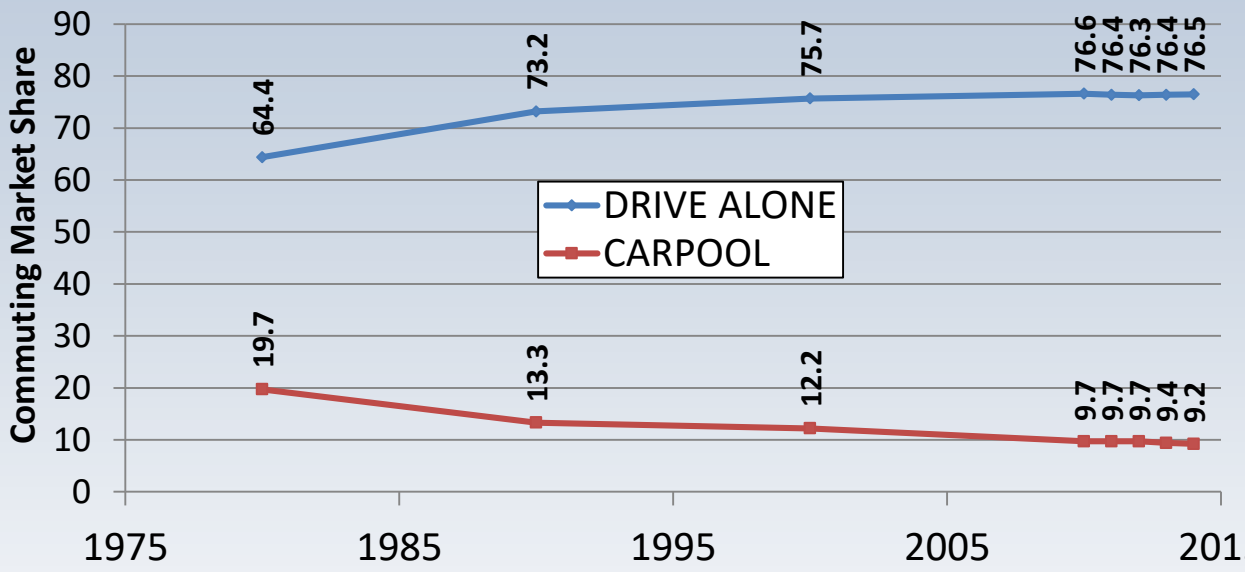
Pooling is Crucial… Huge Increase in VKT/VMT With Individually Owned AVs (Hell Scenario)



Source: Early findings from UC Davis/Berkeley "chauffer" study: *Harb, M., Xiao, Y., Circella, G., Mokhtarian, P., & Walker, J., presented at TRB Meeting, Washington D.C., January 8, 2018.*

But Will Travelers Embrace "Pooling"?

- Large in-car time savings ($3000-$10,000/year) ($10-30/hr x 300 hours)
  - So why bother sharing?
- Concerns about:
  - Personal security (no "adult" in car)
  - Longer and uncertain trip times
- Functional needs
  - Families, sports gear, dogs, business/equipment
- Non-functional "needs"
  - Status and image, entertainment, investment



<u>Possible responses:</u>

- Redesign car for privacy (passenger-centric)
- Monitor riders (cameras)
- High "tax" on single-occupant vehicles
  - Usage, reg fees, incentives for pooling (curbspace, HOV lanes…)

What Will Really Happen?

Which "Cost" Factor Will Dominate… resulting in "hell" or "heaven"?

- Huge time "savings" … leading to individual ownership of AVs and large increases in VMT ("hell")

or

- Huge cost reductions for MaaS … leading to vast reduction in car ownership and VMT, plus large equity, infrastructure, jobs benefits ("heaven")

Need Strong Policy to Direct Investments and Behavior Toward Integration of the 3 Revolutions = Sustainable Transportation

- More travel choices for all and more access by young, poor, and physically disadvantaged
- Less traffic congestion and environmental impact
- Safer streets and repurposed parking
- More efficient transit

- More vehicle use and empty vehicle circulation
- Urban sprawl
- Cyber attacks on cars and violations of privacy
- Decline in transit use and bigger gap between haves and have-nots

China and US Leading the Mobility Revolutions
… But Toward Heaven Scenario??

1. ELECTRIC VEHICLES	TESLA	BYD
2. SELF-DRIVING CARS	WAYMO	Baidu 百度
3. RIDE-HAILING	UBER	滴滴

DUNNE Automotive

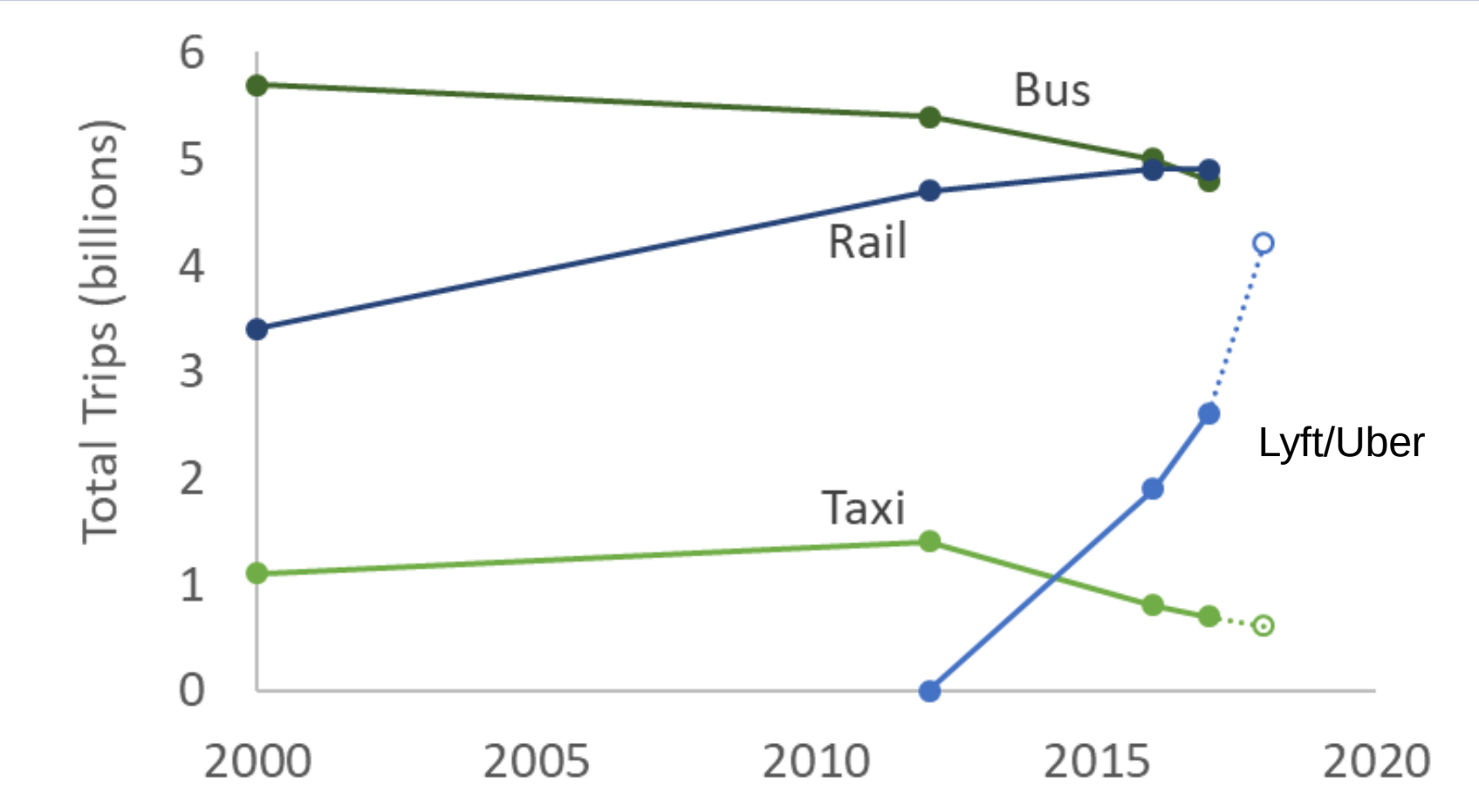
The 3 Revolutions Will Be Disruptive

- Taxis
- Transit
- Automotive industry (especially with MaaS)
- Oil companies

…. plus rental cars, insurance, parking, vehicle service and repair, aftermarket vehicle parts suppliers, etc.

First Disruption: Taxis

In US, taxis lost half their passengers and continue to decline



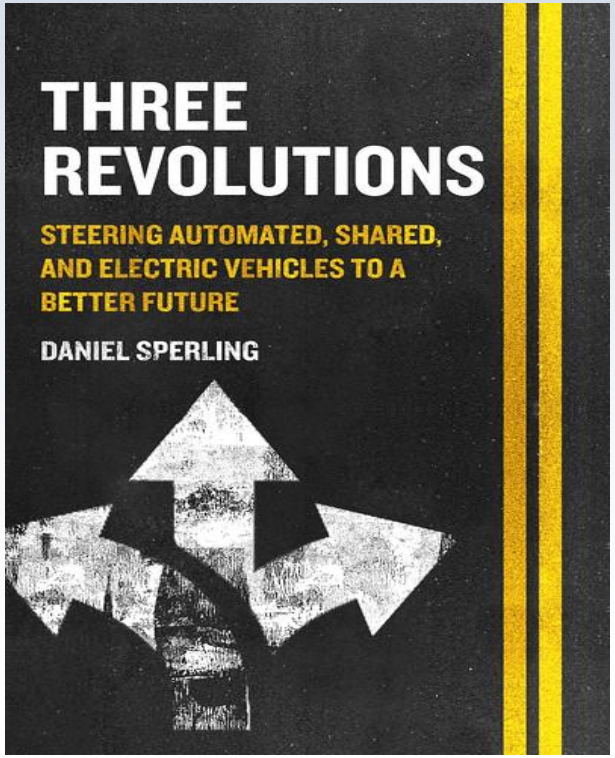
Transit data from APTA, Taxi data from US Census, and projections from Schaller Consulting (2018)

Key Issues and Insights… Toward Pooling and Pricing

- Goal: VKT ↓ PKT ↑
- Vision: Transition from car monoculture
  - End car ownership?!
  - Focus transit on what it does well
  - Pooling as central strategy (cars, microtransit, bus, rail)
- EVs central to low carbon future
- Need more active policy intervention to direct investments and behavior toward pooling and “integration” of transit and pooling services

Thank You


eco


THREE REVOLUTIONS
STEERING AUTOMATED, SHARED, AND ELECTRIC VEHICLES TO A BETTER FUTURE
DANIEL SPERLING