



Osher Lifelong Learning Institute, Winter 2022 **Contemporary Economic Policy**

University of Southern Maine
January-February, 2023

Host: Jon Haveman, Ph.D.
National Economic Education Delegation



Available NEED Topics Include:

- Healthcare Economics
- Climate Change
- Economic Inequality
- Economic Mobility
- US Social Policy
- Trade and Globalization
- Minimum Wage
- The U.S. Economy
- Immigration Economics
- Housing Policy
- Federal Budgets
- Federal Debt
- Black-White Wealth Gap
- Autonomous Vehicles



Course Outline

- **Contemporary Economic Policy**

- Week 1 (1/10): Trade and Globalization (Alan Deardorff, Univ. Michigan)
- Week 2 (1/17): Trade Deficits and Exchange Rates (Alan Deardorff)
- Week 3 (1/24): US Economic Update (Geoffrey Woglom, Amherst College)
- Week 4 (1/31): Monetary Economics (Geoffrey Woglom)
- **Week 5 (2/7): Autonomous Vehicles (Jon Haveman, NEED)**
- Week 6 (2/14): Healthcare Economics (Jon Haveman)



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Submitting Questions

- **Please submit questions of clarification in the chat.**
 - I will try to handle them as they come up.
- **We will do a verbal Q&A once the material has been presented.**
 - I will also do some Q&A during the break.
- **Slides will be available from the NEED website tomorrow (https://needelegation.org/delivered_presentations.php)**



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OLLI – University of Southern Maine

Driving Change – Autonomous Vehicles’ Big Impact

National Economic Education Delegation

Jon Haveman, Ph.D.

February 7, 2023



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Credits and Disclaimer

- **This slide deck was authored by:**
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- **Disclaimer**
 - NEED presentations are designed to be nonpartisan.
 - It is, however, inevitable that the presenter will be asked for and will provide their own views.
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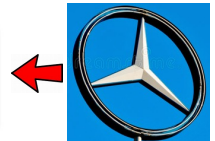
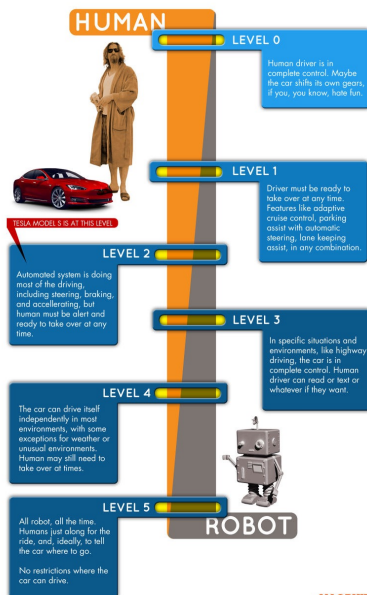
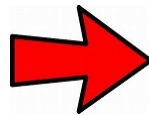
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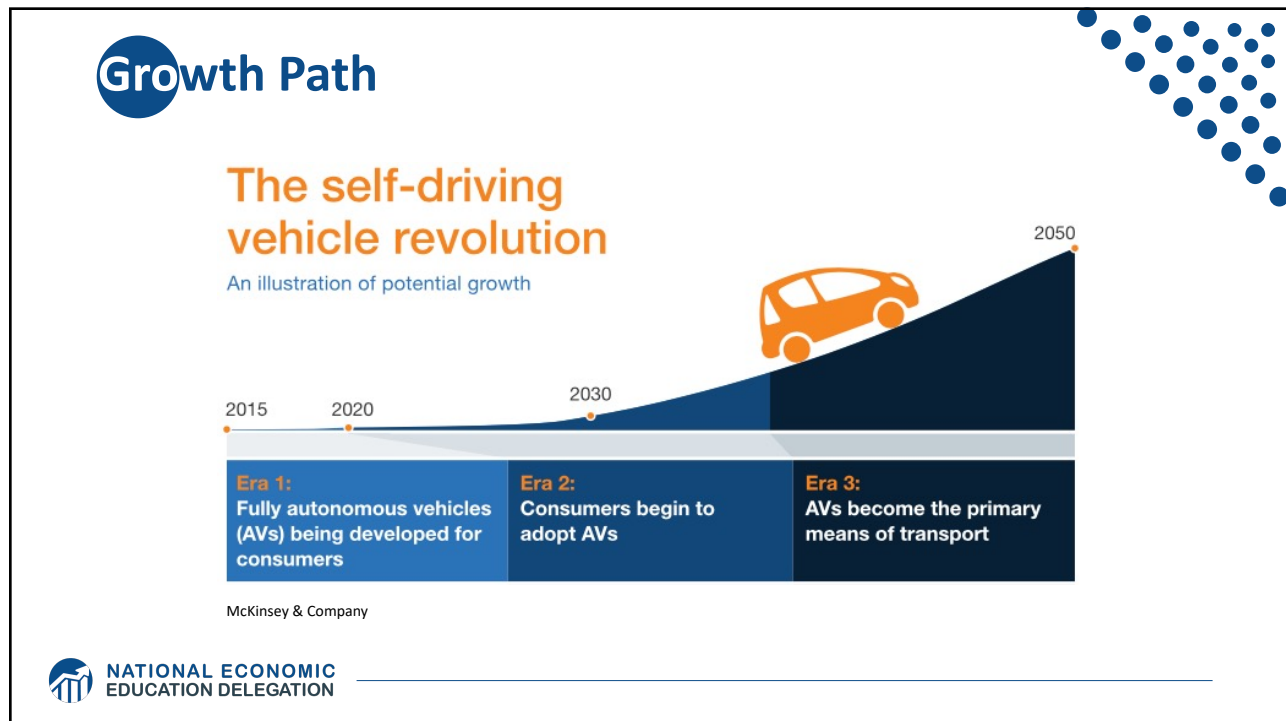
Outline

- Where does the AV path lead?
- Policy/Planning Issues
- Major Economic/Development Changes

Autonomous Taxonomy

SAE AUTONOMY LEVELS






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Three Important Questions:

1. When will Transportation as a Service (TaaS) be available?
2. How quick will the transition be?
3. What will the future look like?

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WHEN?

What do the headlines say?



NVIDIA to introduce level-4 enabling system by 2018



First autonomous Toyota to be available in 2020



Volkswagen

Volkswagen expects first self driving cars on the market by 2019



Audi

Audi to introduce a self-driving car by 2020



TESLA MOTORS

Elon Musk now expects first fully autonomous Tesla by 2019, approved by 2021



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40+ Corporations Working On Autonomous Vehicles



TOYOTA



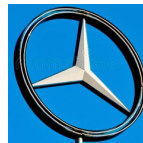
WAYMO



HONDA



Audi



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WHEN?

What is possible?

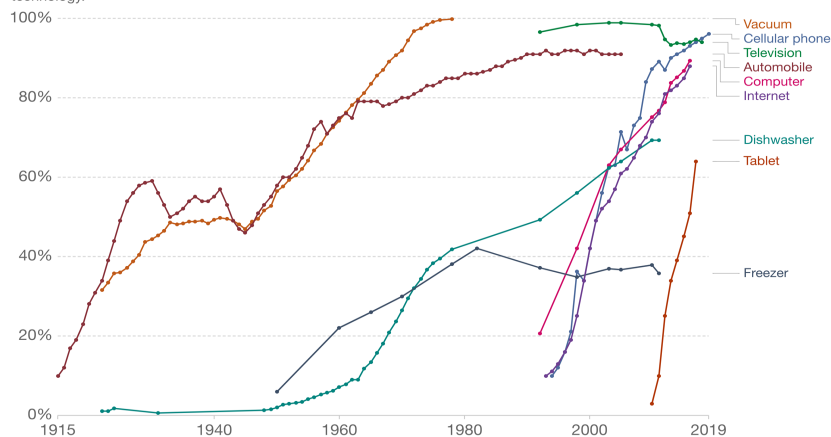
- **By 2025 (?)**
- **Potentially 95% of VMT by 2035.**
 - Last 5% may be very difficult to achieve.
- **Is this possible?**
 - Horses to cars: 10 years – early 1900s
 - But adoption of EVs is so slow!
 - Adoption of AVs will be rapid.



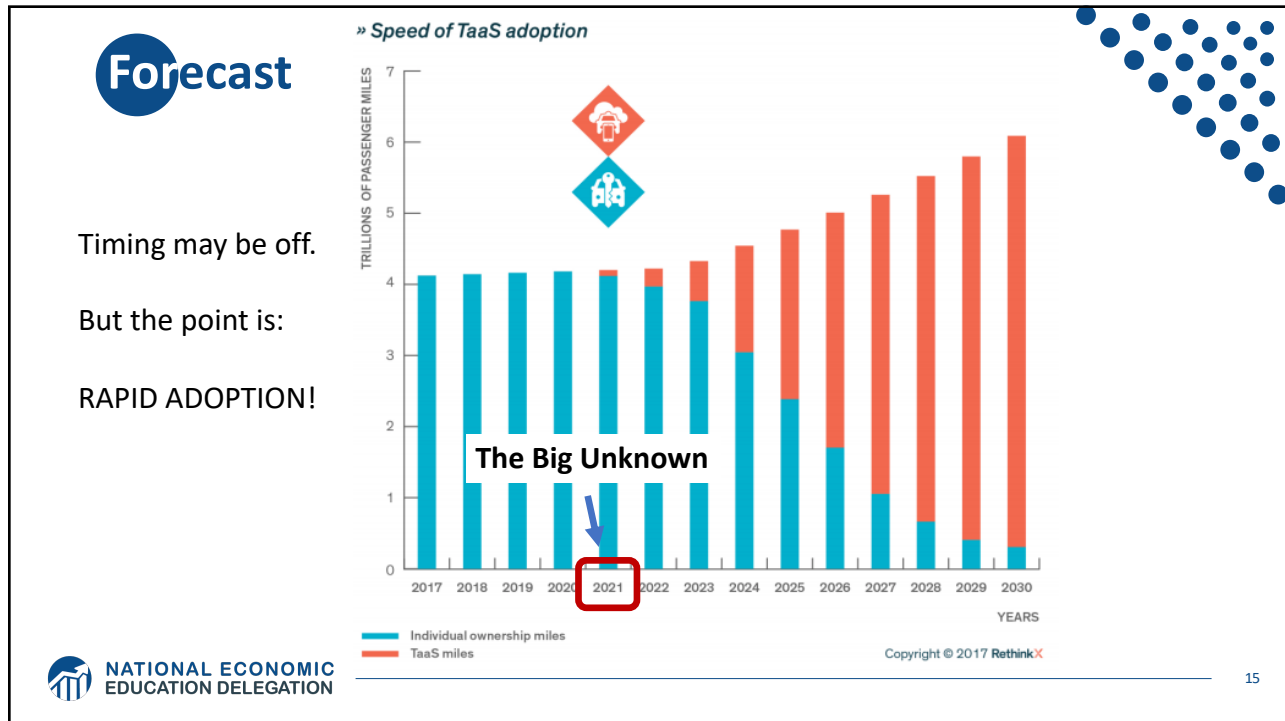
Rate of Technology Adoption – Faster!

Technology adoption in US households, 1915 to 2019

Technology adoption rates, measured as the percentage of households in the United States using a particular technology.



Source: Comin and Hobijn (2004) and others
 Note: See the sources tab for definitions of household adoption, or adoption rates, by technology type.



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Waymo's self-driving cars are now available on Lyft's app in Phoenix

Lyft and Motional's all-electric robotaxi service is now live in Las Vegas

Singapore's self-driving cars can now be hailed with a smartphone

NuTonomy joins forces with 'the Uber of Southeast Asia'

Cruise is now charging for rides in its driverless vehicles in San Francisco

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Fee-For-Service Autonomous TaaS

- Cruise: San Francisco driverless on June 1, 2022
- Motional: Las Vegas in early 2023
- More are surely coming soon....

Waymo is Headed to New York!



New York City



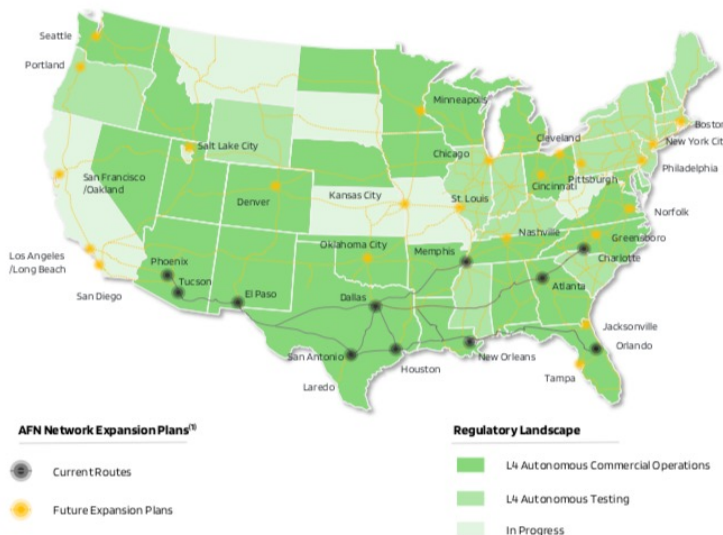
Waymo driving territory

Image courtesy of Waymo

Trucking – Highly Fertile Ground

- **Long haul trucking is likely the first place we will see it adopted.**
 - Reduces costs associated with drivers.
 - End run around limits on hours of driving.
- **Where does it stand?**
 - Lots of trials underway.
 - TuSimple – actively building a long haul network.
 - Waymo – focused more on last mile/local delivery.

TuSimple Current and Future Routes (Level 4)



44 states
allow autonomous semi-truck testing

26 states
allow autonomous semi-truck commercial deployment

50 states
cohesive AV operations framework laid out in US DOT 4.0 AV Regulations

Actively Pursuing Autonomous Local Delivery

- Dominos
- Walmart
- Amazon
- CVS Pharmacy
- Stop and Shop
- Postmates
- Kroger



What will the future look like?

This:



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But, will it be:





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Hell

- **Primarily individual private car ownership**
 - Much as today.
- **Internal combustion engines**
- **Why Hell?**
 - Dramatically increased VMT and pollution.
 - Potentially increased congestion.
 - Parking

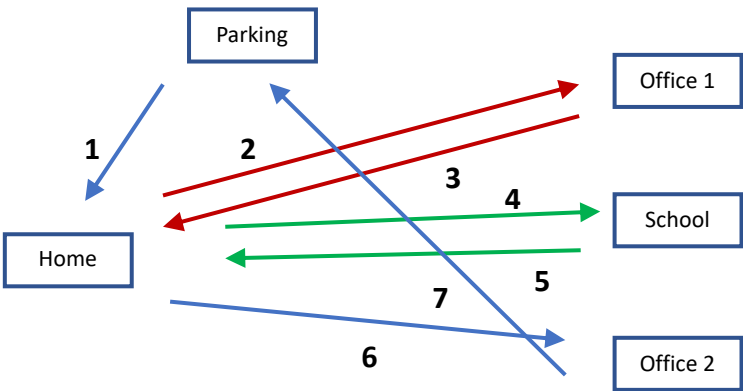





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Two Adults and a Child: Morning Miles



And this is just the morning.....



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Heaven



- **Vehicle ownership will be very limited**
 - Private ownership for those with specialized vehicle needs.
 - Fleet ownership will serve everybody else.
- **Engines: electric**
- **Insurance: product liability**
- **Not clear when we will get there, but this is the likely model.**
 - 2030 for widespread adoption in many regions.



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Why is this Heaven?

- **Not only autonomous, but:**
 - Shared
 - Connected
 - Green
- **Far fewer cars in existence.**
 - Better resource utilization: steel, rubber, aluminum, and land!
- **VMT could go up or down, but more productive than in Hell.**
- **Congestion effects – unclear, but likely reduced.**
 - Right-sized vehicles, platooning, sharing, V2V communication
- **Minimal need for parking.**



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Economics Drives Transition: Private

- **Adoption dividend for private individuals**

- Eliminate car ownership
 - Ave annual cost of owning a car: \$9,666 (2021)
 - Cost per mile will fall: \$0.64 to \$0.19
- Repurpose your garage
 - \$50,000 from transition to bedroom

Average Costs Per Mile

Miles per Year	10k	15k	20k
Average Cost	82¢	64¢	55¢

- **Time recovery**

- 50% of the SF Bay Area workforce has a commute in excess of 30 minutes.

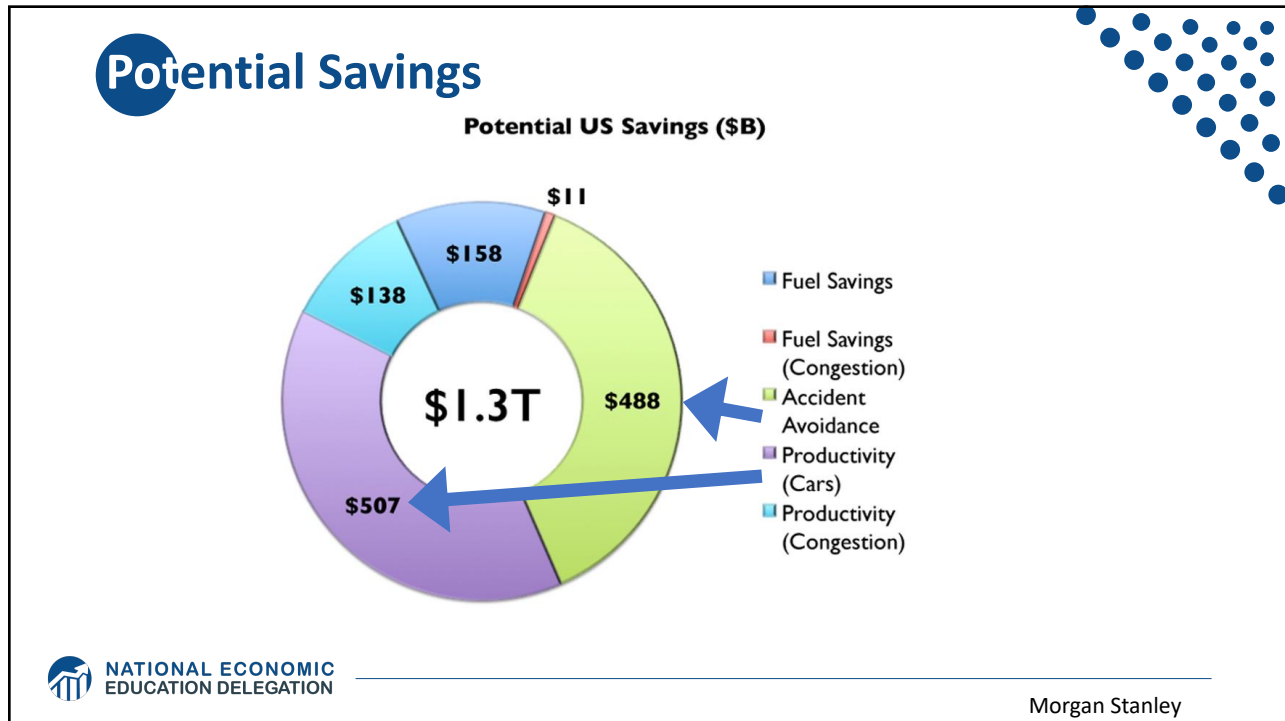


Economics Drives Transition: Public

- **Economic and social costs associated with human drivers are enormous:**

- ACCIDENTS:
 - Drive 25% of congestion.
 - Result in 40,000 deaths.
 - And 2 million injuries.
 - 90+% caused by human error.
- Increased productivity from not driving.
- Costs of human drivers estimated at up to \$1.3 TRillion each year





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Public Policy/Planning Issues

- Government buy-in:**
 - Essential – gov’t must encourage progress
 - Difficult – because of displacement issue
- Important transitional issues:**
 - What infrastructure should be developed?
 - What to do about public transportation?
 - What to do with all of the parking spaces?

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 Morgan Stanley

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Planning

- **Respond to the coming changes**

- The planning horizon for any investment in transportation infrastructure based on today's predominant technology has changed.
 - It may have gotten **MUCH shorter**.

- **Encourage the changes to happen more quickly**

- Mobility, safety, productivity, and environmental benefits abound.



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Responding to the coming changes:



- **Transportation organizations must develop a forecast for adoption in their specific geography**

- San Francisco – faster than Chicago
- Chicago – faster than Fresno
- Fresno - faster than Kansas

- **How does this affect the ROR calculation on projects?**

- Highway expansion? Public Transportation?



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Encourage Change

- **Mobility and equity considerations**
 - Elderly/disabled/impoverished
- **Safety:** only way to reduce traffic fatalities is by coordinated effort
- **Productivity:** reduced congestion
- **Environment:** speed transition to electric vehicles

These are all societal benefits that come about too slowly if the private market is left to itself.

Mobility and Equity

- **Mobility**
 - Handicapped
 - Elderly
 - Lower income
- **Equity**
 - Public Transportation often does not work well for low-income workers/residential workers
 - Does not go from residential to residential, but from residential to commercial



Safety and Productivity



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Environment



Mother Jones

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Environmental Implications Depends: Heaven or Hell

- **Improved resource utilization**
- **More efficient travel**
 - Right sized vehicles
 - Optimized routes
 - Reduced congestion
 - No searching for parking
- **Increased VMT**
- **Cleaner technologies**
 - Electric
 - Lighter vehicles
- **Energy use of onboard electronics**
 - Weight and functional
- **Increased urban sprawl**

Bottom line: push governments at all levels to embrace and to implement policies deterring private vehicle ownership and zero passenger miles



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Interim Summary

- **Transition is coming very quickly!**
 - Most reports are extremely conservative
 - Apply generally, but faster in many regions.
- **Very important to start incorporating AVs into planning now.**
 - To realize the benefits of AVS.
 - Sacrifice expansion for maintenance.



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What Changes Will This Bring?

- Disposable income
- Government finances
- Transportation demand
- Infrastructure
- Housing
- Public transportation
- Employment
- Parking

Potentially dramatic improvements in infrastructure planning and maintenance -
Data sharing and integration

Disposable Income



- Costs \$9,666 to own a car
- Will cost \$3,000 to use TaaS
- Net increase in disposable income of > \$6,000
- Spread across all households: more than \$1 trillion in new spending in the economy
- Major boost to economic activity
 - CREATING JOBS!

Government Finances



- **Government finances thrown for a loop:**

- Revenues up and down:
 - Parking revenue, tickets, traffic violation revenues
 - More commercial, retail and residential space
- Less spending on road development
- More (maybe less) spent on road maintenance
 - Fewer road miles
 - but perhaps more VMT



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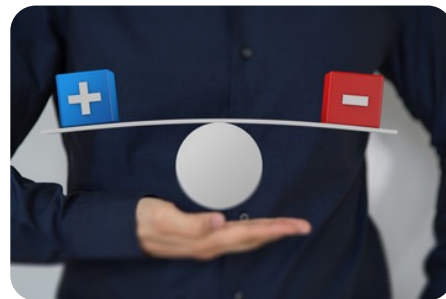
Transportation Demand

- **Demand for transportation will likely increase significantly: price falls, demand rises**

- Commutes may increase in distance, but not necessarily in duration
- Zero passenger trips will arise
 - Deliveries

- **At the same time, demand for roadway lane-miles will likely decrease**

- AVs make significantly more efficient use of space
- Front to back and side to side



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Infrastructure

- **Focus of transportation infrastructure:**

- Currently on expansion
- Will turn toward:
 - Maintenance
 - Signage and striping has to be robust
 - TaaS providers push for fewer potholes?
 - Adding technology
 - Stop lights will be digital as well as visual
- Some will disappear: Signs!



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Housing



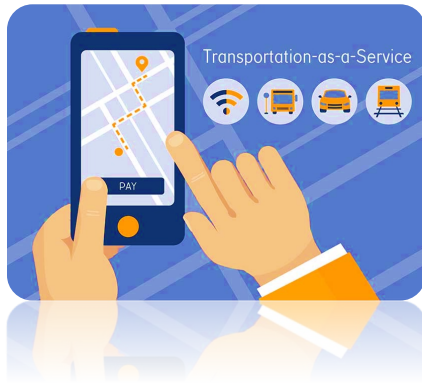
- **Housing is suddenly easier to build**
 - Issue of traffic congestion is significantly reduced.
 - Space for new housing is available where parking lots used to be.
- **Existing houses can now accommodate more people: garage to bedroom conversions.**



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Public Transportation



- **Ambiguous implications for public transportation**
- **Demand may:**
 - Shrink because of low cost of TaaS
 - Grow because last mile problem is solved
- **Extensions may be added through contract with TaaS company**

Cautionary Tale From Long Ago

- **Automobiles impact on rail:**

“The increasing dominance of cars was also felt by railway companies, which by June 1894 had to start making **pricing concessions** for transporting goods, even including free transport.”



- Samuel I. Schwartz, No One at the Wheel, 2018

Employment

- **Massive job displacement/relocation (Millions!):**
 - Drivers of all varieties: truck, taxi, delivery...
 - Car production jobs, car parts production jobs
 - Gas station, vehicle repair, and body shop
 - Police and fire
 - Health care workers
 - And so on...



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Employment (con't)



- **What jobs will be created?**
 - IT jobs
 - Retail/Production jobs
 - ??
- **Always easier to identify things that will go away than to identify what will pop up in its place.**
- **Regardless of where they are created, training programs will be crucial to the transition.**



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Parking

- **Greatly reduced demand for parking lots.**
- **Service providers will own parking lots in strategic places.**
- **Street parking will largely be a thing of the past.**
 - More green space in cities
- **Shopping mall and apartment parking?**
 - Converted to housing?



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Freeing Up Urban Space from Parking

- **Los Angeles: 14% of incorporated land area**
 - 200 Square miles
- **San Francisco: 275,450 on-street parking spaces**
 - Enough to parallel-park a line of cars 60 miles longer than California's entire 840-mile coastline
- **Nationwide: (estimate) 500 million spaces**
 - That's larger than Delaware and Rhode Island combined.
 - Could be as many as 2 billion (add in Connecticut and Vermont).



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Potential Problems and Concerns

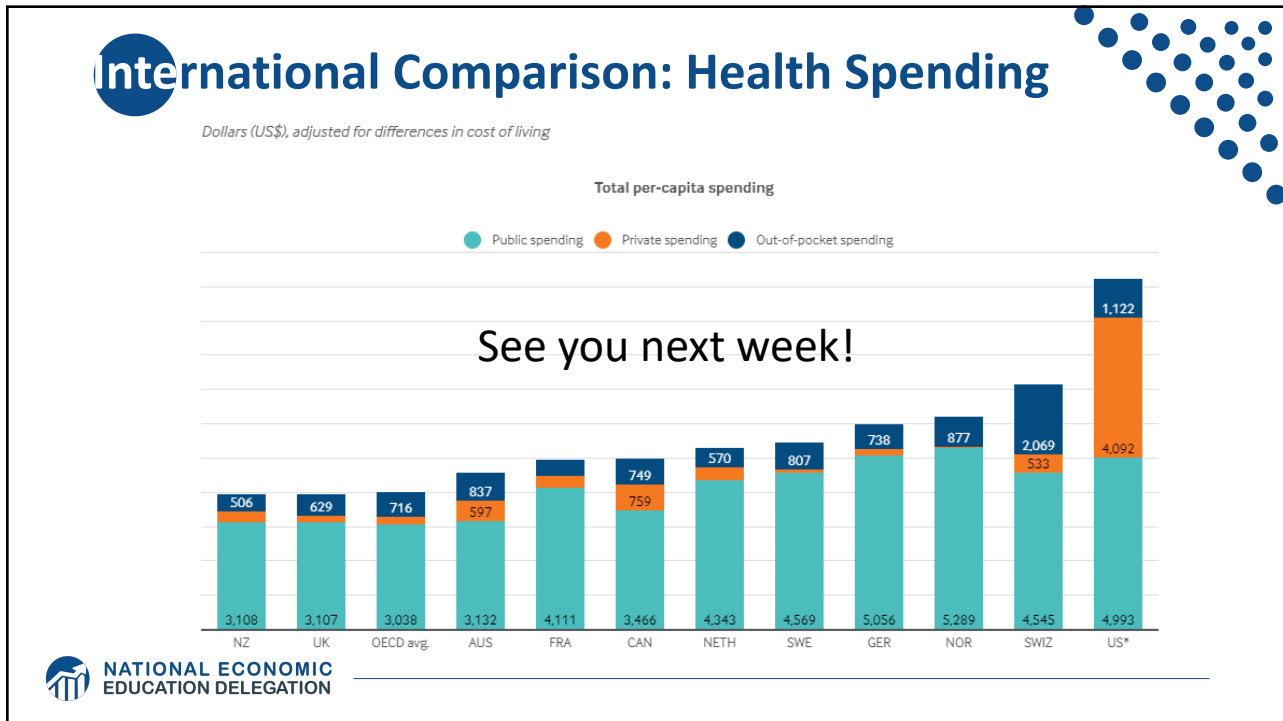
- **Expansion of the electric grid to provide sufficient capacity.**
- **Mining for rare earth minerals for batteries.**
- **Hacking of autonomous vehicles for nefarious purposes.**
- **Competition in service provision in some markets.**
- **And many more...**



Summary of Change

- **Massive employment upheaval.**
- **Local government finances will look very different.**
- **Housing will be easier to build and more plentiful.**
- **Parking conversions will be commonplace.**
- **Demand for transportation infrastructure will likely decline.**
 - **Transportation infrastructure technology will be a booming business.**
- **Demand for public transportation may well decline.**
- **Coming likely sooner rather than later!**





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Thank you!

Any Questions?

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