

Osher Lifelong Learning Institute - Berkeley

Contemporary Economic Policy Issues

Fall, 2020

Jon Haveman, Ph.D.
National Economic Education Delegation



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National Economic Education Delegation

- **Vision**

- One day, the public discussion of policy issues will be grounded in an accurate perception of the underlying economic principles and data.

- **Mission**

- NEED unites the skills and knowledge of a vast network of professional economists to promote understanding of the economics of policy issues in the United States.

- **NEED Presentations**

- Are **nonpartisan** and intended to reflect the consensus of the economics profession.



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Course Outline

• What Economists Know About Important Policy Issues

- Week 1 (9/21): Coronavirus Economics
- Week 2 (9/28): Economic Mobility (Oana Tocoian, UCSD)
- Week 3 (10/5): Economics of Immigration
- Week 4 (10/12): Racial Inequities – Black/White Wealth Gap
- Week 5 (10/19): U.S. Policy History and Discrimination
- Week 6 (10/26): Health Economics (Veronika Dolar, SUNY, Old Westbury)
- **Week 7 (11/2): Infrastructure Economics (Mallika Pung, Univ. New Mexico)**
- Week 8 (11/9): Autonomous Vehicles

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Infrastructure Economics



OLLI-Berkeley
November 2, 2020
Mallika Pung, Ph.D.

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Credits and Disclaimer

- **This slide deck was authored by:**
 - Mallika Pung, University of New Mexico – Valencia
 - Daniel Marcin, The George Washington University
- **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.
 - Such views are those of the presenter and not necessarily those of the National Economic Education Delegation (NEED).



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Outline

- **What do we mean by infrastructure?**
- **Current state of infrastructure in the US**
- **Infrastructure investment in the US**
- **Infrastructure in economic models**
- **Why should we invest in infrastructure?**
- **Public or private infrastructure investment**
- **Broadband infrastructure**



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What is Infrastructure?



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What is Infrastructure?

- **Basic services that promote economic activity**

- For example:

- Physical structures
- Systems
- Institutions
- Services
- Facilities

- **We will mostly focus on physical structures**



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Categories of Infrastructure

- **Transportation**

- Highways, roads, bridges
- Mass transit
- Airports, seaports

- **Water**

- Supply
- Distribution

- **Waste management**

- Trash, recycling, and wastewater

- **Energy**

- Generation
- Transmission

- **Communications**

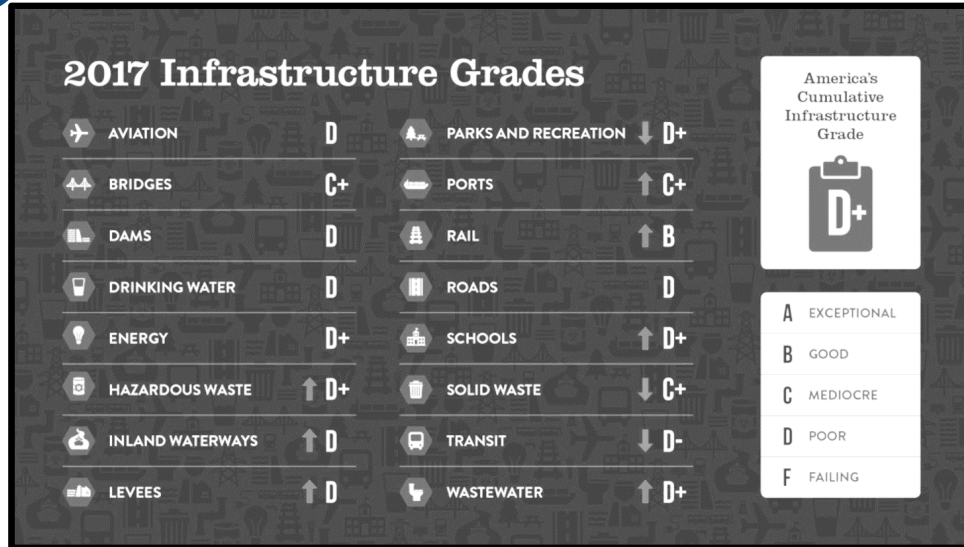
- Telephone
- Internet



Current State of Infrastructure in the US



Current State of Infrastructure in the US



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Current State of Transportation Infrastructure

• Roads

- Over 4 million miles of roads.
- In 2018: 3.3 trillion VMT (Vehicle Miles Traveled)
- 40%+ of America's urban interstates are congested
- In 2017, 8.8 billion hours of traffic delay
 - o Costing the country \$166 billion in wasted time and fuel

"The average auto commuter spends 54 hours in congestion and wastes 21 gallons of fuel due to congestion at a cost of \$1,080 in wasted time and fuel."

-- 2019 Urban Mobility Report, Texas A&M Transportation Institute

- 36,096 motor vehicle fatalities in 2019

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Current State of Transportation Infrastructure

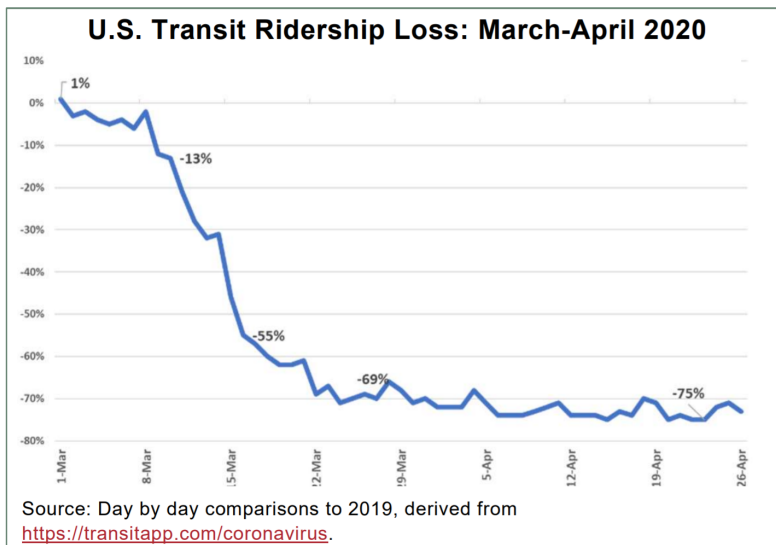
• Mass Transit

- ~2,500 separate transit agencies.
- Transit ridership: reached 10.7 billion in 2014
- 50% of passenger trips by bus
 - o 10% of fleets NOT in “state of good repair”
- 33+% by heavy rail (subway/metro)
 - o 3% of fleets NOT in “state of good repair”
- Transit’s physical infrastructure fares considerably worse (% NOT in “state of good repair”):
 - o 15% of facilities (e.g., maintenance facilities),
 - o 17% of systems (e.g., power, signal, communications, fare collecting)
 - o 35% of guideway elements (e.g., tracks), and
 - o 37% of stations

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Current State of Transportation Infrastructure

U.S. Transit Ridership Loss: March-April 2020



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Current State of Transportation Infrastructure

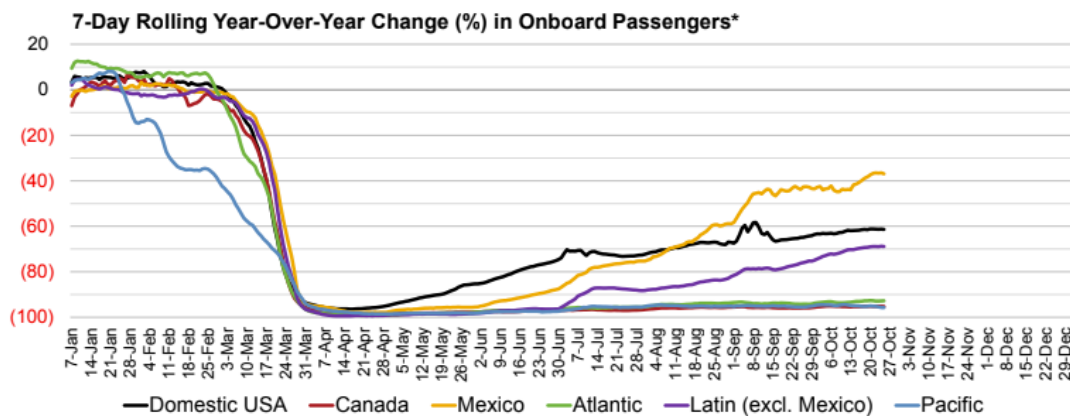
• Aviation

- In 2018, 10 million+ commercial flights
 - o Flying ~3 million passengers daily
- National Plan of Integrated Airport Systems (NPIAS) identifies 3,300+ airports
- Contributed 5.1% to US GDP
 - o Generated 10.6 million jobs
- In 2017, 80% of flights were on-time. Delays were caused by
 - o late-arriving aircrafts (6.8%),
 - o air carriers (5%),
 - o weather (3.1%), and
 - o diverted flights (0.2%).

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Current State of Transportation Infrastructure

In Most Recent Week, U.S. Airline Passenger Volumes* Were 63% Below Year-Ago Levels
 Domestic Air Travel Down 61%, International Air Travel Down 77%



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Current State of Transportation Infrastructure

• Ports

- 99% of US overseas trade pass through ports
- Los Angeles and Long Beach – busiest ports in the US
 - o Top 10 U.S. ports account for 3/4th of U.S. trade
- Congestion decreased port productivity by over 25% over the past decade
- Port infrastructure upgrades needed to accommodate new, larger ships with deeper navigation channels

• Waterways

- More than 600 million tons of cargo
 - o 14% of annual domestic freight
- Beyond their 50-year design life
- 50% vessels experience delays due to maintenance shut downs



Current State of Water Infrastructure

• Drinking Water

- 150,000+ public drinking water systems
- 1 billion+ glasses of drinking water consumed daily
 - o 80% from surface waters such as rivers, lakes, oceans, reservoirs
 - o 20% from groundwater aquifers
- Delivered via 1 million miles of pipes
 - o Majority laid in mid-20th century and are aging
 - o estimated 240,000 water main breaks occur each year
 - o 6 billion gallons of treated drinking water lost daily due to leaking pipes
 - could support 15 million households



Current State of Water Infrastructure

• Wastewater

- ~15,000 wastewater treatment plants
 - 1.3 million miles of public and private lateral sewers
- Used by 76% of Americans
 - Likely to serve 56 million more people by 2032
- Structural failure, blockages, and overflows cause at least 23,000 to 75,000 sanitary sewer overflow events each year



Current State of Water Infrastructure

• Dams

- There are over 90,000 dams in the US providing:
 - drinking water,
 - irrigation,
 - hydropower,
 - flood control, and
 - recreation
- Average age – 56 years
- By 2025, 7 out of every 10 dams will be over 50 years old
- In 2015, there were 15,500 high-hazard potential dams
 - up 52% since 2005



Current State of Water Infrastructure

• Levees

- A network of 30,000 miles of levees
- Levees in the U.S. Army Corps of Engineers Levee Safety Program protect
 - over 300 colleges and universities,
 - 30 professional sports venues,
 - 100 breweries, and
 - an estimated \$1.3 trillion in property
- Built in the mid-20th century with an average age of 50 years, aging fast
- Levees are crucial with majority of the U.S. population living within 50 miles of a coast



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Infrastructure Investment in the US

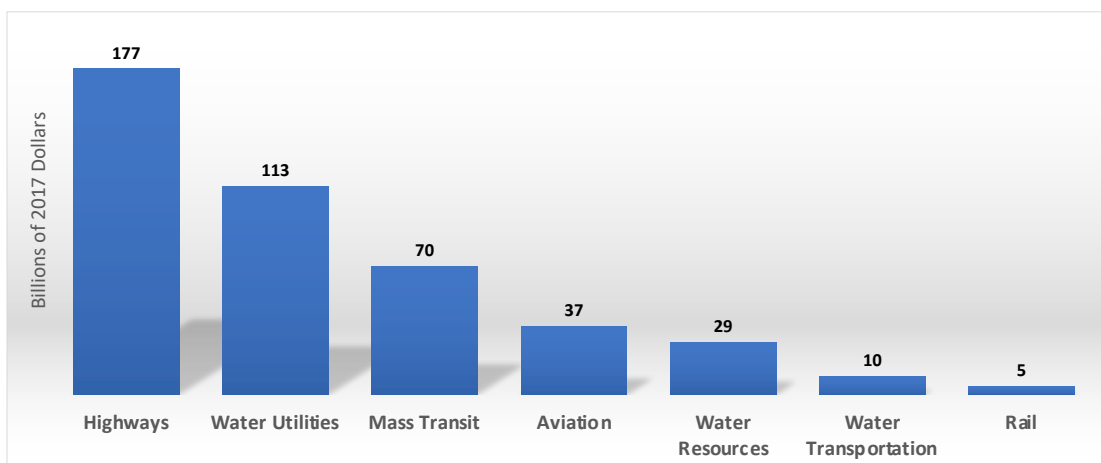


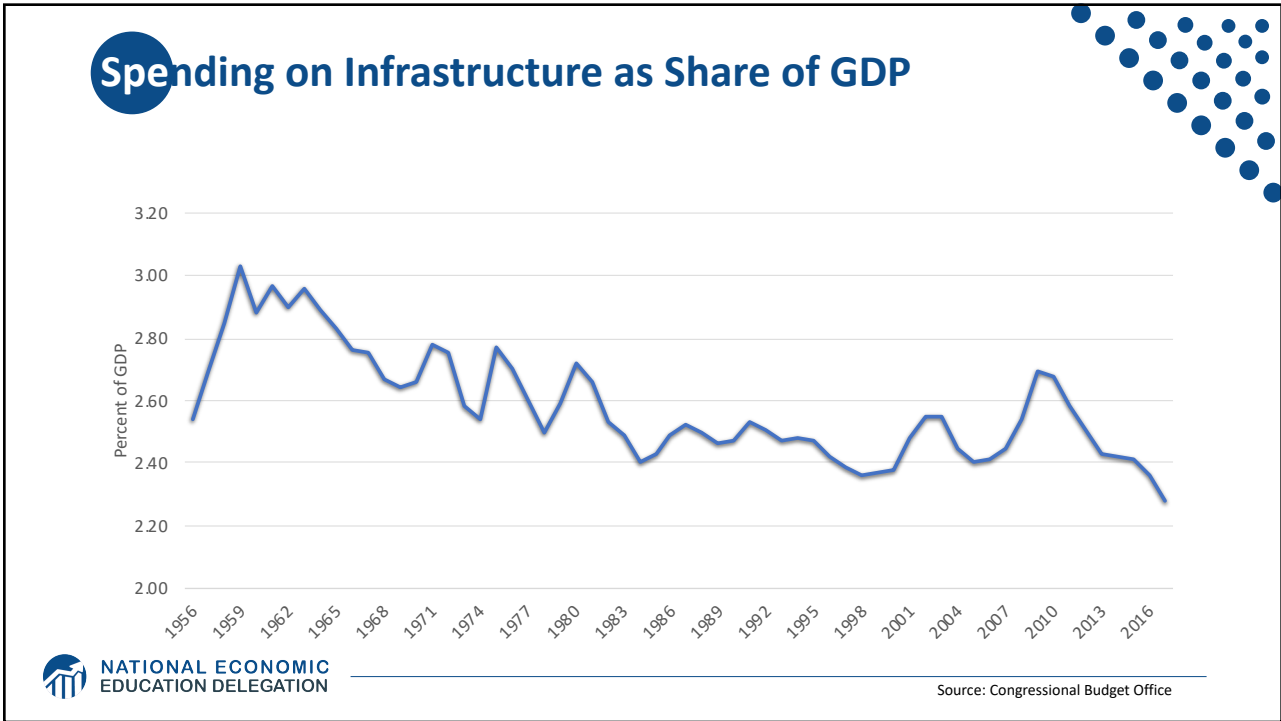
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Infrastructure Investment in the US

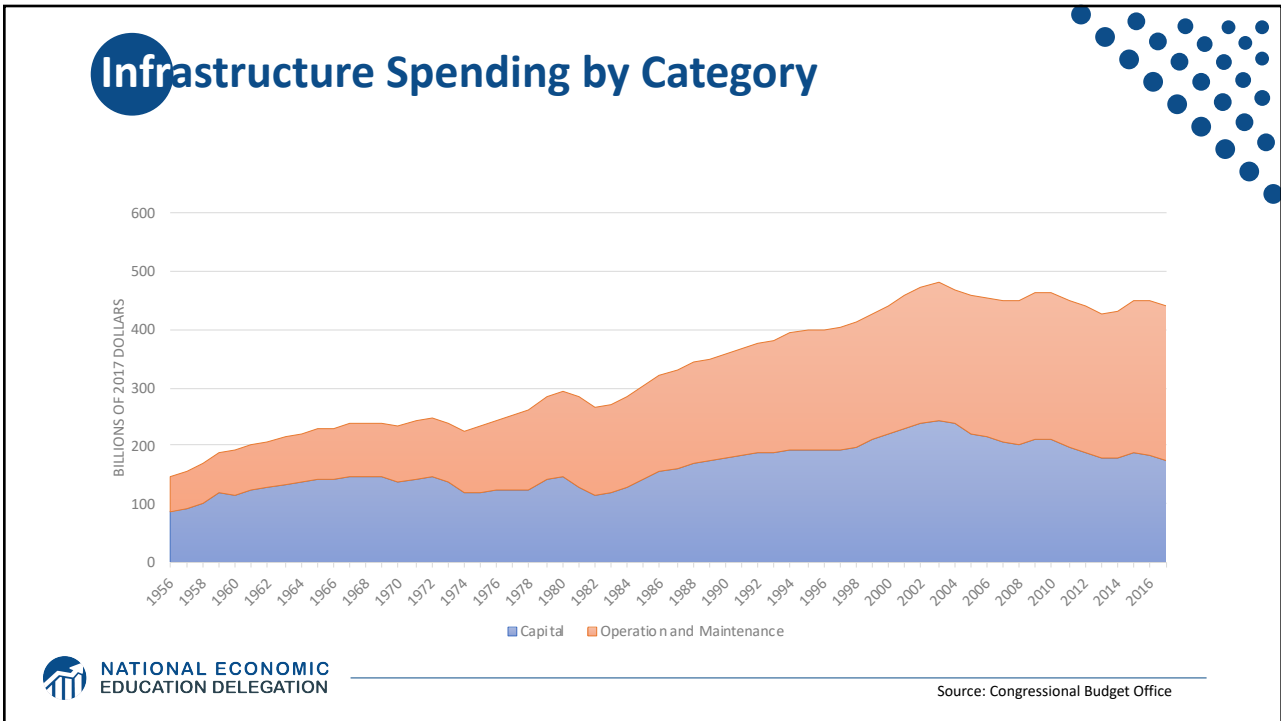
- Transportation, drinking water, and wastewater infrastructure
 - mainly funded by the public sector
- In 2017, Federal, State and Local governments spent
 - \$441 billion on infrastructure
 - 2.3% of gross domestic product

Government Spending on Infrastructure, 2017

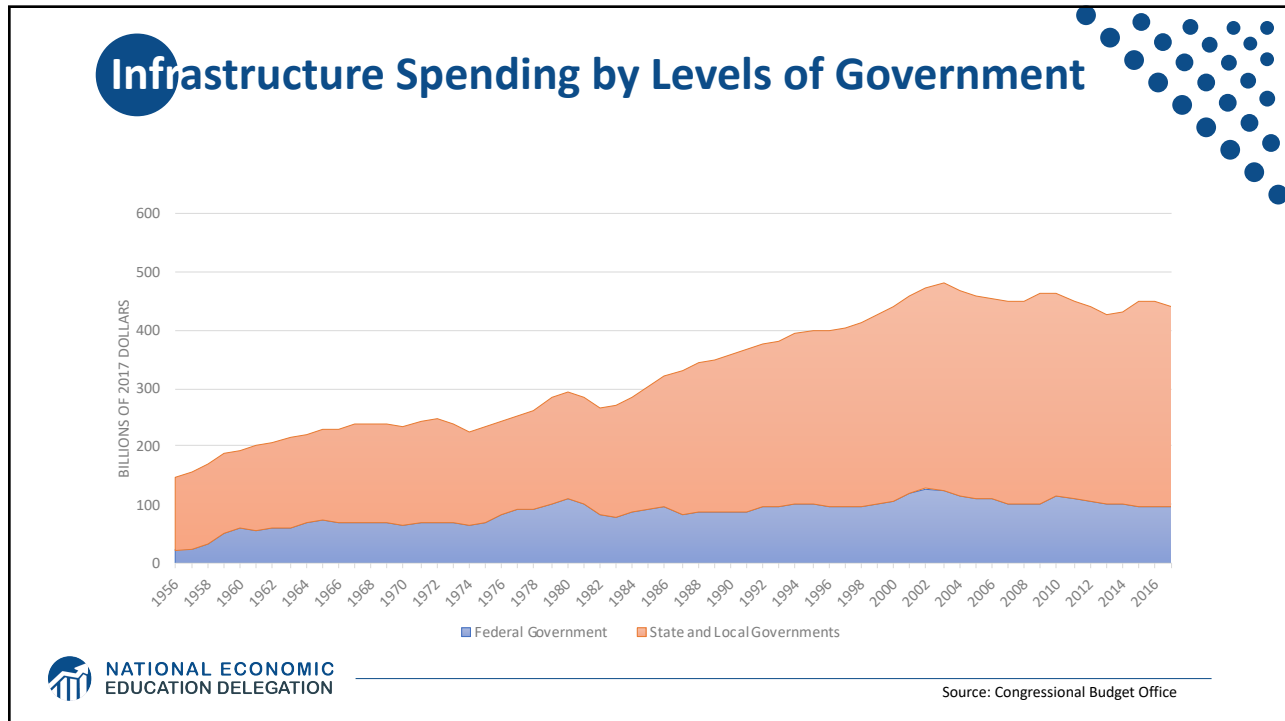




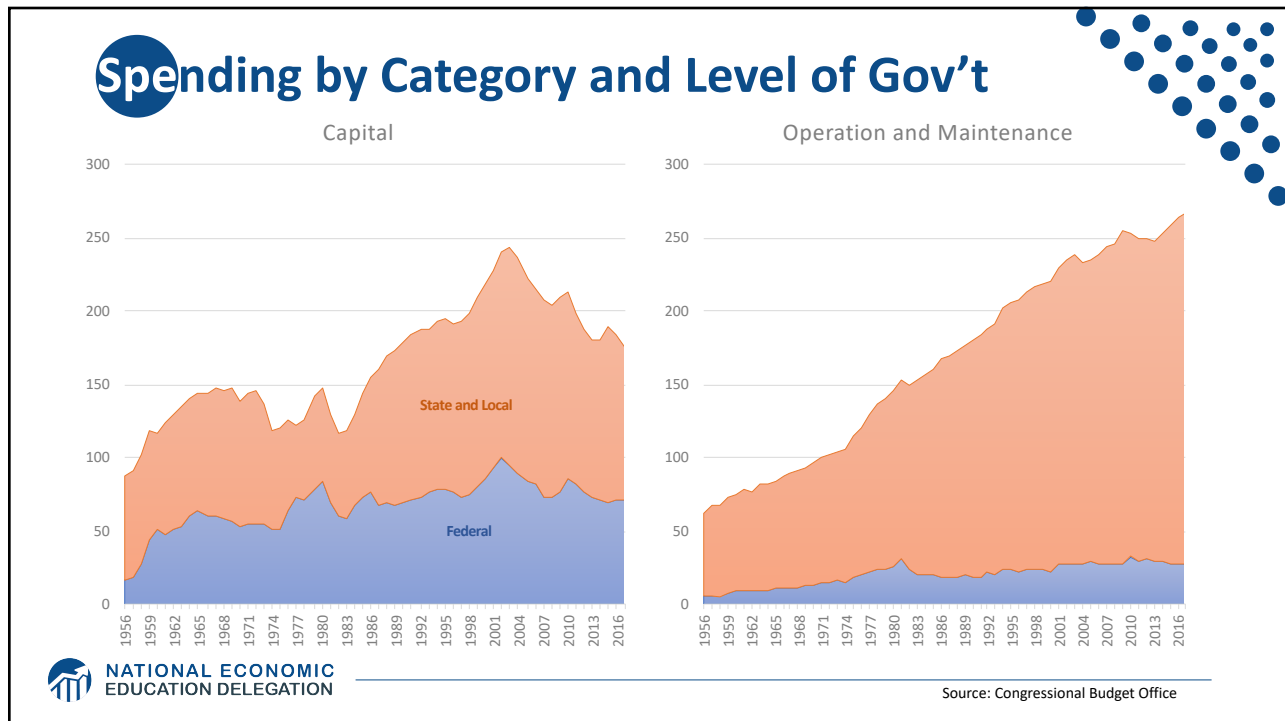
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Infrastructure in Economic Models



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Infrastructure in Economic Models

- **Vast macroeconomic literature on relation between infrastructure and economic growth**
 - Neoclassical growth model aka the Ramsey Model
 - Endogenous growth model
 - Variants
- **Wide variation in the magnitude of economic effects of infrastructure spending on growth or productivity**



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Data issues that make the task difficult

- Direction of causality
- Spurious correlation
- Heterogenous Effects



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Why Should We Invest in Infrastructure?



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Why Should We Invest in Infrastructure?

- **Vital ingredient to economic growth**

- Facilitates economies of scale, raises productivity
- A 10% rise in infrastructure assets directly increases Real GDP per capita by 0.7 – 1%
 - o Increasing spending by ~\$45 billion *might* raise GDP per capita in the US by ~\$400 - \$550
 - o Caveats apply
 - o Productivity growth raises standards of living



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Why Should We Invest in Infrastructure?

- **Vital ingredient to economic growth**

- Reduces trade costs by improving access to markets
 - o Port capacity improvement
 - o Reducing traffic congestion
- Reduces effective distances, facilitates trade and agglomeration
- Advances public health by providing clean water and effective sewage systems



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Case for Spending More on Infrastructure Maintenance

- **Rundown infrastructure increases costs**

- Longer travel time → higher costs for businesses
- Wear on cars → more spending on car repairs → faster car depreciation
- Vehicle deterioration → Additional fuel consumption

“The average motorist in the U.S. is losing \$523 annually -- \$112 billion nationally -- in additional vehicle operating costs as a result of driving on roads in need of repair.”

-- November 2016 Urban roads TRIP report

- **Deferred maintenance is a debt burden on the future generations**



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Public or Private Infrastructure Investment?



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Public or Private Infrastructure Investment?

- **Public Goods**

- Nonexcludable use
- Nonrival consumption

- **Are US highways a “public good?”**

- You can restrict access at on/off ramps, and highways get congested!



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Public or Private Infrastructure Investment?

- **If highways are not a public good, should the government be investing in it and providing it for “free”?**

- There might be some other motivation for public provision and subsidy
 - Externalities, maybe?
 - But pollution, congestion, roadway wear/tear are all negative effects of driving on highways



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Public or Private Infrastructure Investment?

- But many roads and streets are public goods
- Other characteristics of infrastructure provision
 - Economies of scale
 - Large fixed costs
- Social benefits might exceed expected financial return
- Private sector likely to underprovide such types of infrastructure
- Economic case for public provision of infrastructure assets



Public or Private Infrastructure Investment?

- **Another argument for public provision**
 - Provision of public infrastructure increases productivity of private infrastructure
 - Incentivizes private capital investment,
 - Increases labor productivity,
 - Indirectly increases employment and wages.



Public or Private Infrastructure Investment?

- **A few more arguments for public provision:**
 - Provides short-term stimulus to the economy by creating jobs
 - Promotes trade and commerce
 - Promotes equity
 - Pays prevailing wages
 - More demographically inclusive
 - Encompasses all congressional districts
 - Promotes public health and well-being
 - Improves public safety
 - Affects not just the present but the future generations also

- **Some of these are more debatable than others**

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Empirical Evidence on Effect of Gov't Spending

- **In studies from 80s, early 90s:**
 - A 1% increase in the stock of public capital raised GDP by 0.39%
- **In more recent studies**
 - by only 0.08% in the short run, 0.12% long run
- **In terms of multiplier, most short-term estimates are less than 1**
 - Due to negative effects of tax/interest rate increases on private C and I
- **Longer term multiplier**
 - OECD panel data – 1.6
 - US interstate highway system – 1.8

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Empirical Evidence on Effect of Gov't Spending

- **Estimates from the 2009 American Recovery and Reinvestment Act**

- Each \$100,000 spent led to 0.8 job-years created
- Highway construction employment unaffected in 2009-10
 - o fell sharply afterwards

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Federal vs. State and Local Gov't Roles in Infrastructure Investment

Mode	Typical Maximum Federal Share of Total Spending	Decision making roles of Federal, State and Local Gov'ts
Highways	80% of capital	State and local gov'ts choose projects, following federal rules and conditions
Mass Transit	80% of capital, 50% of operations	State and local gov'ts choose projects, following federal rules and conditions
Rail	Not applicable	Regulatory
Aviation	75%-90% of capital	State and local gov'ts choose projects, following federal rules and conditions; Federal gov't designs the national aviation system
Water Transportation	40%-100% of construction, 50%-100% of operations	Federal gov't chooses water projects with Congressional approval

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Local Government Spending More Effective?

- At the end of 19th century
 - Parasitic diseases killed 8 in every 1000 residents (45% of all deaths)
- But by 1940, mortality from infectious diseases declined by 75%
- About 25-50% of this decline attributable to public water and sewer systems that were financed, built and maintained not by the federal or state government, but by cities.



Fiscal Substitution of Federal Infrastructure Investment

- Crowding out:
 - \$1 increase in federal highway grants, reduces state and local spending by 20- 80 cents
- The effect will vary depending on
 - fiscal condition of state and local governments,
 - whether federal spending change is permanent or temporary,
 - magnitude of the spending change,
 - direction of the change



What About Private Sector Investment?

- **New development implies need for new infrastructure investments**

- New residents mean need for
 - New schools, new sewers, new traffic lights, new electric wires
- Who should pay for this? The new residents?
 - A very difficult question and depends on a lot of things
 - Disagreement among economists about the right answer
 - No one-size-fits-all answer



What About Private Sector Investment?

- State and local governments own almost all of the nation's transportation and water infrastructure.
- Most of the private-sector investment in these occurs through public-private partnerships for publicly owned infrastructure.



What Is a Public-Private Partnership?

“an agreement by which the government contracts a private company to build or improve infrastructure works and to subsequently maintain and operate them for an extended period (for example, 30 years) in exchange for a stream of revenues during the life of the contract”

-- Engel et al. (2011)

- New federal investment favors new construction
- Traditional procurement separates design, construction and maintenance aspects
- No incentive for construction contractors to build to minimize long term maintenance costs
- PPP helps correct this incentive problem



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Types of PPP contracts

- **PPP contracts differ based on the amount of risk transferred from the public to the private sector:**

- Design-Build (DB)
- Design-Build-Operate-Maintain (DBOM)
- Design-Build-Finance-Operate-Maintain (DBFOM)
- Similarly, we can have DBF, DBFM, etc.



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Public-Private Partnerships in the US – Some Examples

- Colorado I-70 Project
- Denver FasTracks commuter and light rail project in Colorado,
- Goethals Bridge reconstruction project linking New York City and New Jersey
- Bayonne Water Joint Venture LLC project, a water and wastewater PPP in New Jersey
- Automated People Mover (APM) project at Los Angeles International Airport (LAX)
- LaGuardia Airport Terminal B P3 project



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Public-Private Partnerships in the US – Some Examples

- A few unsuccessful P3s in California
 - Route 91 toll lanes in Orange County
 - Route 125 toll road in San Diego County
 - Presidio Parkway project connecting the City of San Francisco to the Golden Gate Bridge



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An Alternative Financing Tool – User Fees

- **Duranton and Turner’s (2011) “fundamental law” of congestion**
 - All free highways will congest
 - An uncongested highway is attractive to anybody currently using a substitute
 - Adding lanes only relieves congestion briefly
- **Way out?**
 - Tolls
 - Encourage carpooling
 - Encourage shifting time of travel, if the toll varies by congestion level
 - Encourage combining several trips into one

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An Alternative Financing Tool – User Fees

- **Singapore’s congestion pricing model**
 - Singapore -- an island nation with land area of 250 sq. miles
 - Limited street capacity in the central business area
 - Heavy congestion
 - Electronic Road Pricing (ERP) System launched in 1998
 - variable pricing designed to respond to congestion in real-time
 - Complementary policies to ERP
 - Parking fees inside the restriction zone doubled
 - Buses and bus frequency increased
 - HOV+4 lanes established
 - 15,000 park-and-ride spaces were established outside the restriction zone

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Broadband – Modern Day Equivalent of the Interstate Highway System



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Another Aspect of Infrastructure – Broadband

- Talk of a digital divide ubiquitous
 - especially in light of the current pandemic
- 21 million+ Americans lack meaningful access to the internet
 - Meaningful access: 25 Mbps download and 3 Mbps upload
 - 14.5 million have no access at all
- Lack of access more common among the less educated, low income, living in rural or suburban areas
- 9 million+ school children lacked internet access for online schoolwork



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Broadband Access

- Lack of access not just a rural problem
 - In 2016, 57% of households in Detroit, MI;
 - 49% in Memphis, TN and
 - 48% in Cleveland, OH without fixed broadband

- Digital redlining within cities

- Where available, limited to a single service provider – natural monopolies
 - Due to high up-front fixed costs of laying fiber optic lines



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Solutions to the Access Problem

- FCC Launched a \$20 billion Rural Digital Opportunity Fund in February 2020
 - Target census blocks without 25/3 Mbps broadband

- Taking matters into their own hands, cities and communities:
 - Building municipal infrastructure and cooperatives providing broadband
 - Despite legal barriers or bans on publicly owned networks in 19 states
 - 850+ communities served by a municipal network or cooperative

 - Community-owned networks are less expensive and have more transparent pricing than private ISPs – Harvard Study



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Community Network Map

Toggle Network Markers

- Citywide Cable
- Citywide Fiber
- Portions of City
- Dark Fiber
- Cooperatives

Additional Network Information

- Stimulus Project
- Gigabit Speeds
- PPP
- Open Access

State Information

- States with Barriers

Source: <https://muninetworks.org/communitymap>

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Technological Advancements of the Future to the Rescue?

- **Low Earth Orbit (LEO) satellite internet**
 - As of October 24, 2020, Elon Musk’s SpaceX launched 895 satellites into low earth orbit as part of the Starlink program
 - aims to provide low-latency (less lag) satellite internet
 - better internet coverage than traditional communications satellites
 - could potentially provide high quality internet to homes and businesses without access to cable, fiber, or reliable cellular internet

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Summary

- **Infrastructure investment is important**
- **Current state of US infrastructure – leaves a lot to be desired for**
- **Public infrastructure investment can play a vital role in long run growth**
 - Improve mobility
 - Raise private capital productivity
 - Improve health
- **May not be ideal as short term stimulus**
- **Private sector involvement via the market process will promote innovation and efficiency**
- **Local access issues may sometimes be better resolved locally than federally**
 - Reforms needed to make the process less cumbersome



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Thank you!

Any Questions?

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- Immigration Economics
- Housing Policy
- Federal Budgets
- Federal Debt
- 2017 Tax Law
- Autonomous Vehicles

