Infrastructure and the U.S. Economy

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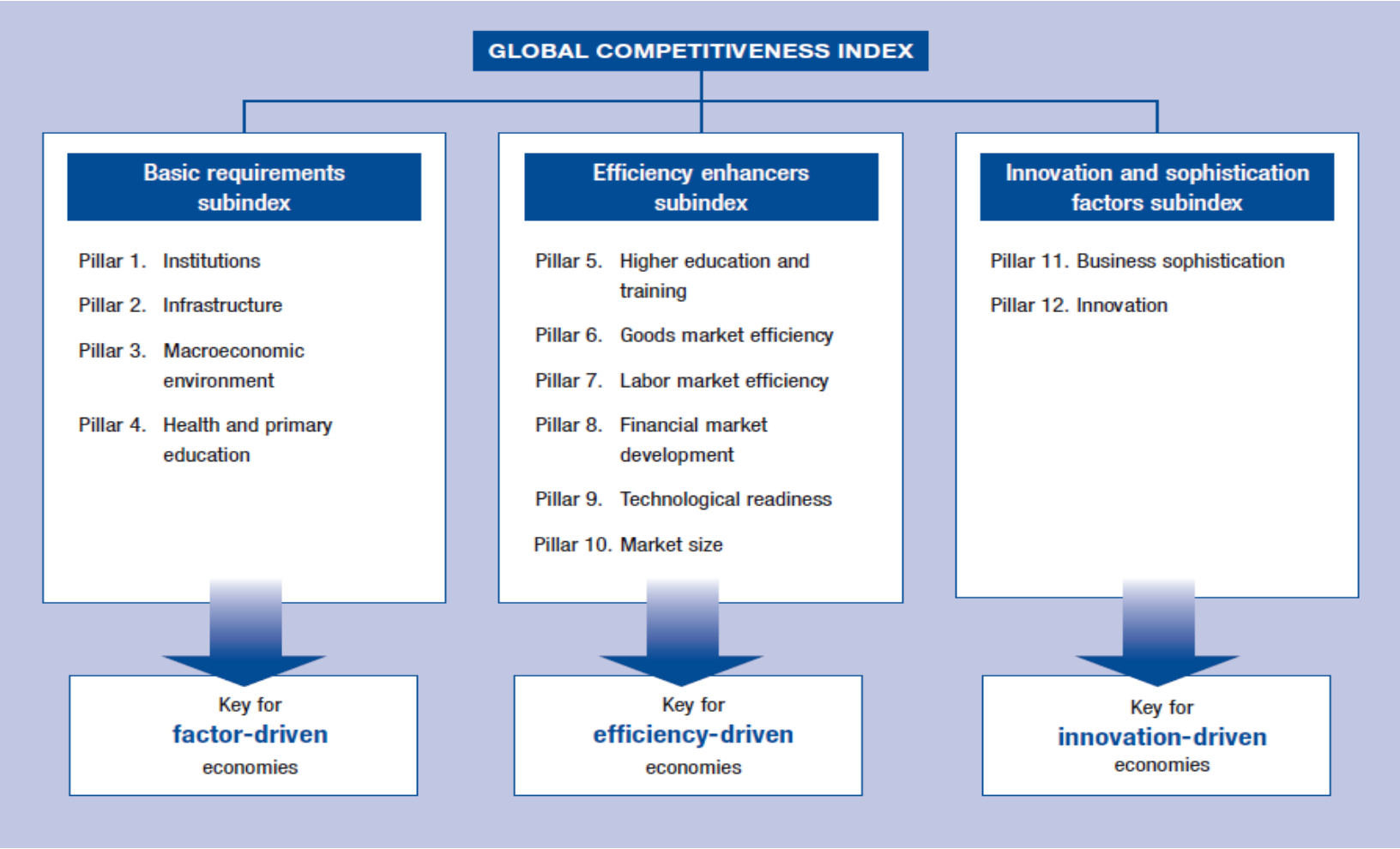
Deliverables

- *Infrastructure Overview*

- *Assemble Information:* Infrastructure investment (by type) and industry-specific data (affects on production and distribution costs) for modeling.
- *LIFT Model Simulations:* Input investment and cost data into LIFT macroeconomic interindustry model.

Infrastructure and Competitiveness



Source: World Economic Forum, The Global Competitiveness Report 2013–2014

Specialization of Regional Economies

Leading Traded Clusters by U.S. Economic Area, 2008

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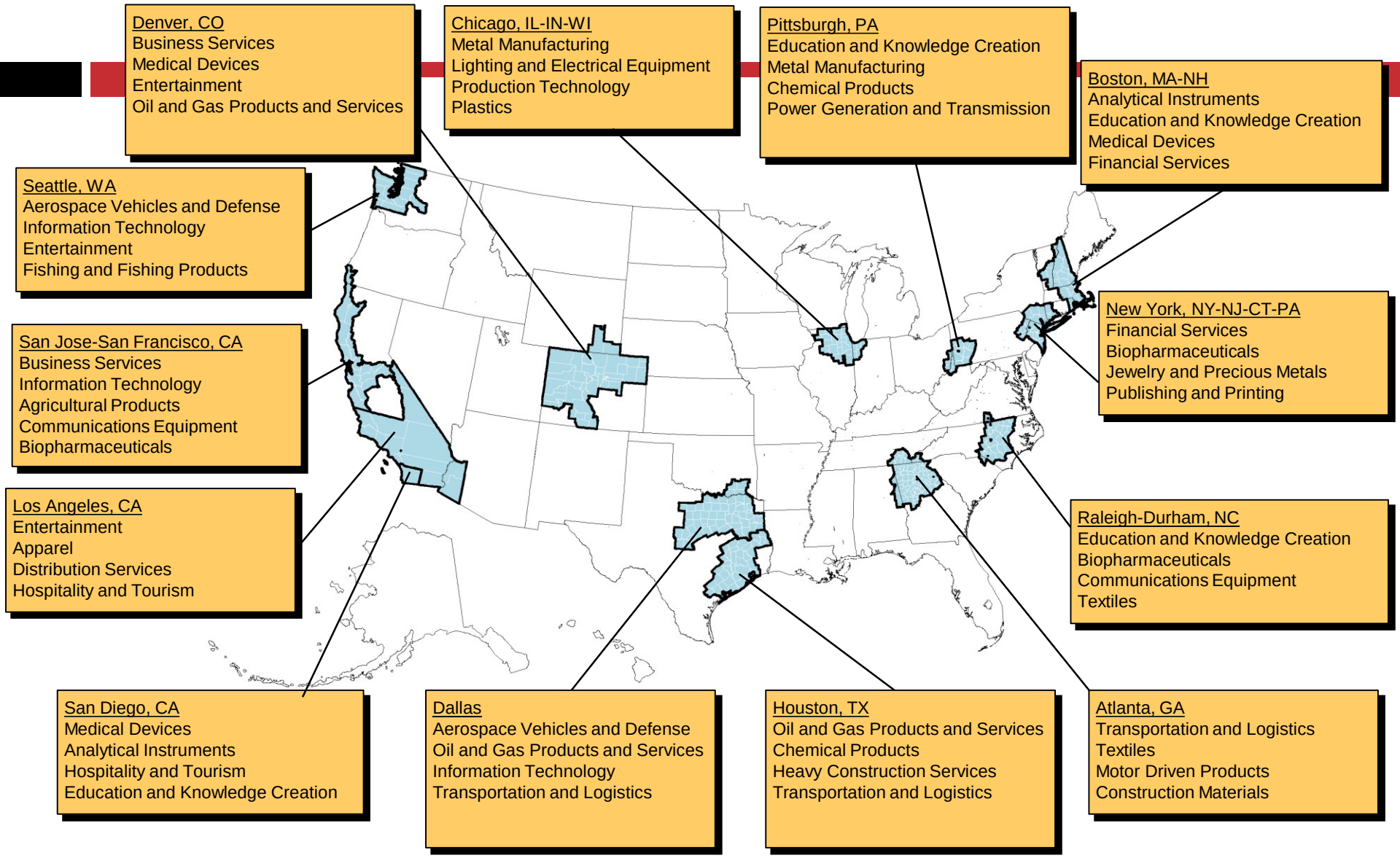


Denver, CO
Business Services
Medical Devices
Entertainment
Oil and Gas Products and Services

Chicago, IL-IN-WI
Metal Manufacturing
Lighting and Electrical Equipment
Production Technology
Plastics

Pittsburgh, PA
Education and Knowledge Creation
Metal Manufacturing
Chemical Products
Power Generation and Transmission

Boston, MA-NH
Analytical Instruments
Education and Knowledge Creation
Medical Devices
Financial Services

Seattle, WA
Aerospace Vehicles and Defense
Information Technology
Entertainment
Fishing and Fishing Products

New York, NY-NJ-CT-PA
Financial Services
Biopharmaceuticals
Jewelry and Precious Metals
Publishing and Printing

San Jose-San Francisco, CA
Business Services
Information Technology
Agricultural Products
Communications Equipment
Biopharmaceuticals

Los Angeles, CA
Entertainment
Apparel
Distribution Services
Hospitality and Tourism

Raleigh-Durham, NC
Education and Knowledge Creation
Biopharmaceuticals
Communications Equipment
Textiles

San Diego, CA
Medical Devices
Analytical Instruments
Hospitality and Tourism
Education and Knowledge Creation

Dallas
Aerospace Vehicles and Defense
Oil and Gas Products and Services
Information Technology
Transportation and Logistics

Houston, TX
Oil and Gas Products and Services
Chemical Products
Heavy Construction Services
Transportation and Logistics

Atlanta, GA
Transportation and Logistics
Textiles
Motor Driven Products
Construction Materials

Source: Prof. Michael E. Porter, Cluster Mapping Project, Institute for Strategy and Competitiveness, Harvard Business School; Richard Bryden, Project Director.

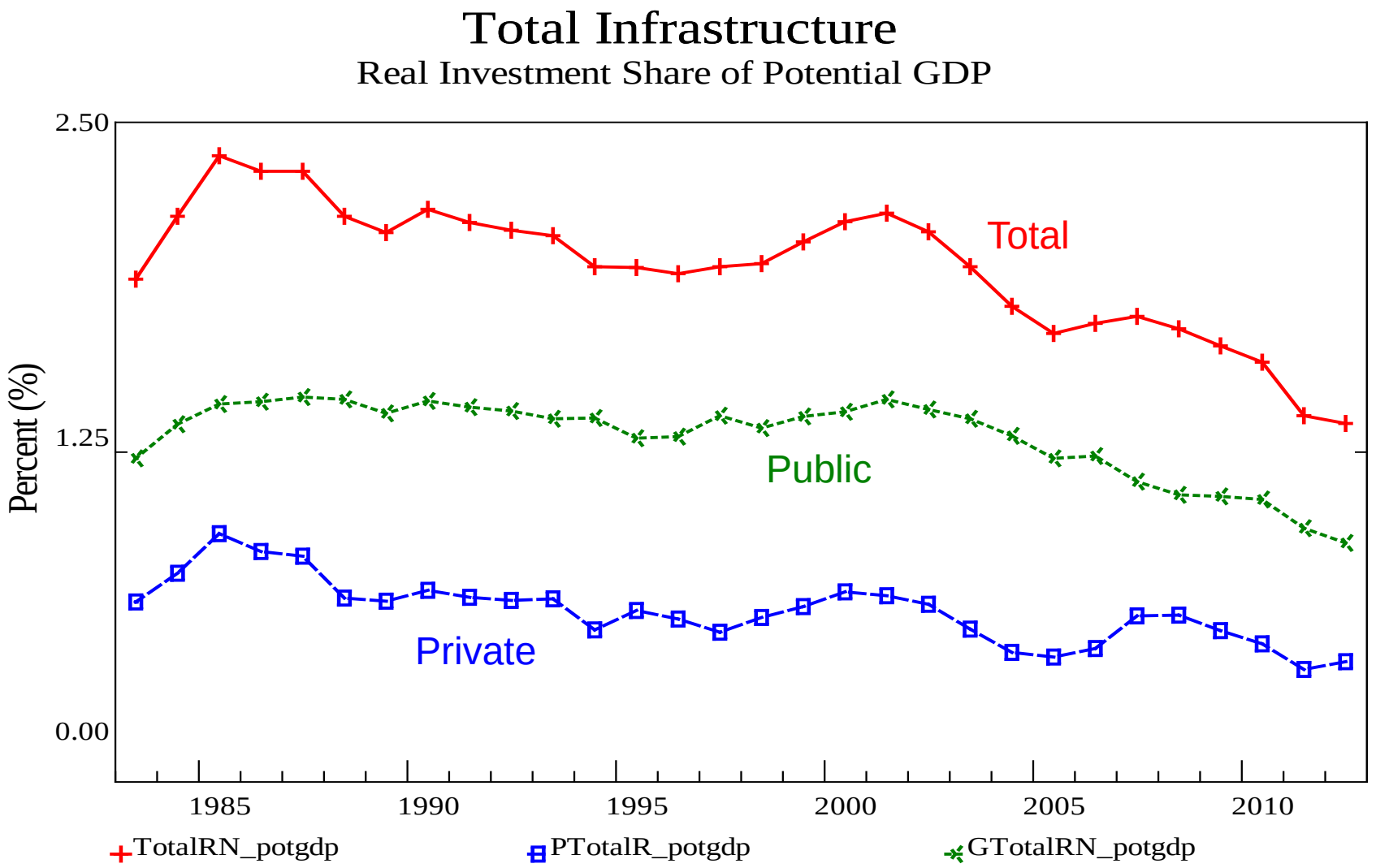
ASCE Report Card (Engineering Assessment): Have we badly neglected infrastructure spending?

Infrastructure System	2009	2013
Aviation	D	D
Bridges	C	C+
Dams	D	D
Drinking Water	D-	D
Energy	D+	D+
Hazardous Waste	D	D
Inland Waterways	D-	D-
Levees	D-	D-

Infrastructure System	2009	2013
Ports	n/a	C
Parks & Recreation	C-	C-
Rail	C-	C+
Roads	D-	D
School	D	D
Solid Waste	C+	B-
Transit	D	D
Wastewater	D-	D
Overall	D	D+

Source: American Society of Civil Engineers (ASCE), *Report Card for America's Infrastructure.*

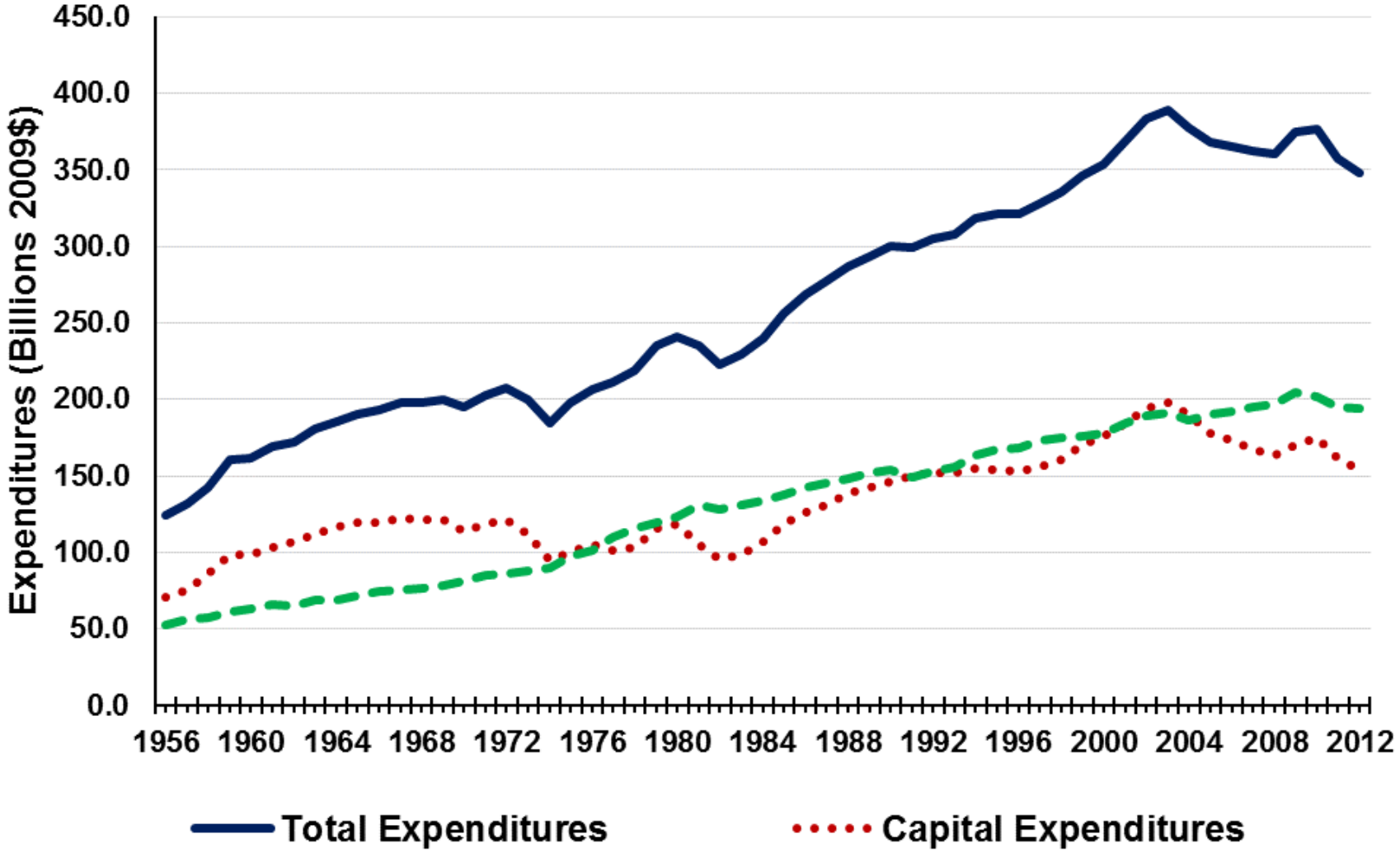
Total Real Infrastructure Investment: Decade-long decline



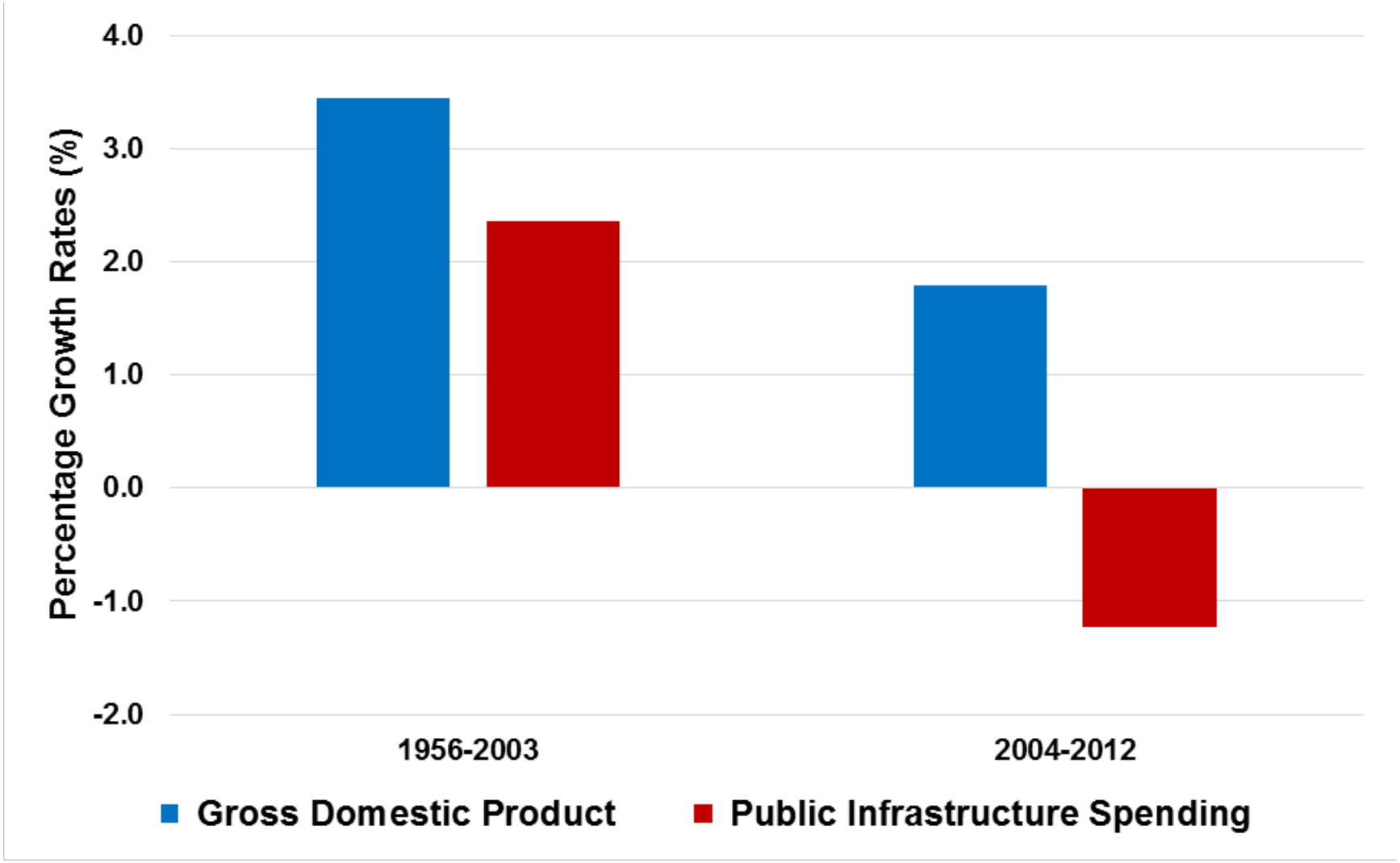
Public Infrastructure Data

- CBO Study: Expenditure by various type of infrastructure.
  - Detail in both real and nominal terms.
  - O&M expenditures as well as capital expenditures.
  - Structures, major equipment, plus real estate.
  - Data from 1956.
  - No comprehensive update since CBO 2010, with federal spending until 2009, state and local through 2007.
- We revise the CBO data set and extend it through 2012.
- We see some interesting and perhaps alarming patterns in the data.

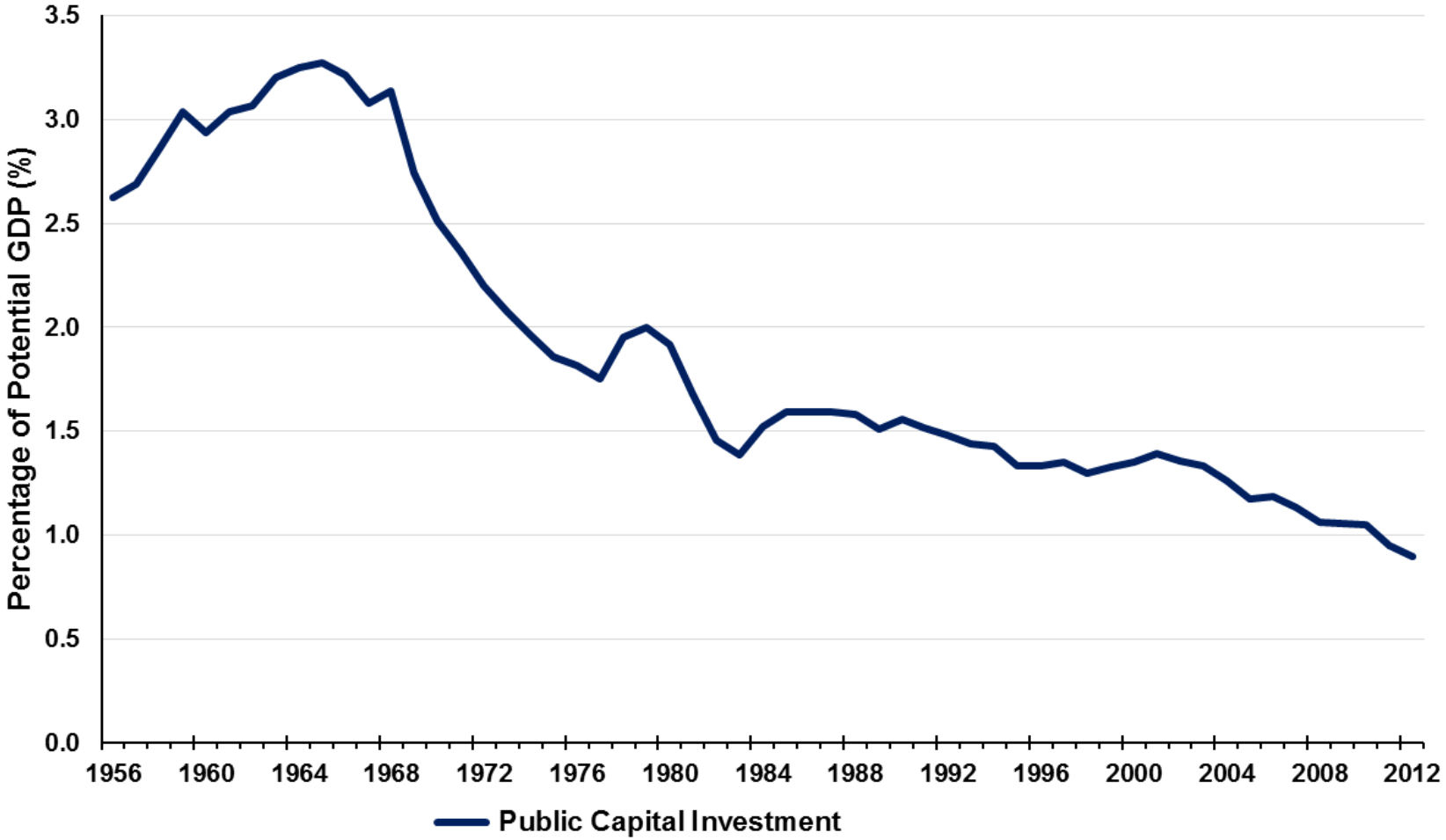
Real Public Infrastructure Investment: 5 Decades Growth, 1 Decade Decline



Real Public Infrastructure Investment: Recently Falling While GDP Rises



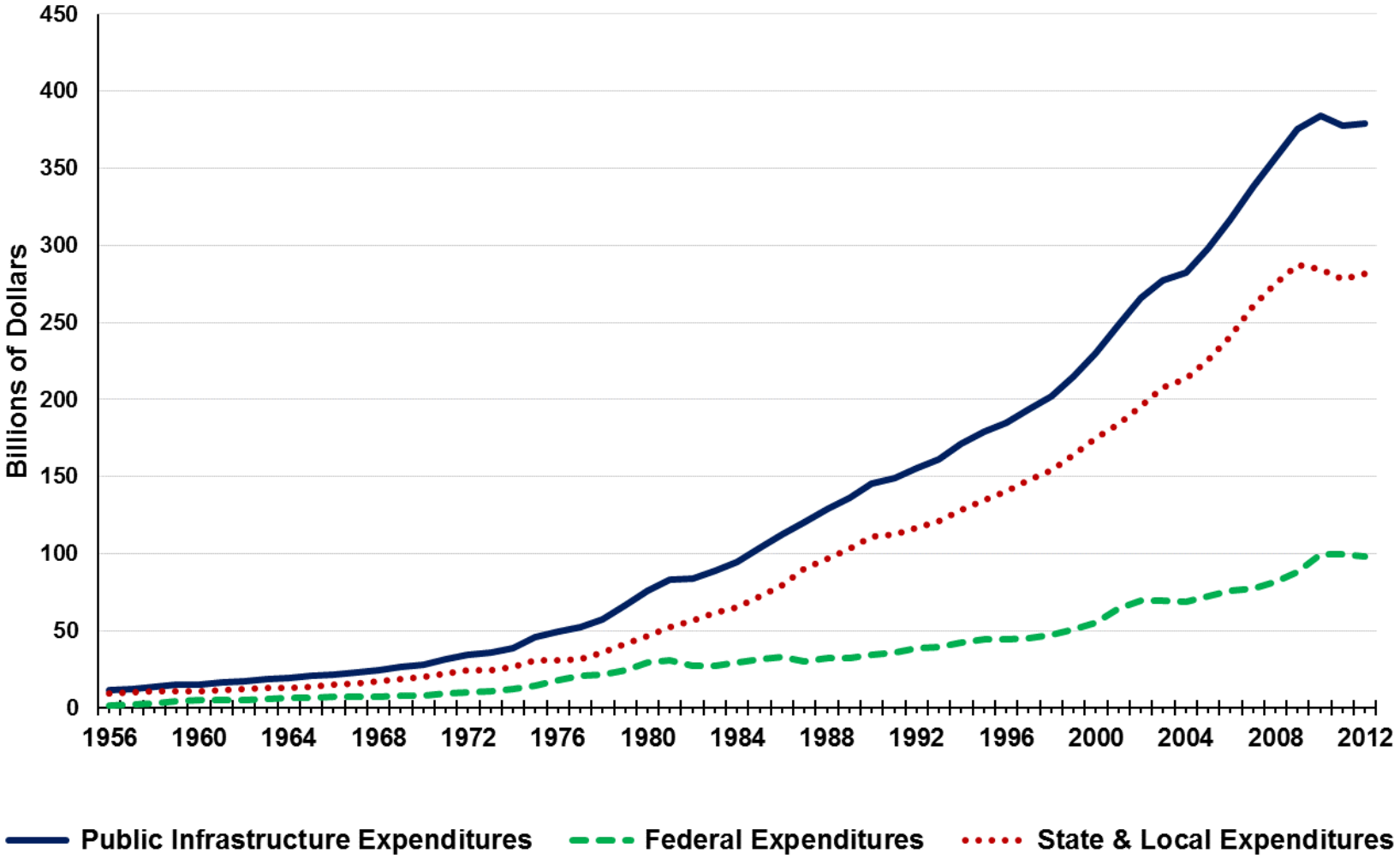
Real Public Infrastructure Investment: Falling Share of Potential GDP



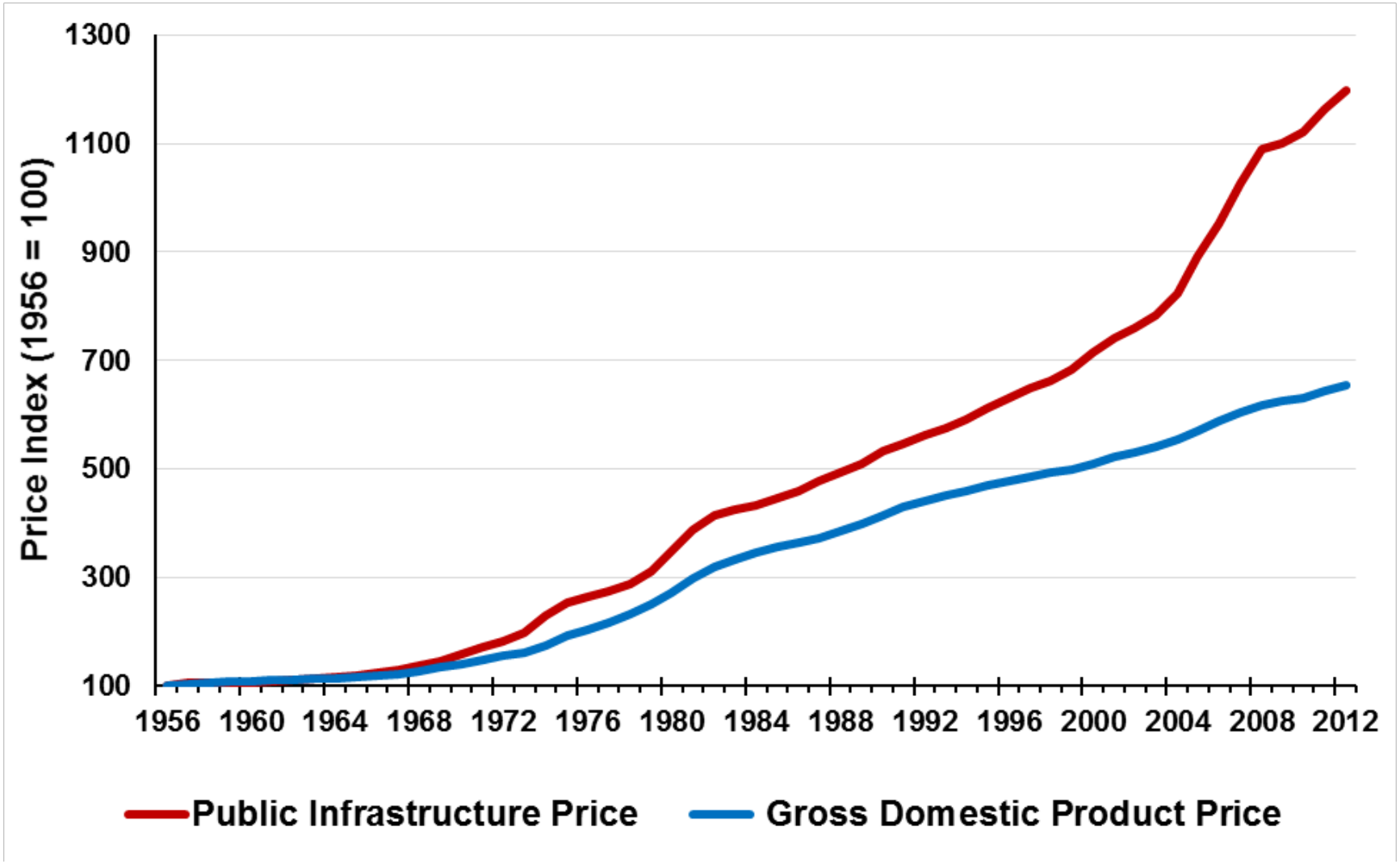
Real Public Infrastructure Investment: 2003-2012

	Billions of 2012$	Billions of 2012$	Average Annual Percentage Growth	Cumulative Percentage Change
	2003	2012	2003-2012	2003-2012
Real Gross Domestic Product	**13,724.40**	**16,244.60**	**1.7**	**18.4**
Public Infrastructure Spending	**423.87**	**379.19**	**-1.2**	**-10.5**
Highways and Streets	193.22	155.98	-2.4	-19.3
Mass Transit	61.43	58.57	-0.5	-4.7
Rail	1.73	1.78	0.3	3.1
Aviation	42.57	36.89	-1.6	-13.4
Ports and Inland Waterways	11.73	9.58	-2.3	-18.3
Water Resources	11.08	11.42	0.3	3.1
Water Supply and Waste Disposal	102.37	104.97	0.3	2.5

Nominal Public Infrastructure Investment: 1956-2012



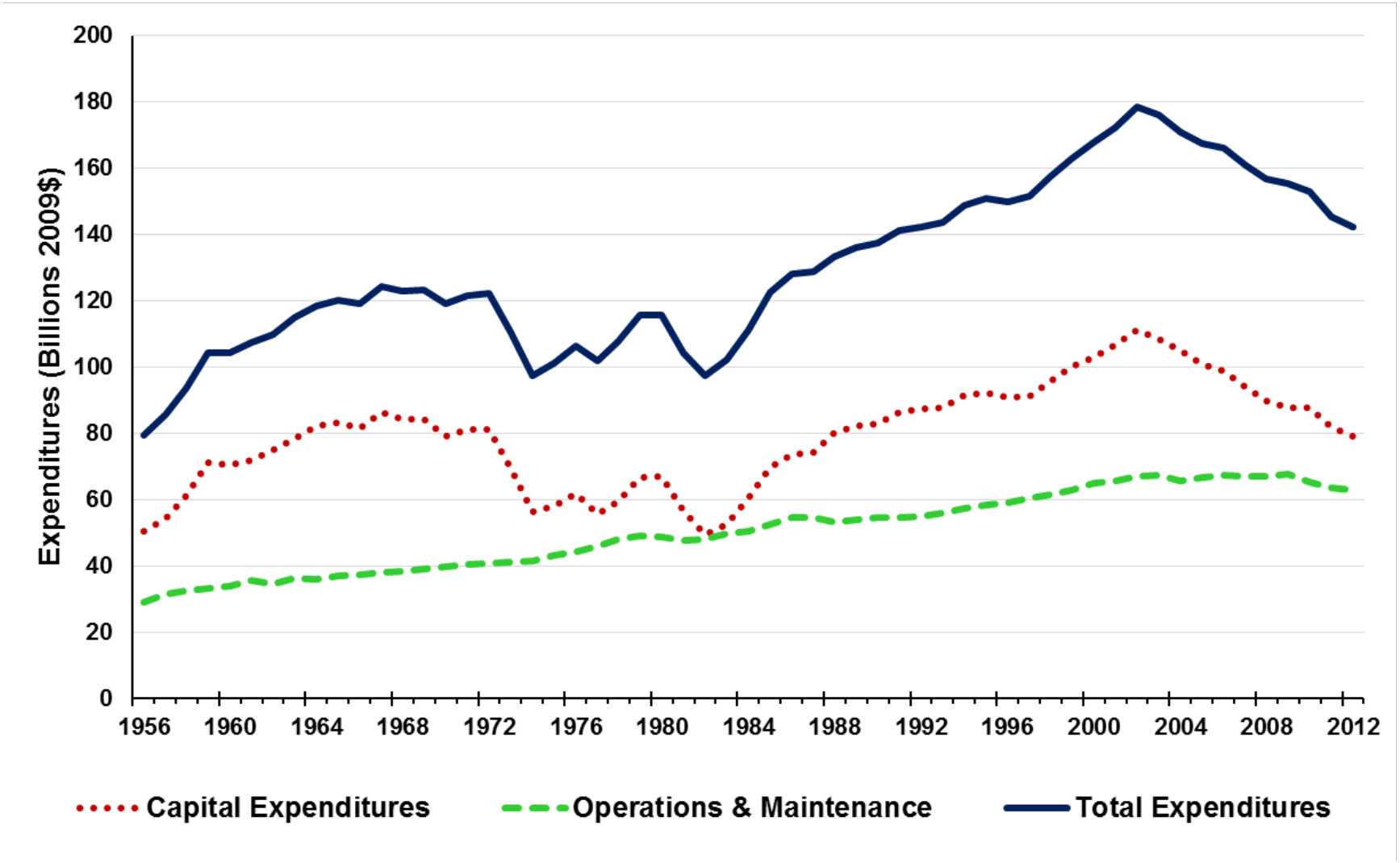
Growth of Infrastructure Investment Prices: 1956-2012



Public infrastructure: Highways and streets are special.

- About 40-50% of all public infrastructure spending. Budget outcomes and other legislative decisions have big impacts.
- Basic consumer transport. Ground transport accounts for 10% of the consumer budget. Work, life, play.
- All the other transport modes depend on roads. World class port, rail or air services can be largely negated by poor roads.
- Real highway spending has fallen for a decade. Other sectors show similar patterns, but they are less marked.

Real Public Expenditures: Streets and Highways



Implications of high construction price growth on streets and highways

- The decline in overall real infrastructure spending for from 2003 to 2012 was a departure from a long-term pattern of growth since the 1950s.
- Construction prices rose rapidly from 2003-2008. Therefore the decline in real spending after 2003 was mainly due to increases in the cost of construction, but nominal spending grew as before.
- From 2008 to 2012, real spending fell because nominal spending was flat.
- Even a constant nominal spending-to-GDP share thus is not sufficient to maintain real investment levels.

Example: ASCE Surface Transportation Study

- Further degradation of roads, bridges, etc.
- Specific cost shocks to transport sectors directly dependent on infrastructure.
- Specific cost shocks to sectors that provide own-transportation
- Effects summarized by price equation:

$$p' = p'A + v'$$

- Increased “real” costs to consumer sector
- Private and public capital investment (didn’t include this)

ASCE Surface Transportation Study inputs (This is the hard part.)

			2020				2040	
		8	60	69	8	60	69	
	Note: each column is an industry. The scalars reflect the relative cost increase for that industry in the specified category caused by degrading roads. Note that sector 60 (trucking) has the largest impacts.	Maintenance & repair construction	Trucking, highway passenger transit	Wholesale trade	Maintenance & repair construction	Trucking, highway passenger transit	Wholesale trade	
	LIFT Variable							
	Labor (hrs per unit of output)	1.004	1.152	1.013	1.005	1.199	1.017	
	Depreciation	1.026	1.110	1.033	1.012	1.069	1.016	
	Indirect Taxes	1.010	1.072	1.014	1.005	1.047	1.007	
	Subsidies	1.000	1.000	1.000	1.000	1.000	1.000	
8	Maintenance & repair construction	1.022	1.106	1.028	1.010	1.067	1.014	
25	Fuel oil	1.022	1.117	1.029	1.011	1.075	1.015	
26	Rubber products	1.023	1.128	1.030	1.011	1.082	1.016	
50	Motor vehicle parts	1.083	1.187	1.094	1.038	1.109	1.045	
64	Transportation services	1.003	1.123	1.011	1.006	1.162	1.015	
72	Finance & insurance	1.008	1.033	1.010	1.004	1.021	1.005	
81	Automobile services	1.066	1.149	1.075	1.031	1.087	1.036	

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TABLE 8★ Cumulative Impacts to the National Economy by Category

(Dollars are in $2010 billions)





	Surface Transportation	Airports	Inland Waterways & Marine Ports	Electricity	Water/ Wastewater
Business Sales					
Through 2020	$1,700	$580	$1,335	$847	$734
2021–2040	$7,062	$2,682	$6,496	$3,590	$6,791
GDP					
Through 2020	$897	$313	$697	$496	$416
2021–2040	$1,765	$1,209	$3,278	$1,954	$3,702
Jobs					
2020	677,000	350,000	738,000	529,000	669,000
2040	410,000	358,000	1,284,000	366,000	1,377,000
Disposable Income					
Through 2020	$930	$361	$872	$656	$541
2021–2040	$2,205	$1,128	$3,662	$2,294	$4,440
Value of Exports					
Through 2020	$114	$54	$270	$51	$20
2021–2040	$1,093	$708	$1,712	$630	$807

SOURCES: LIFT/Inforum Model of the University of Maryland, and EDR Group.

NOTE: This Table reflects the research conducted in 2011 and 2012 and findings of the four infrastructure sector studies that preceded this report. Jobs rounded to the nearest thousand.

Methodology: What happens with a larger investment?

Long term benefits of infrastructure investment:

- Persistent infrastructure gaps lead to further degradation of transport and utility infrastructure.
- Develop specific cost shocks to transport and utility sectors directly dependent on infrastructure.
- Specific **cost (or price)** shocks to sectors that provide own-transportation.
- Increased “real” **costs** to consumer sector

Short term benefits of investment (politically correct):

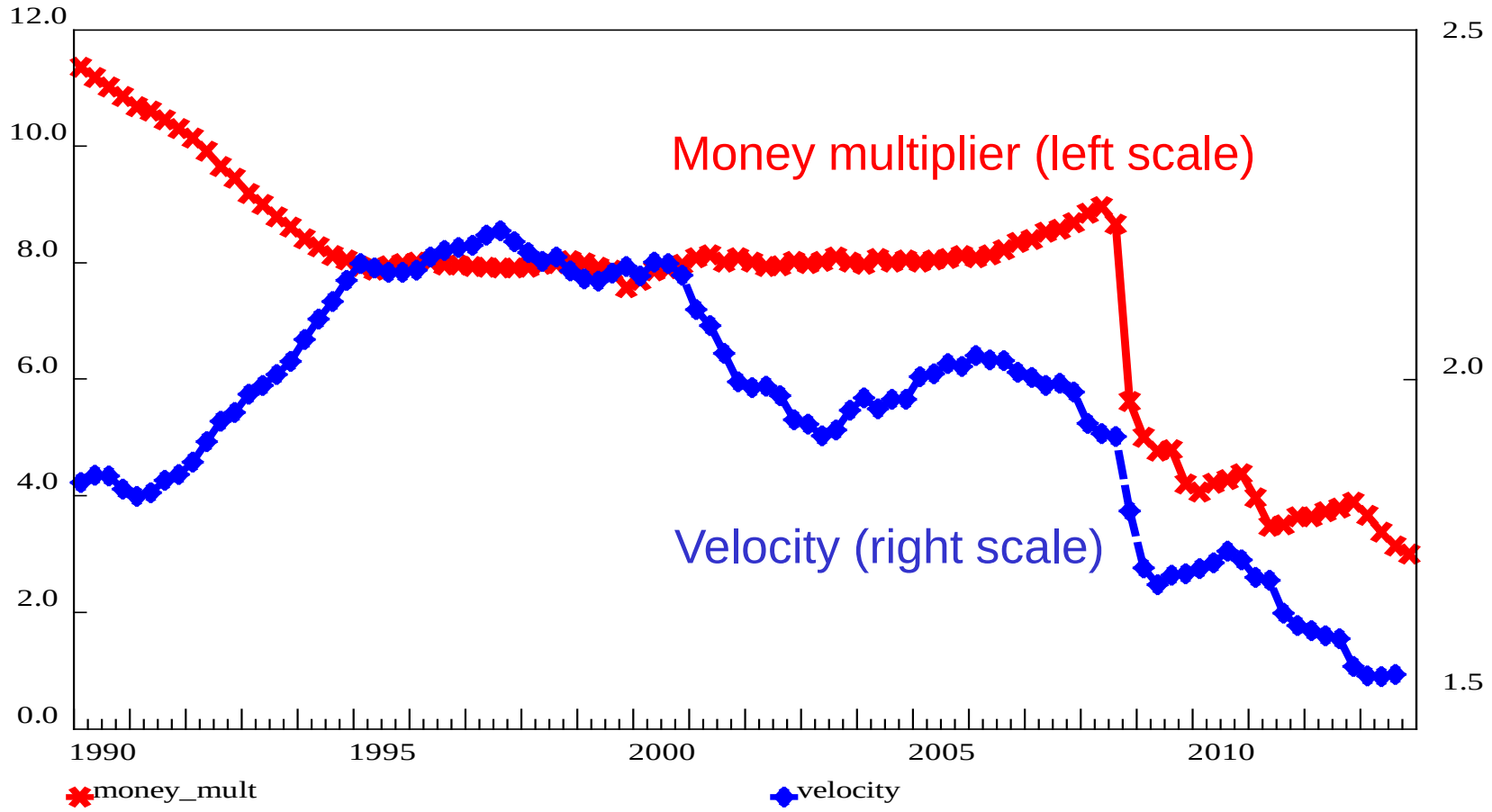
- Lost private and public capital investment will hinder economic growth, especially given current weakness.

Reality of the short term

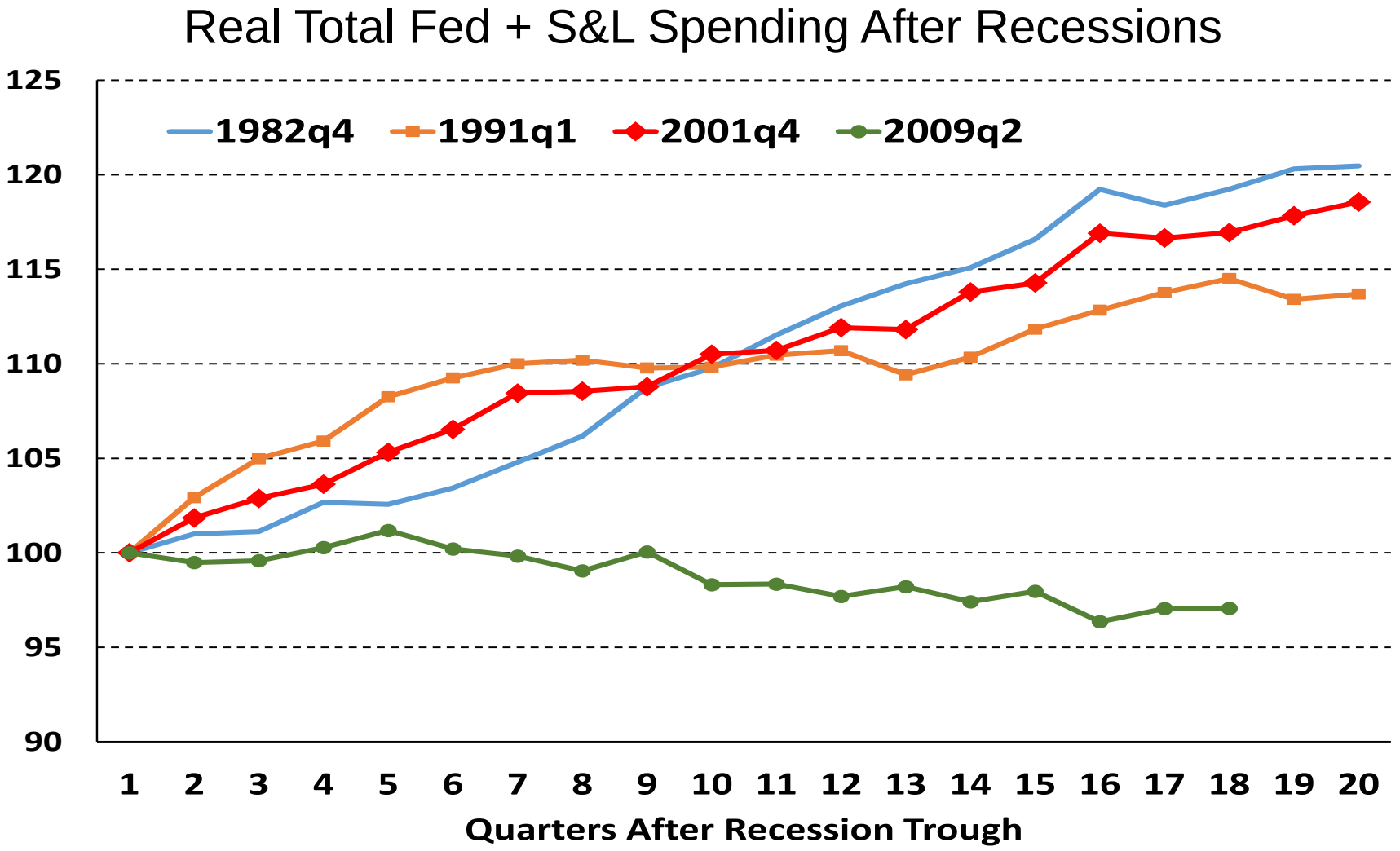
- Monetary Policy is fully implemented, and, while necessary, is relatively ineffective
- Recent experiences suggest (scream) that there are high fiscal multipliers at the zero lower bound.
- U.S. Fiscal Austerity (defined as a contraction of real goods and services expenditures) is primary factor behind disappointing growth (~2%).

Is monetary policy effective?

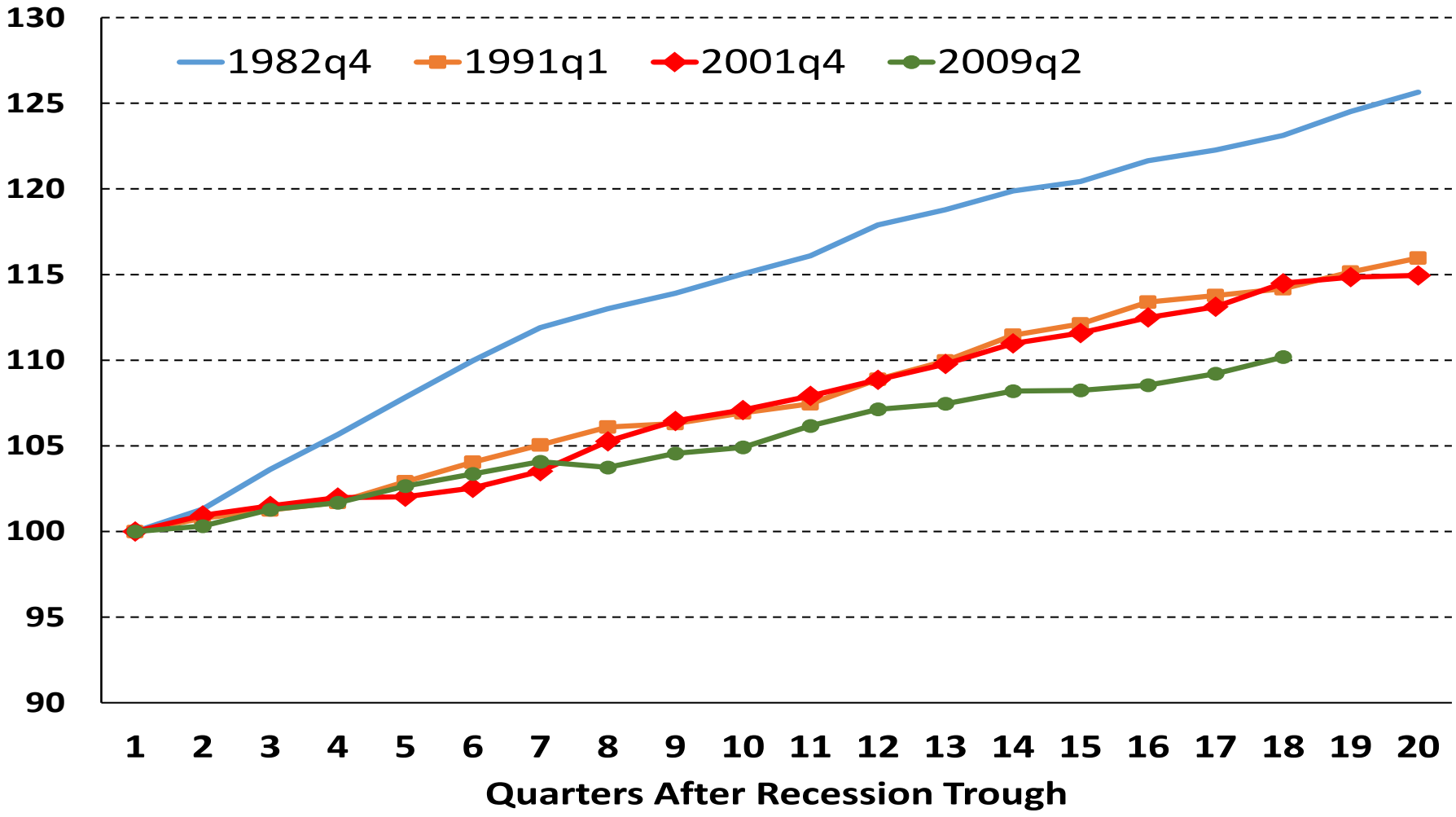
Money multiplier (m2/mbase) and velocity (gdp/m2)



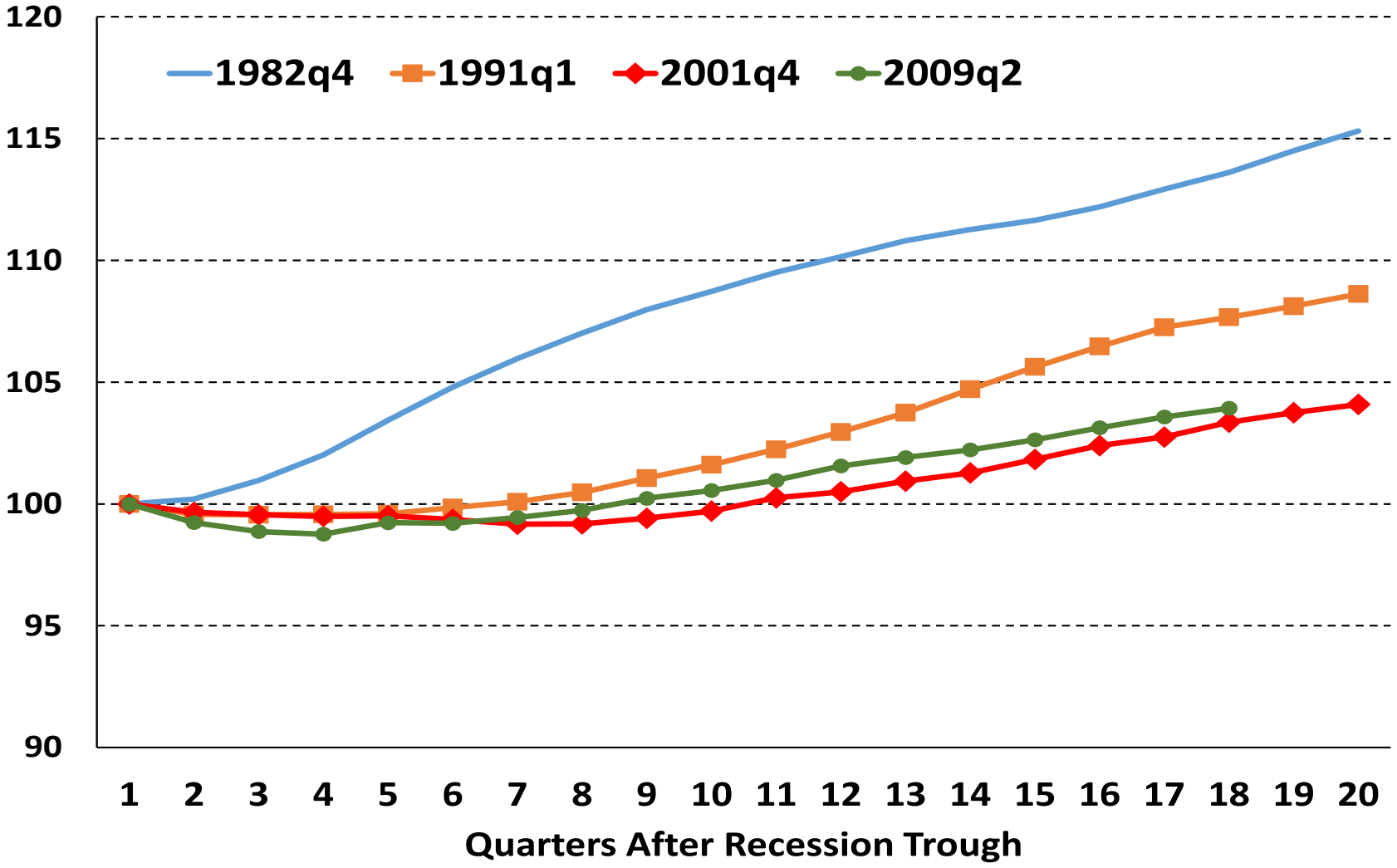
Is Fiscal Policy Is More Effective?



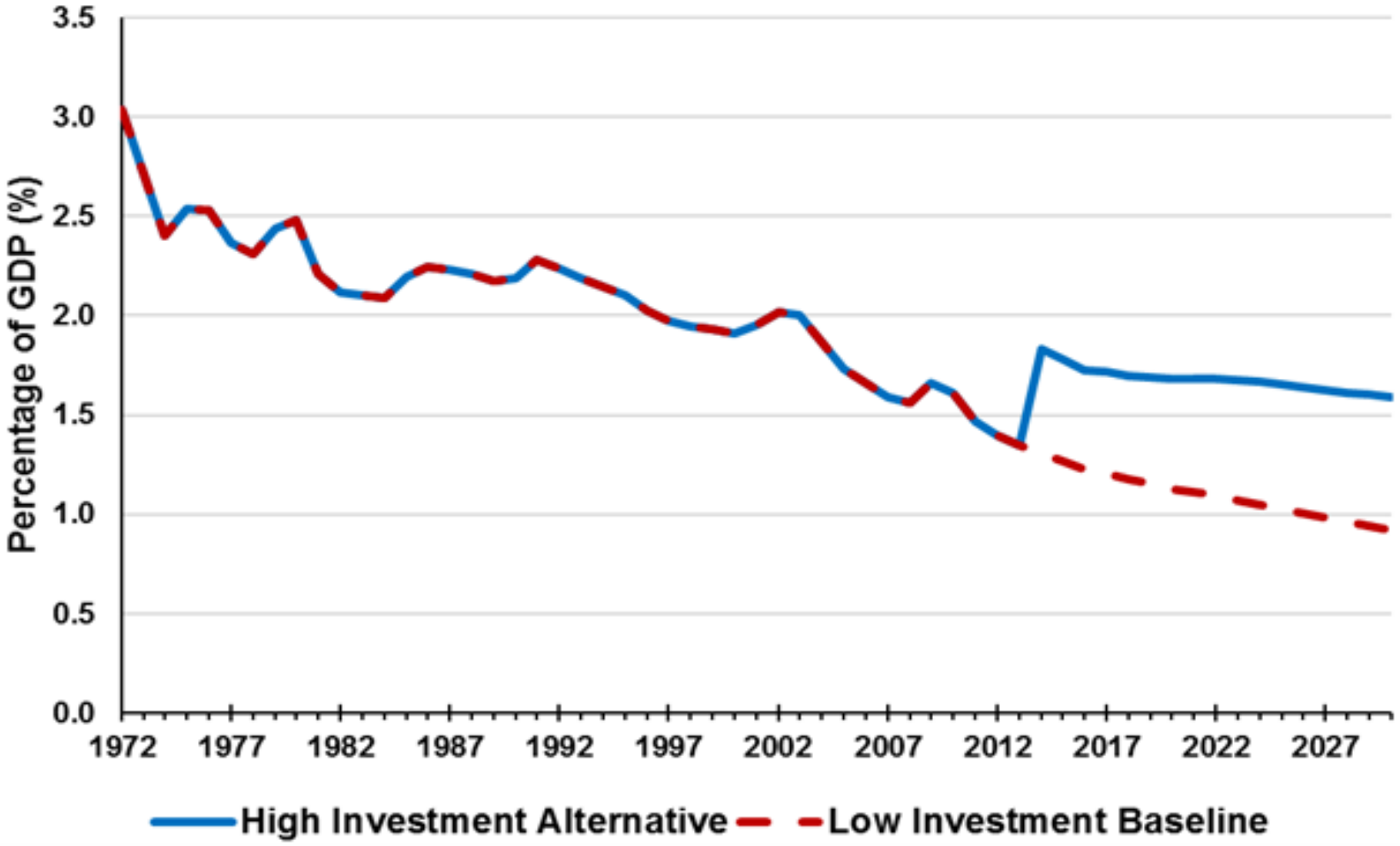
GDP Recovery After Recessions



Employment Recovery after Recessions



Engineers recommend a much larger spend for infrastructure



Enhanced investment is large.

	Difference in Investment, Billions of 2009$				
	2015	2017	2020	2025	2030
Highways and Streets	60.0	63.3	73.8	93.0	114.4
Mass Transit and Rail	8.0	8.3	9.2	10.9	12.7
Ports and Inland Waterways	2.0	2.0	2.1	2.2	2.4
Aviation Facilities	5.0	5.2	5.7	6.7	7.7
Water and Wastewater	8.0	8.4	9.7	11.9	14.2
Total Public Investment	**$83.0**	**$87.3**	**$100.6**	**$124.7**	**$151.4**
As percent of GDP	**0.5**	**0.5**	**0.5**	**0.6**	**0.6**

Enhanced Infrastructure Impacts

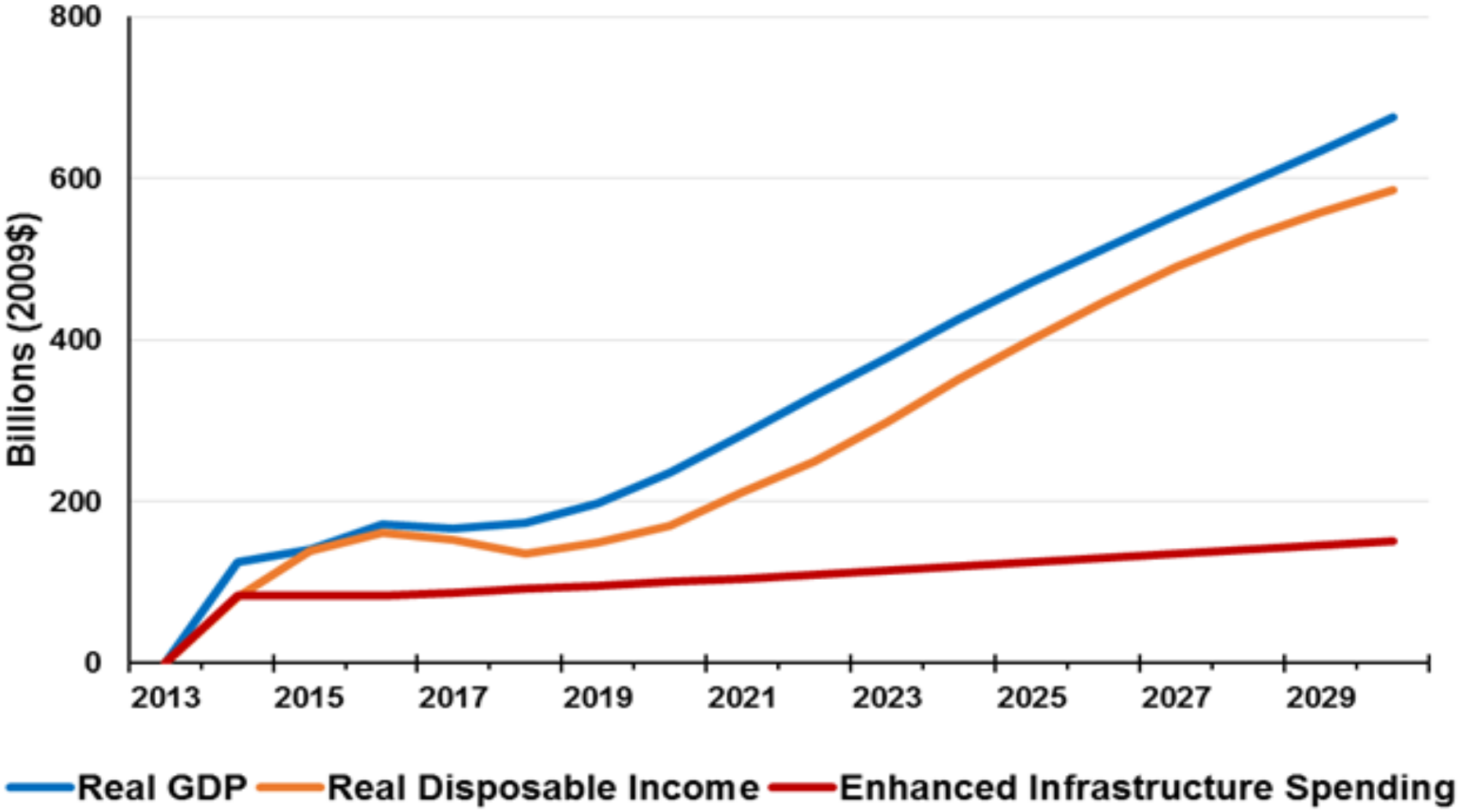
(please note large short-term multiplier)

	2015	2017	2020	2025	2030
Enhanced Real Investment					
Billions of 2009$	83	87	101	125	151
As percent of GDP	0.5	0.5	0.5	0.6	0.6
REAL GDP by FINAL DEMAND CATEGORY					
Gross Domestic Product	0.9	1.0	1.3	2.3	2.9
Personal Consumption	0.4	0.6	1.0	2.0	2.7
Nonresidential Structures	1.6	1.3	0.9	2.2	2.4
Equipment Investment	1.4	0.9	0.7	1.6	1.7
Residential Investment	0.9	1.3	0.7	2.7	3.0
Exports	0.2	0.5	1.0	2.0	2.8
Imports	1.3	1.2	1.6	2.8	3.4
Government	2.7	2.8	3.4	4.3	4.9
PRICE INDICATORS					
GDP Deflator	0.1	0.3	0.2	-0.3	-0.4
PCE Deflator	0.0	0.1	0.0	-0.8	-1.0
Exports Deflator	0.0	0.0	-0.2	-0.7	-1.0

Enhanced Infrastructure Impacts

LABOR FORCE, EMPLOYMENT, PRODUCTIVITY					
Labor Force	0.1	0.3	0.5	0.5	0.5
Thousands	160	447	835	868	912
Total Employment	0.8	1.1	0.8	1.0	0.6
Thousands	1283	1721	1298	1580	1130
Total Lab Productivity (12$/hr)	-0.1	-0.2	0.4	1.2	2.2
REAL DISPOSABLE PERSONAL INCOME					
Percent Difference	1.2	1.2	1.2	2.6	3.4
Billions of 2009$	140	153	170	401	587
2009$ per Household	1122	1201	1300	2916	4072
NOMINAL FISCAL BALANCES (Billions of dollars)					
Public Infrastructure Spending	98.6	109.1	136.2	189.1	253.0
as percent of GDP	0.5	0.5	0.6	0.6	0.6
Government Net Borrowing	94.4	76.4	1.4	-25.5	-55.7
as percent of GDP	0.5	0.3	-0.1	-0.1	-0.2
Government Net Debt	161	321	404	255	125
as percent of GDP	0.1	0.5	0.4	-0.8	-1.6

Benefit/Cost Ratio Increases over time



Industry Output

Figures show the percent difference between high and low investment scenarios.

	2015	2017	2020	2025	2030
Gross Domestic Product	0.9	1.0	1.3	2.3	2.9
Agriculture,forestry,fisheries	0.4	0.7	1.1	1.9	2.5
Mining	1.0	1.0	1.2	1.8	2.2
Construction	4.3	4.4	4.4	6.5	7.4
Manufacturing					
Non-Durables	0.7	0.8	1.2	2.2	2.8
Durable materials & products	1.7	1.6	1.9	3.1	3.6
Non-Electrical Machinery	1.3	1.1	1.2	2.3	2.7
Electrical Machinery	0.6	0.6	0.9	2.0	2.9
Transportation Equipment	0.8	0.7	1.1	2.1	2.6
Instruments & miscellaneous	0.5	0.5	0.8	1.6	2.1
Transportation	1.0	1.2	1.7	3.1	4.1
Utilities	0.3	0.4	0.7	1.4	1.7
Trade	0.6	0.8	1.2	2.5	3.2
Finance, Insur & Real Estate	0.5	0.6	1.0	2.2	2.9
Services	0.9	0.9	1.2	2.2	2.8

Industry Employment

Difference between high and low investment scenarios in thousands of jobs.

	2015	2017	2020	2025	2030
Agriculture,forestry,fisheries	-2	1	-23	-55	-96
Mining	9	10	7	5	1
Construction	672	741	693	918	985
Manufacturing	113	155	103	124	75
Non-Durables	28	49	38	52	45
Durable materials & products	48	53	37	42	24
Non-Electrical Machinery	22	28	15	16	4
Electrical Machinery	5	7	4	3	0
Transportation Equipment	8	13	8	12	6
Instruments & miscellaneous	2	4	0	-1	-5
Transportation	1	-14	-80	-178	-315
Utilities	2	10	4	0	-11
Trade	104	223	170	262	172
Finance, Insur & Real Estate	24	56	40	51	31
Services	360	537	382	449	282
Total Employment	1283	1721	1298	1580	1130