Highway Infrastructure:

Policy Issues for Regions

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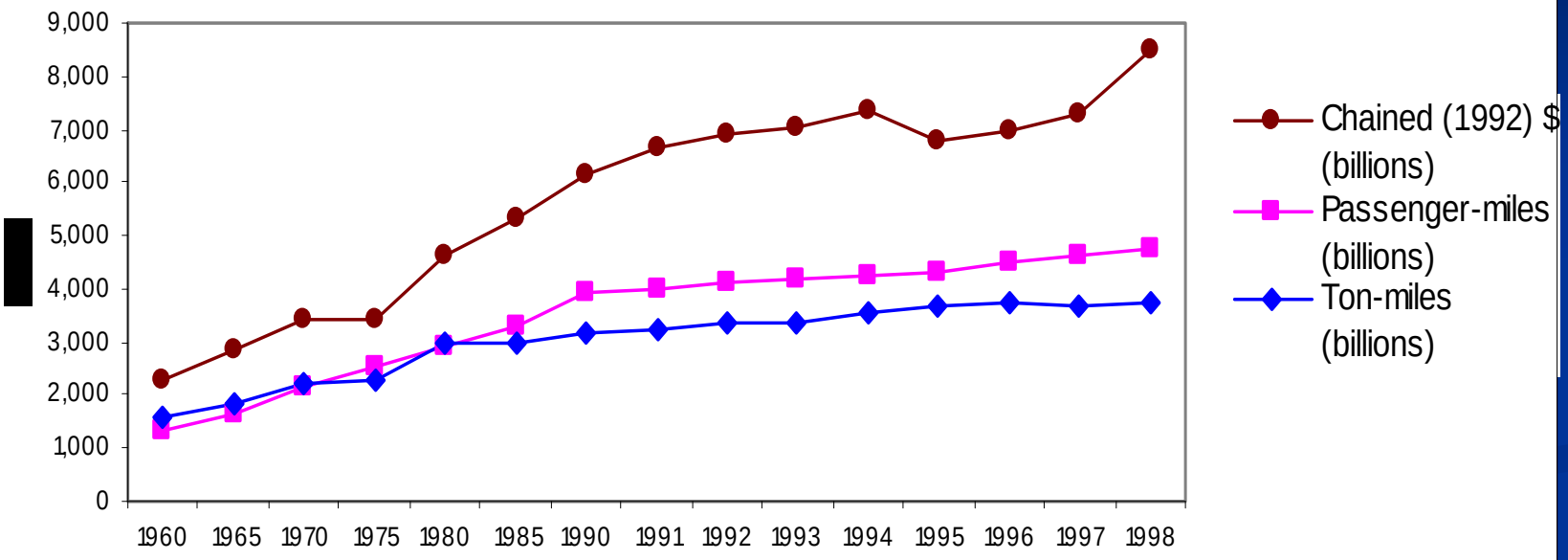
Federal Reserve Bank of Chicago Conference
Maintaining and Financing Public Infrastructure in Tough Budgetary Times
September 25, 2002

Central Role of Transportation Infrastructure

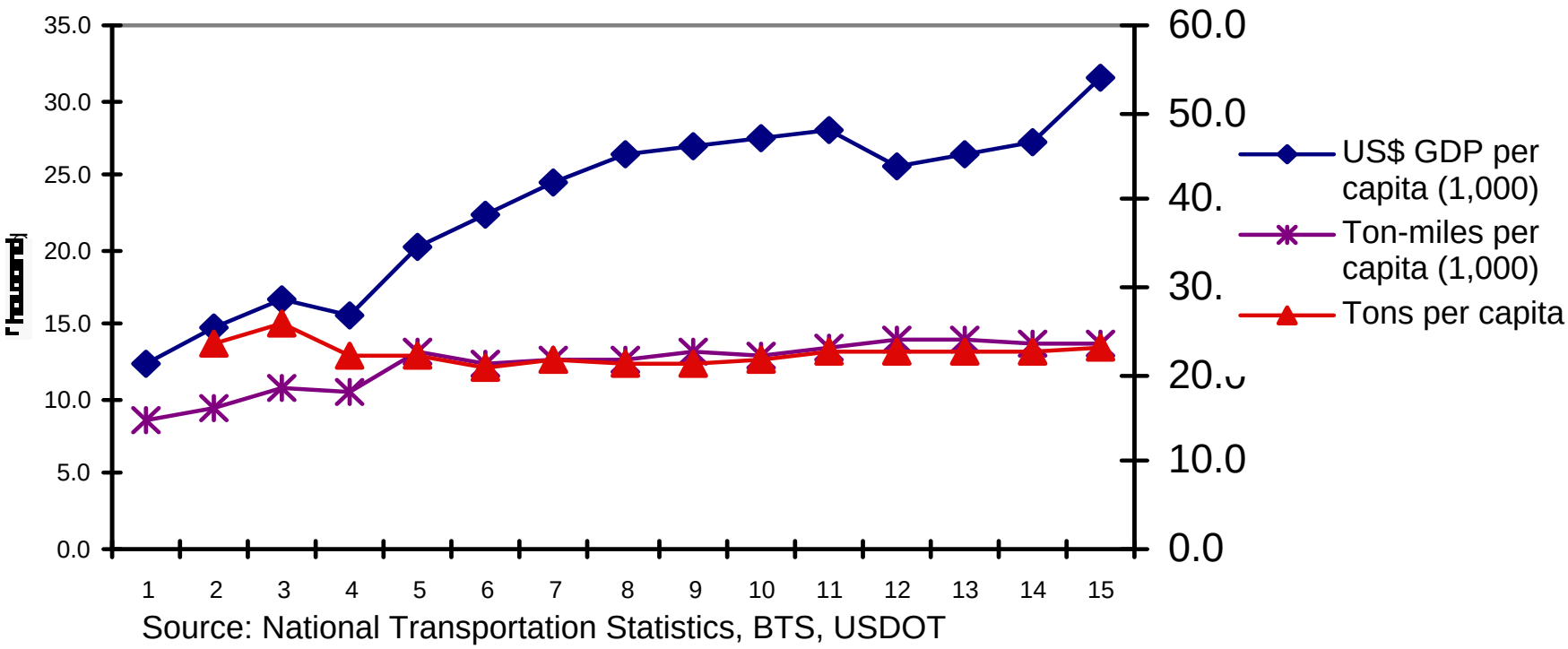
- Transportation systems are the backbone of developed market economies
- Essential for getting goods to market (customers) and workers to businesses
- Has been a major means of communication
- Since WWII the economy has increasingly depended upon **highways** for both passenger and freight transportation

Figure 1. Passenger and Freight Transport in the U.S. 1960-1998



Source: National Transportation Statistics 2000, BTS, USDOT

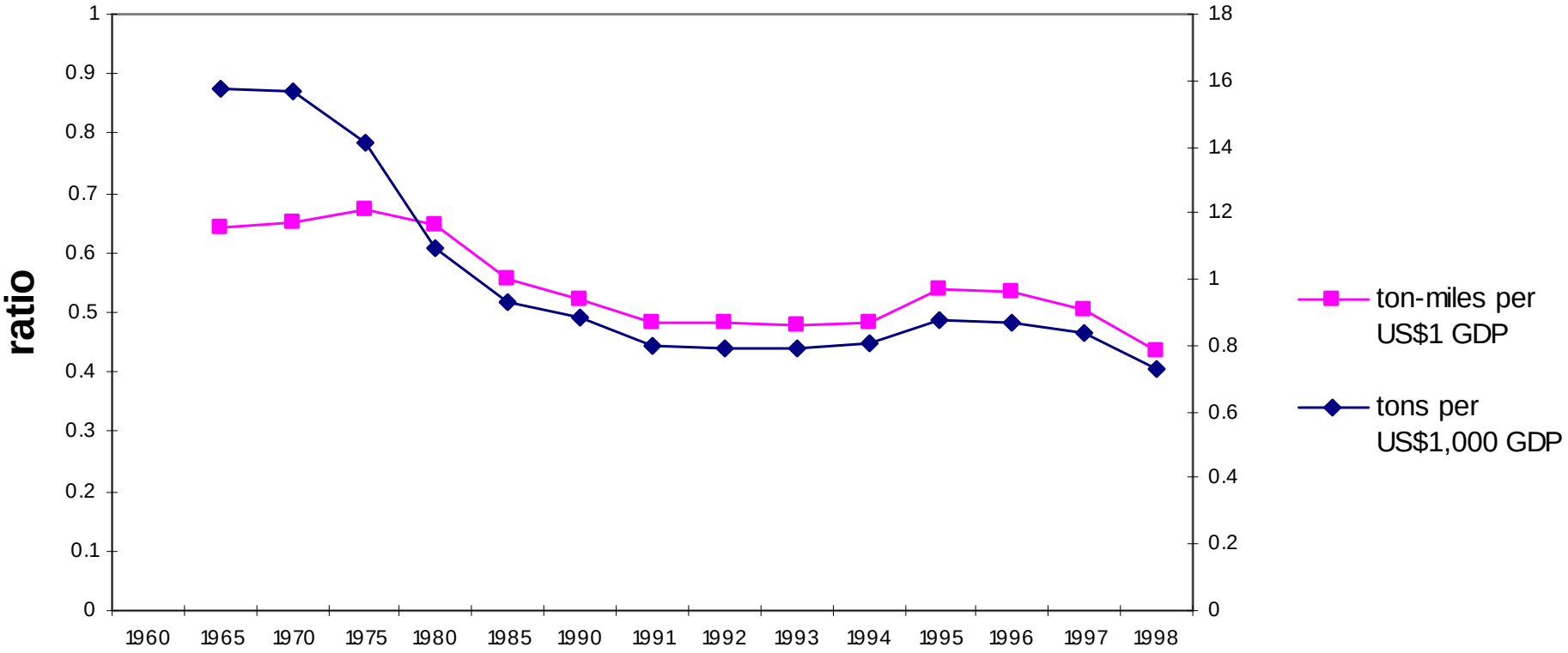
Figure 3. Freight Traffic Intensity in the U.S. 1960-1998



Source: National Transportation Statistics, BTS, USDOT

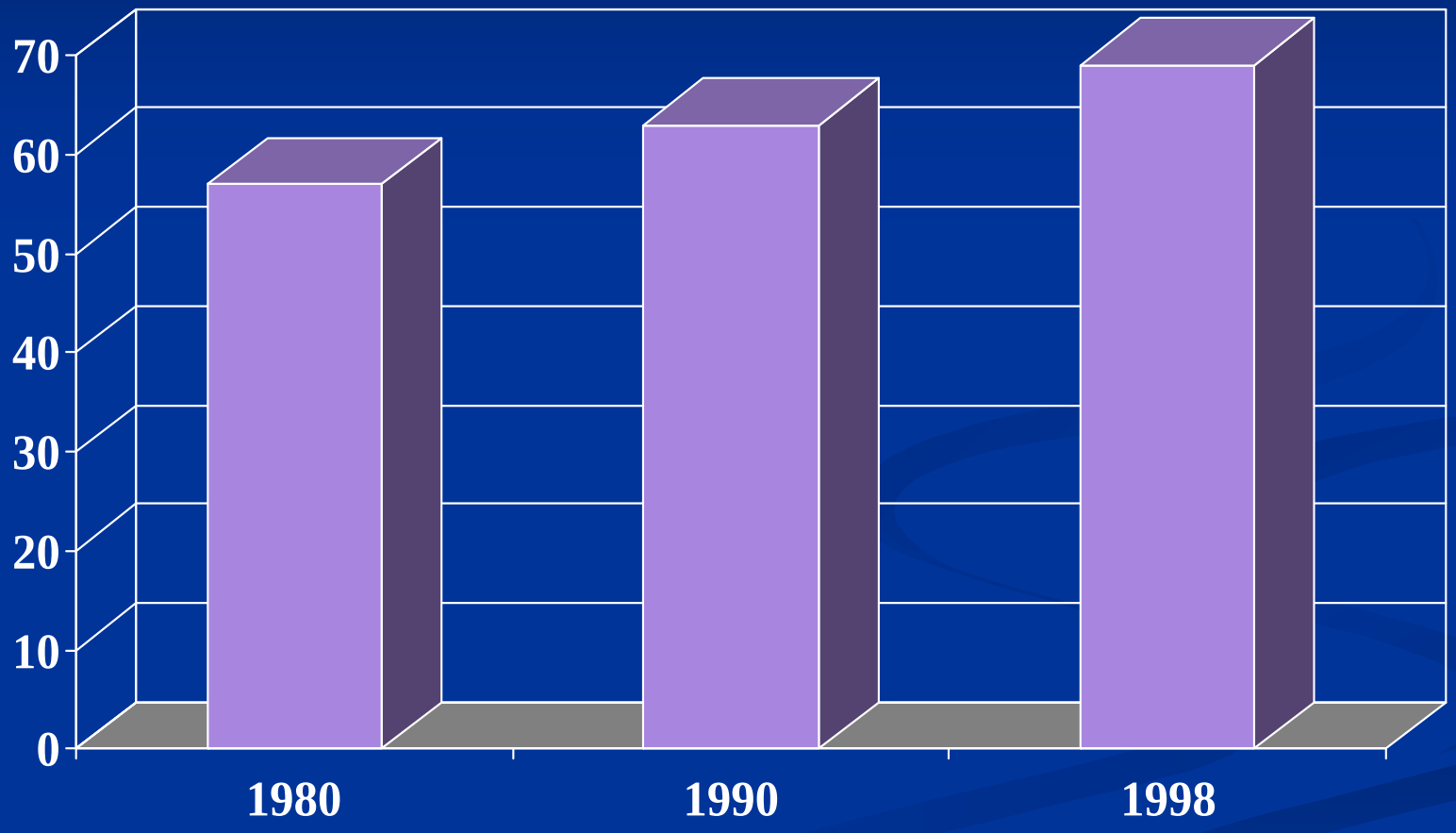
Transportation Infrastructure, Freight Services Sector and Economic Growth
T. R. Lakshmanan, William P. Anderson, Center for Transportation Studies
Boston University

Figure 4. GDP Freight Intensity



Source: National Transportation Statistics, BTS, USDOT

Percentage of Goods Shipped By Roads



Increasing dependence on highways over other modes

Debate

- Considerable controversy has taken place during the past decade over the value to the economy of highway investment
- Current thrust of the debate is less with respect to improving the efficiency of the highway system *per se,* as measured by travel time and/or travel cost savings
- Rather, it has more to do with the impact of highway investment on economic development—jobs, income, and tax base

Expanded Role of Transportation

- "Transportation is a means to a greater goal, not an end in itself"
- The greater goal is economic and community development
- An efficient and reliable transportation system is key to successful economic development
- Transportation dollars are one of the largest sources of economic development incentives

Expanded Regional Emphasis

- USA Today—"Ballot jammed with traffic issues" (9/24/02)
  - Referendums triple as taxpayers are being asked to foot bill for road relief
- Transportation experts say voters increasingly are more willing to pay for roads and other improvements that they use every day than for highways and transit systems hundreds of miles away
  - Five of the year's 36 votes are statewide—the rest are regional or local

Key Questions

- The key question is ***not*** …

  Whether transportation systems are important to the economy

- Rather, the question is …

  Whether additional investment (additional dollar) in transportation systems contributes to economic growth

- More specifically, which achieves the outcomes desired by state and local decision-makers

Outline

- Define economic development
- List the many facets of economic development that regional practitioners and elected officials would like to pursue
- Provide a framework to examine these linkages
- Review the results
- Discuss the process of investing in regional transportation infrastructure

Economic Development

- "Economic development occurs when the income and product generated within a region increases."

Multiple outcomes

- Jobs
- Income
- Quality of life
- Environmental preservation
- Environmental justice
- Sustainable development

Economic Development Opportunities

- Link key centers in region to national markets, thus helping to make the area more competitive for growth
- Provide for more efficient flows of commerce to enhance area's developmental potential
- Facilitate commuting flows of people to new jobs and public services
- Open up new sites for commercial/industrial development
- Provide local access roads to stimulate retail development

Economic Development Opportunities

- Provide quality of life benefits by providing access to new services and employment opportunities
- Promote tourism/recreational development
- Enhance the flow of goods and services within a sub-regional trade area to increase economic "multiplier effects."
- Strengthen and diversify the local economy
- Support new business initiatives

Estimates as Project Decision Tools

- Better access to employment or production
- Better access between workforce and production center
- Connectivity improved between cities

Jobs maintained/ generated, investment

Improved workforce availability to employers

Potential developable sites

Economic Development

Does (how does) highway investment:

- Improve productivity?
- Increase value added (personal income)?
- Create new jobs?
- Improve environmental quality?
- Enhance quality of life?
- Improve low-wage workers' access to jobs?

Decision makers want answers to these questions for specific projects

How to answer these questions?

- Benefit-Cost Analysis
  - Compare benefits of projects to costs
  - Compute benefit to cost ratio
  - Rank ratios
  - Choose a cutoff point
- Macro production functions
  - Estimates contribution to output
  - Rates of return to various types of investment

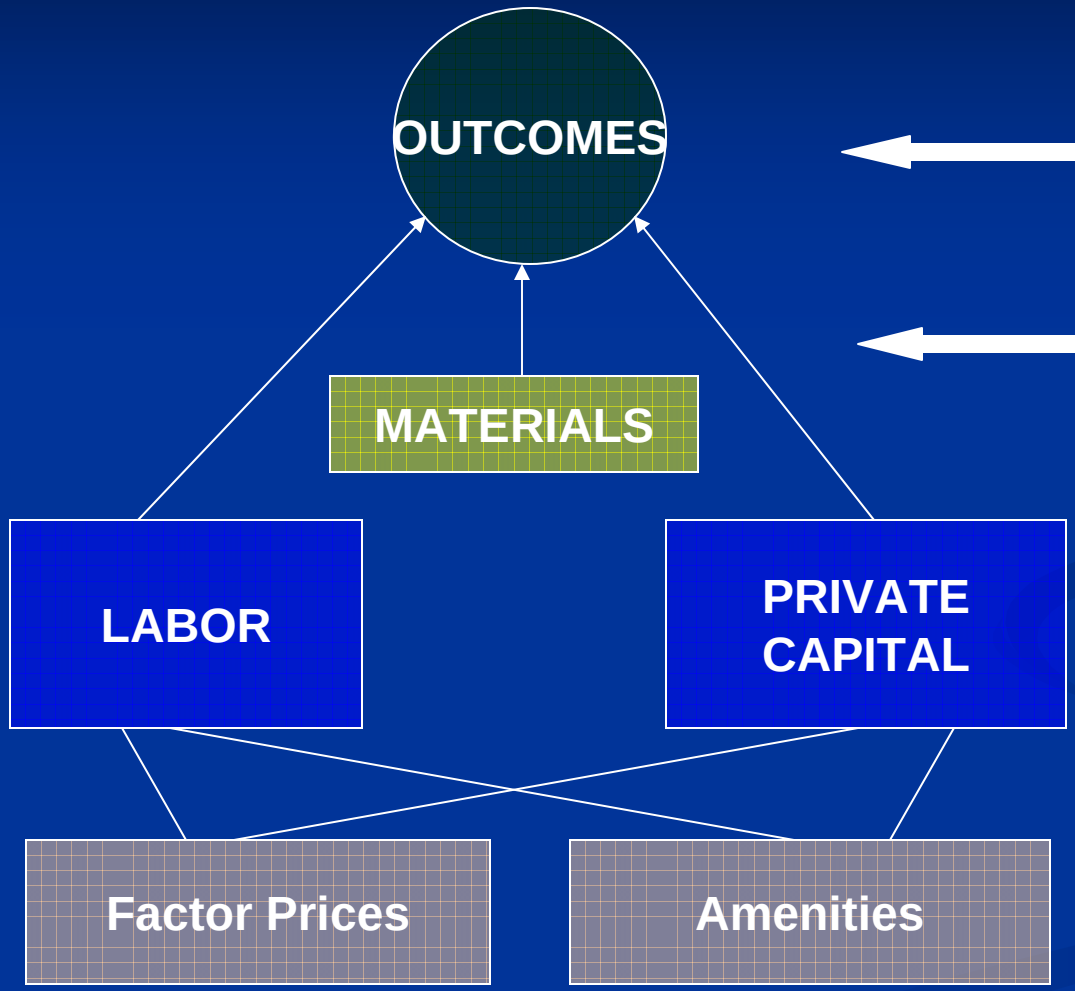
Highway Infrastructure

Economic Activity

Complex Relationship

- Regional economic growth process
- Relationship between infrastructure investment, performance of the facility, and economic and environmental outcomes
- Indirect effects
- Measurement of capital

Regional Growth Process and Supply-side Effects



Highways

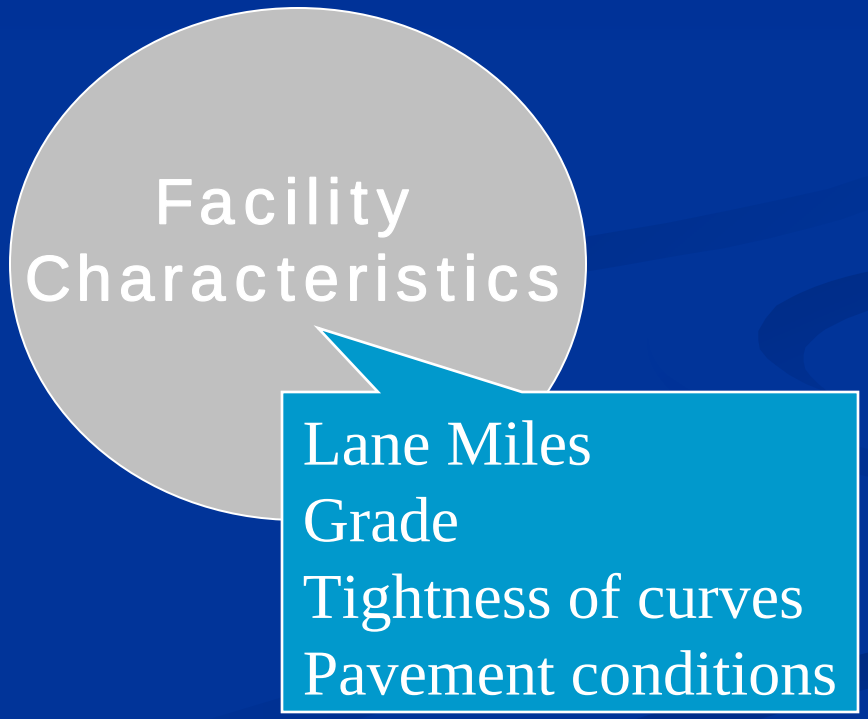
Directly Affect Outcomes

Increase Productivity

Key Relationship

- Key relationship is the effect of highways on economic outcomes (e.g., GSP, income, jobs)
- Measured as the percentage change in GSP resulting from a 1% increase in highways investment
  - (elasticity of output with respect to infrastructure)
- Relationship can also described as a rate of return

Relation between system characteristics, output and outcomes



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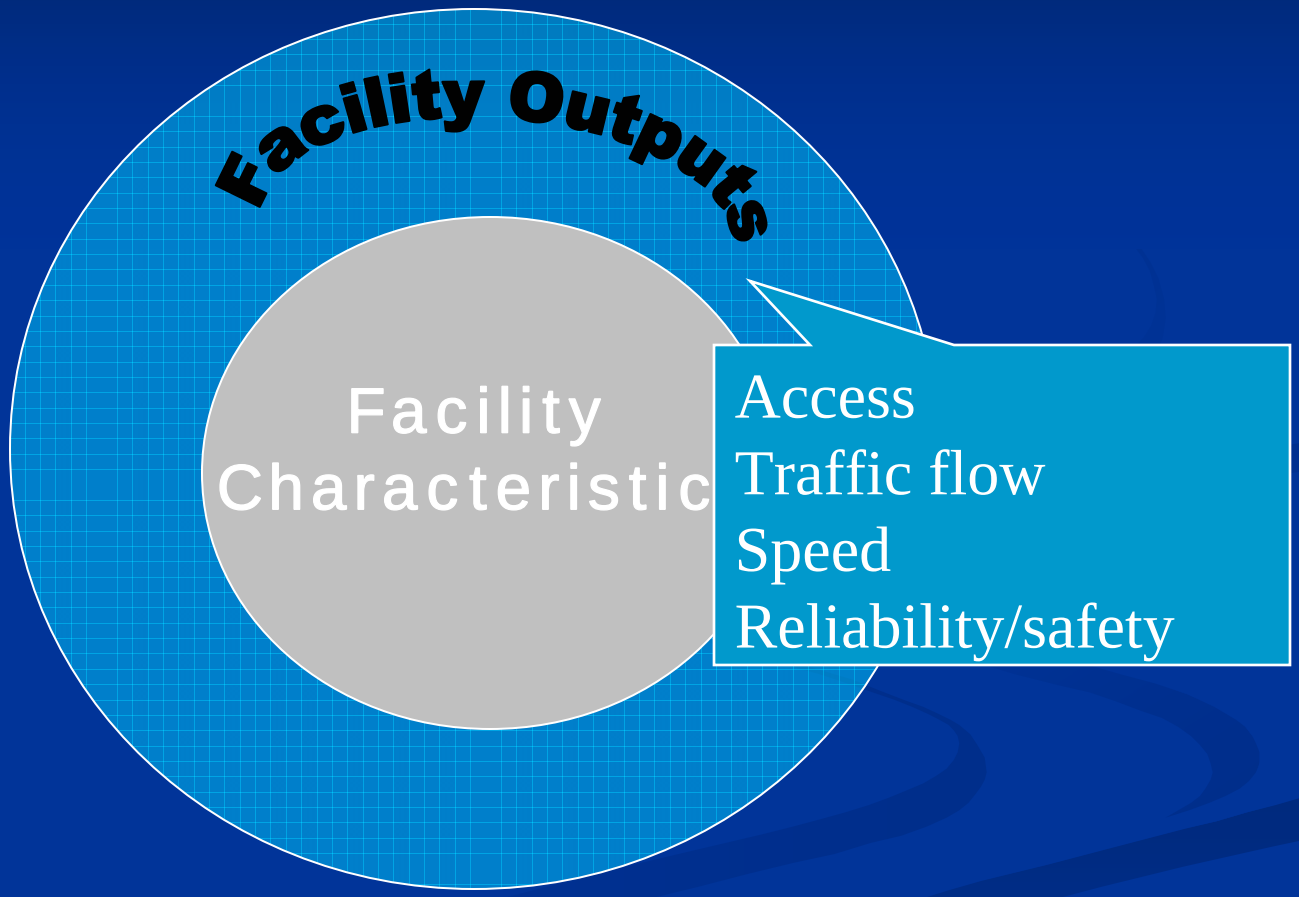

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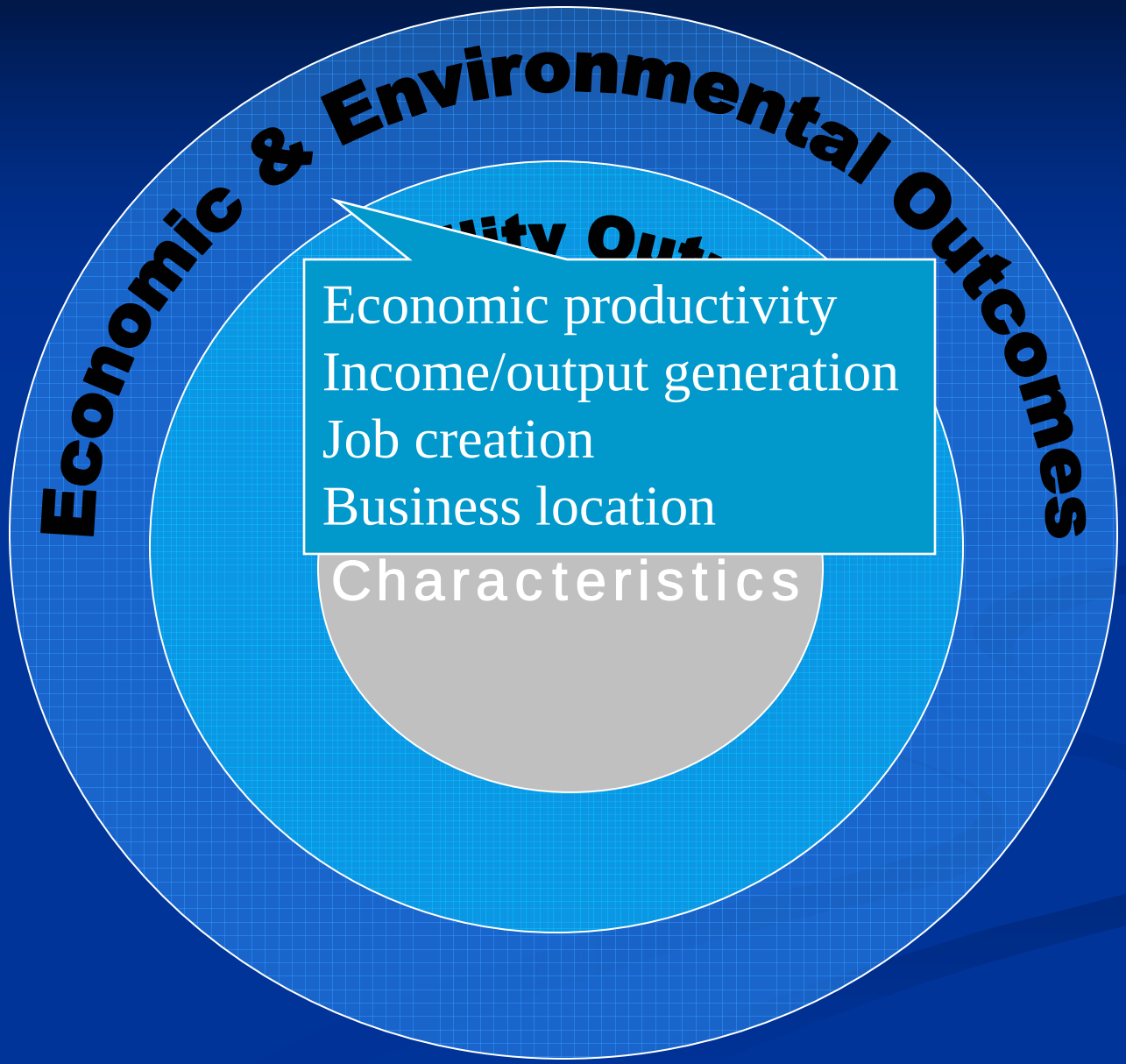

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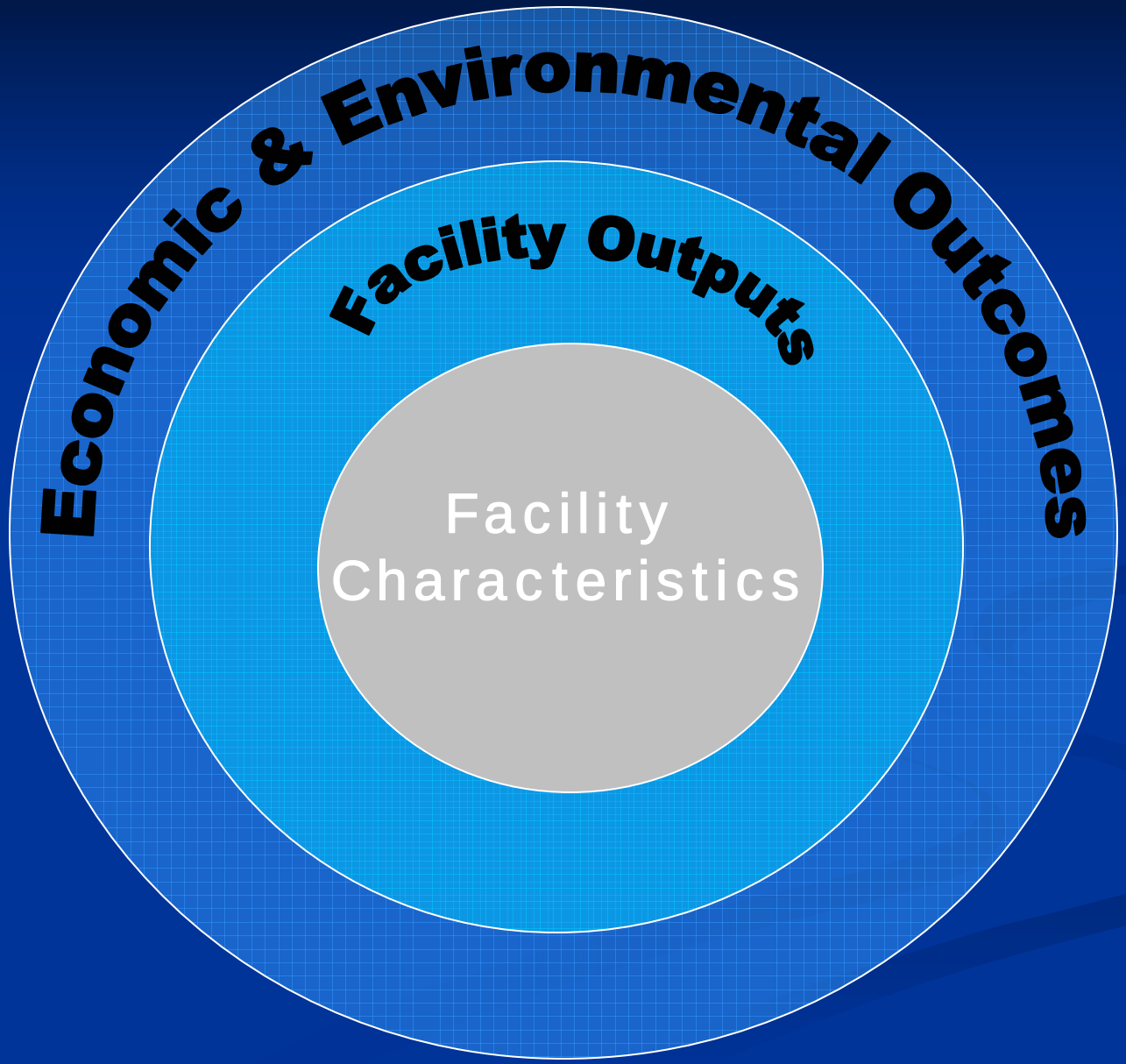


Indirect Benefits

- Spillover of benefits into regions outside the immediate vicinity of the project, and outside scope of measure of benefits
- Highways may affect other aspects of economy not directly related to transportation activities
  - Attract or expand resources such as private capital
  - Make other inputs more productive
  - Affect environmental quality
- Elevate economy to higher stage of development
- Network effects

Measurement

- Physical characteristics
  - Lane miles
  - Congestion
  - Pavement condition
- Dollar value—perpetual inventory method
- Traffic flows within and between regions
  - Vary by region

Tons shipped between selected Midwest States

From/To	Ohio	Indiana	Michigan	Illinois	Rest of country	Total tons
Ohio	328,679 69.9%	11,901 2.5%	15,994 3.4%	7,295 1.5%	105,783 22.5%	469,652
Indiana	11,258 3.9%	160,453 56.2%	11,271 3.9%	35,333 12.4%	67,490 23.6%	285,805
Michigan	26,873 8.3%	9,140 2.8%	239,272 73.9%	9,188 2.8%	39,334 12.2%	323,807
Illinois	11,745 2.2%	44,487 8.4%	7,882 1.5%	301,608 57.4%	159,454 30.4%	525,176

“Macroeconomic” Studies

- Studies mostly at national and state level
- Results vary widely depending upon the time period, level of geographic aggregation, functional form, controls
  - Output elasticities range from 0.00 to 0.41
- Recent estimates converge to 0.04-0.08 for most recent periods, declining over time from above-normal to normal returns

US Studies

Geographic Level	Estimates	Study
National	0.39	Aschauer (1989)
National	0.34	Munnell (1990)
National	0.04-0.08	Nadiri and Mamuneas (1999)
State	0.17	Eisner (1991)
State	0.15	Munnell (1990)
Metro areas	0.08	Duffy-Deno and Eberts (1991)
Metro areas	0.03	Eberts (1986)

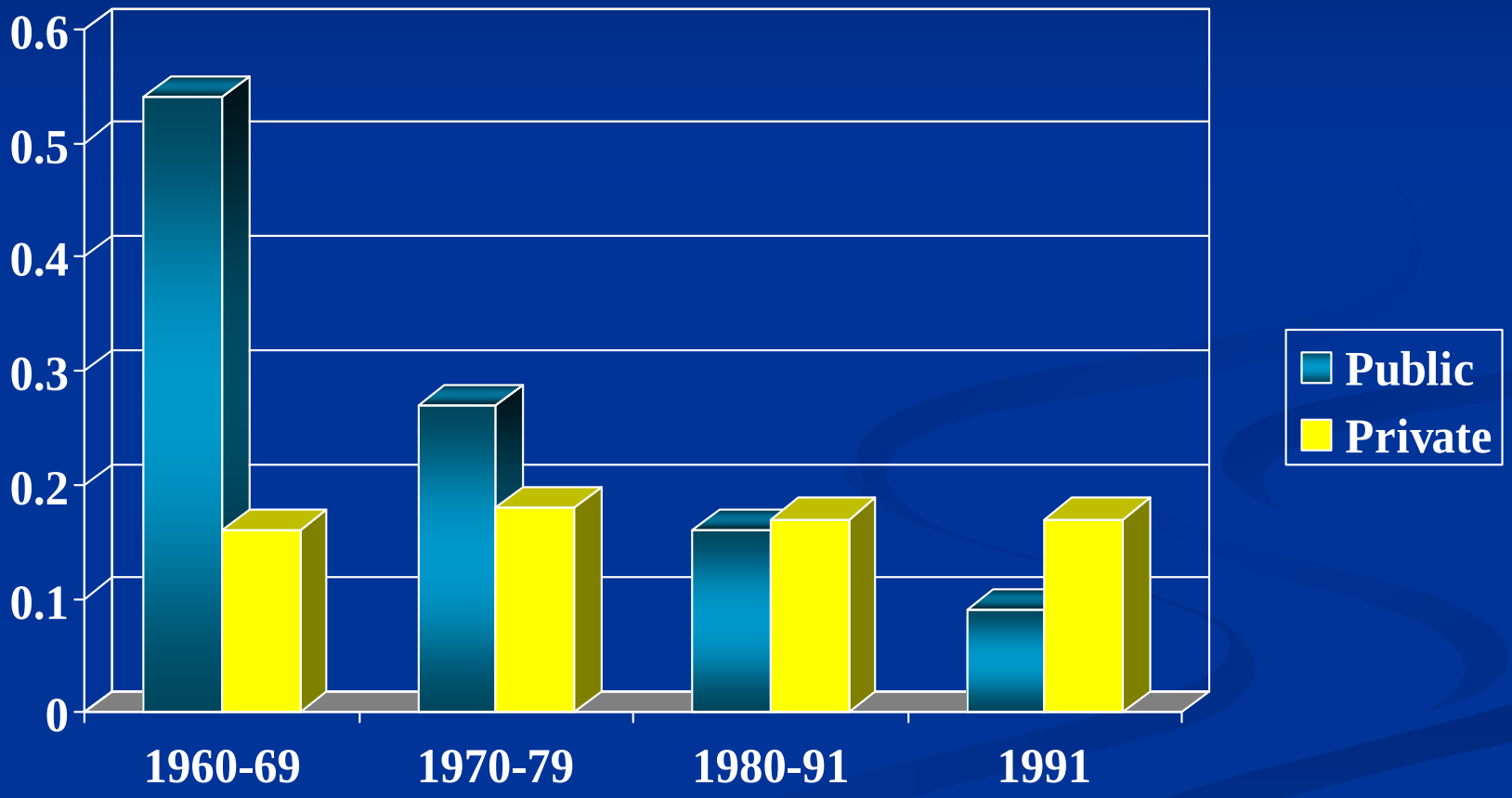
General Consensus

- Estimates around 0.04-0.10
  - Smaller than original studies because some econometric problems have been corrected, eg. Nadiri & Mamuneas
- Spillover effects are minimal
  - Some argue that higher estimates for national than state and metro level studies reflect ability to capture indirect effects
  - State and metro studies report smaller estimates because they correct for some econometric problems
  - Studies that explicitly estimate spillovers find little evidence that they exist

Rates of Return

- Production function approach allows one to estimate the rates of return for private capital and public capital and to compare the two
- Comparison addresses the question of the relative contribution to output of an additional unit of input

Rates of Return Over Time US 1960-91



Results of Direct Effect

- Rate of return of private capital typically larger than that of highway capital
- Suggests that the US is not underinvested in highway capital
- Rate of return of highway capital in US has declined over time as the highway (particularly interstate) system matures
- Dollar invested in highway system brings about the same return (or a little less) than a dollar invested in the private sector, according to estimates

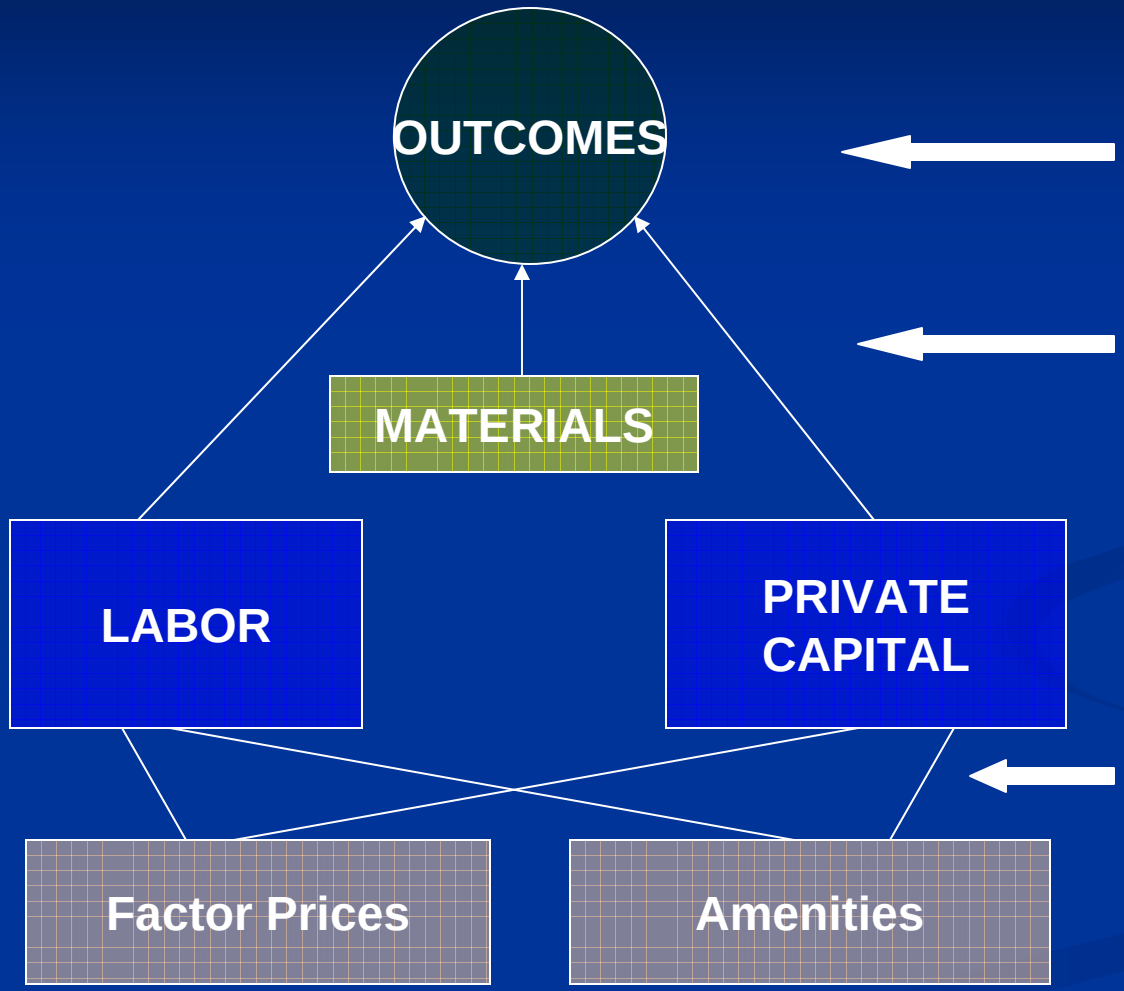
County-level Estimates of Cobb-Douglas Production Function

	A	B	C	D	E	F
Hours	.702 (.017)	.702 (.016)	.700 (.016)	.679 (.017)	.690 (.017)	.725 (.017)
Private capital	.356 (.013)	.355 (.013)	.350 (.013)	.328 (.014)	.320 (.014)	.307 (.013)
Lane miles	.061 (.015)	.055 (.016)	.057 (.015)	-.004 (.019)	-.084 (.030)	-.046 (.031)
% Poor pavement			-.097 (.083)	-.114 (.082)	-.120 (.082)	.073 (.260)
% congestion			.435 (.103)	.190 (.119)	.132 (.118)	.293 (.113)
% interstate		.172 (.074)			.140 (.073)	.120 (.071)
Population				.170 (.105)	.173 (.104)	.394 (.097)
Population**2				-.003 (.005)	-.002 (.005)	-.014 (.004)
Land area					.061 (.017)	-.029 (.021)

Model F includes state dummies

std errors in ( )

Regional Growth Process and Supply-side Effects



Highways

Directly Affect Outcomes

Increase Productivity

Indirectly Affect Outcomes

Attract Inputs

Highway Investment Stimulates Private Investment

- Infrastructure formation encourages private sector investment (complements)
  - An increase in infrastructure raises the return to private capital, which causes more investment in private capital
- Most studies find that public capital and private capital are complements—highways encourage investment
- Evidence shows that highways attract new business startups and expansions
- But that highways alone cannot stimulate growth—other factors must be present

Agglomeration

- Agglomeration economies result from the close proximity of business activities
  - Allows businesses to share common resources such as talented labor pool, supplier networks, technical expertise, and communication and transportation networks
- Urban public infrastructure directly affects the efficient operation of cities
  - Without an efficient highway system, positive gains achieved from agglomeration could be completely offset by gridlock

Agglomeration Research

- Few studies have considered the effects of both infrastructure and agglomeration
- Studies find positive effects of infrastructure on regional productivity
  - France—average traffic speed
  - Germany—estimates of public capital stock
  - Japan—estimates of public capital stock
  - US—efficiency of highway system (circuity)

Effect of Highway Infrastructure on Employment Change

Industry	Firm Size	Openings	Closings	Expansions	Contractions
All	All	+	-	+	-
All	Small	(+)	(-)	+	-
Mfg	All	+	-	+	(+)
Mfg	Small	(+)	-	(+)	(-)

Decision-making Process

- "Transportation investment is not simply an engineering decision but requires strong advocacy and political coalition building."
  - Coalition building necessary to gain approval for new infrastructure investment
  - This is nothing new, but the maturity of the transportation system has made it more intertwined in other decisions, including environmental, noise, traffic flows through neighborhoods, neighborhood safety, etc.

Economic/Community Development

- Community development
  - Social
  - Political
  - Natural
  - Economic
- Multiple stakeholders
  - Residents
  - Businesses
  - "Community Interest/Action" groups

Connects and Disconnects

National

Transportation System

National network requires national-level coordination

Somewhat centralized in state DOTs

Durable structure

State

Local

Economic/ Community development

Fragmented effort by nearly 1000 cities and and 50 states

Partnerships

Continuous/adaptive process

Institutional Arrangements

- Innovative ways in which transportation people are talking with economic/community development people
  - Regional councils and coordinators
  - Staff within DOTs dedicated to economic development issues
  - Combined departments, such as the Department of Transport, Local Governments and the Regions in the UK
  - Informal local partnerships at state and local levels

Paradigm Shifts

Think of transportation as attributes not modes

Alan Pisarski

- Access
- Mobility
- Safety
- Reliability
- Individualized modes

- Ultimately, the infrastructure is not important, but the right of way
- Shipping lanes, air rights, etc.

Transportation/Economy

- Transportation is essential to developed economies
- Evidence suggests that US is not currently under-invested in transportation infrastructure
  - Super returns have been replaced by normal returns
  - Rate of return of highways is typically less than the rate of return of private capital
- Regions may be under- or over-invested
- Highways can promote private investment
  - But they alone cannot stimulate growth
  - Region (or country) will not grow without other factors
- Efficient highway system promotes efficient operation of cities (agglomeration)

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