The Economic Analysis of Infrastructure

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Abstract

The Federal Reserve's use of low interest rates has historically fueled bull markets by making borrowing cheaper. However, this "easy money" policy, popularized by Alan Greenspan, can lead to market bubbles and eventual economic downturns, as seen during the 2008 financial crisis. The aftermath of prolonged low interest rates often includes inflation, mass defaults, and recessions, affecting wages and employment. As a result, infrastructure investment has emerged as a compelling alternative as it offers both immediate and long-term benefits by complementing private capital and generating positive externalities.

Background

Historically, the Federal Reserve's use of low interest rates—part of its quantitative easing strategy—has made borrowing cheaper, fueling bull markets. However, as seen in the lead-up to events like Black Thursday and the 2008 financial crisis, prolonged low rates can lead to market bubbles that eventually require drastic intervention. Alan Greenspan, Chair of the Federal Reserve from 1986 to 2006, popularized this approach by frequently adjusting interest rates to promote market growth. Known as the "Greenspan Put", this "easy money" policy spurred unprecedented expansion in capital markets and boosted Greenspan's popularity within politics and the American conscience. However, this rapid growth came with serious trade-offs. First, when bull markets get too hot, or grow too fast, inflation tends to increase out of control which requires extreme hikes in interest rates. This immediately results in high rates of borrowing and a decrease in the money supply.

This can lead to mass defaults on mortgages, decline in money market funds, and even a recession. The latter happens since it discourages spending, which depresses the economy. This

monetary contraction has consequences for many participants in the economy such as the many people who can inevitably lose their jobs or receive lower wages, further reducing consumer spending which can potentially lead to a recession.

Easy Money

The PBS documentary "Age of Easy Money" highlights the sequence of events that led up to the unprecedented actions of the Federal Reserve today. This documentary was aired in the advent of the uptick in the inflation rate in April 2022 where inflation increased to over 8.5%, the highest rate in 4 decades. This resulted in increased costs for consumer goods, the cost of borrowing, and eventually a stagnant economy. The panelists have concluded that even with government gridlock and political dysfunction, we have become very dependent on the Federal Reserve and cheap money to drive the American economy. The goal of many panelists to achieve "balance" in the American economy came with many obvious policy recommendations. Mohamed Abdullah El-Erian, chief economic adviser at Allianz, stated that we should be doing "stuff that really promotes genuine, durable, inclusive growth" rather than "artificial growth" fueled by short-term monetary policy. He notes that essential policies for such growth—like tax reform, labor retraining, and infrastructure investment—lie beyond the Federal Reserve's control. Since short-sighted use of low interest rates and monetary policy can be detrimental to the quality of life for Americans, it is worth examining how much the federal government can stabilize the economy with proper infrastructure investments. Such investments provide positive externalities and influence economic growth. It helps people by reducing costs to access markets, raising returns on existing assets, facilitating human capital accumulation, and facilitating agglomeration economies and the dissemination of knowledge (Brookers 2010).

Benefits of Investment Domestically

Infrastructure investment offers both immediate and long-term benefits by complementing private capital and generating positive externalities. These include increases in GDP, higher wages, and improved productivity. More specifically, projections from Penn Wharton have shown that a $200 million investment in infrastructure over ten years could increase public capital by 4.6% by 2040, increasing labor productivity and private capital formation and leading to measurable economic growth. However, the effectiveness of such investments significantly depends on the execution and funding mechanisms. The same projection that includes additional borrowing displayed that it crowds out private capital, meaning that projects with additional federal borrowing may see lower utility and returns on investments. But this can be offset by higher productivity in public capital as shown in the second projection (Penn Wharton, 2021). Overall, this analysis shows how infrastructure investment complements monetary policy while addressing structural economic risks.

Benefits of Investment Internationally

The idea of infrastructure development is not limited to the United States. The effectiveness of such policy is unveiled in a study of BRICS nations named "Uncertain Supply Chain Management". This study demonstrates that infrastructure directly enhances supply chain efficiency (H1) and drives economic growth (H3). This study offers empirical evidence that macroeconomic infrastructure affects the development of BRICS nations since proper transportation and communication infrastructure streamlines supply chains logistics, bolsters' national competitiveness, and influences economic growth (Alexandroa 2023, 169). Their

regression table results in p-values of 0.000 for both H1 and H3, indicating a 99.9% significance

level (Alexandroa 2023, 173). This shows that the relationship between infrastructure

development and these outcomes is robust. Infrastructure investment is not just a growth catalyst

but a stabilizing factor in the economy. Improved supply chain efficiency reduces operational

disruptions and stabilizes the economy during times of uncertainty. However, the complexities

within BRICS nations—ranging from inefficient use of resources to regulatory obstacles—

highlight the importance of context-specific policies and tailored strategies to maximize the

benefits of infrastructure investments. In addition to this, the study calls for further research to

explore the additional factors influencing economic growth within the diverse landscape of the

BRICS group. This means each nation, especially the United States, need tailored policies to

drive economic growth.

Hypothesis result

Hypothesis	Construct*)	Original Sample	STDEV	T Statistics	P Values	Result
H1	INFRA → SCS	0.610	0.107	5.720	0.000	Accepted
H2	INFRA → NACOM	-0.234	0.082	2.845	0.005	Accepted
H3	INFRA → CEG	0.725	0.117	6.176	0.000	Accepted
H4	SCS → CEG	-0.038	0.122	0.314	0.754	Rejected
H5	NACOM → CEG	0.074	0.123	0.596	0.552	Rejected
H6	INFRA → SCS → CEG	-0.023	0.08	0.292	0.771	Rejected
H7	INFRA → NACOM → CEG	-0.017	0.032	0.541	0.589	Rejected

*) INFRA=Macroeconomic Infrastructure; SCS=Supply Chain Smoothness; NACOM=National Competitiveness; CEG=Country's Economic Growth

Figure 1R. Alexandro and Basrowi /Uncertain Supply Chain Management 12 (2024)

Methods

With the positive externalities of infrastructure investment taken into consideration, this

paper will showcase multiple linear regression models. They will utilize a set of dependent

variables and independent variables in multivariate linear regression models generated by

RStudio. This helps determine causality between dependent variables when studied in relation to

independent variables. The dependent variables that will be studied include the following: Real GDP (GDP), Unemployment rate (UNEMP), and inflation rate (CPI). Each of these will be studied in relation to the following independent variables: highway spending (HIGH), government expenditures (GOVEX), Producer Price Index of Railroad Rolling Stock (PINDEX), Hours Worked for Construction (HWORK), and Public Transit Ridership. These independent variables were chosen since they are all inputs of government expenditures in infrastructure. They are also renamed to simplify the visualized linear regression tables.

Results

Infrastructure on GDP

	Dependent variable:				
	GDP				
	(1)	(2)	(3)	(4)	(5)
HIGH	0.033	0.052	-0.037	-0.022	0.027
	(0.099)	(0.094)	(0.116)	(0.079)	(0.055)
GOVEX		0.014^{*}	0.015^{*}	0.016^{**}	0.017^{***}
		(0.008)	(0.008)	(0.005)	(0.004)
PINDEX			0.155	0.080	-0.088
			(0.123)	(0.086)	(0.071)
HWORK				0.276^{***}	0.251^{***}
				(0.063)	(0.043)
RIDER					0.075^{***}
					(0.018)
Constant	2.022^{***}	1.806^{***}	1.663^{***}	1.775^{***}	2.118^{***}
	(0.562)	(0.544)	(0.547)	(0.374)	(0.268)
Observations	20	20	20	20	20
R^2	0.006	0.163	0.239	0.667	0.855
Adjusted R^2	-0.049	0.065	0.096	0.578	0.803
Residual Std. Error	1.944 (df = 18)	1.835 (df = 17)	1.804 (df = 16)	1.233 (df = 15)	0.843 (df = 14)
F Statistic	0.112 (df = 1; 18)	1.660 (df = 2; 17)	1.675 (df = 3; 16)	7.502^{***} (df = 4; 15)	16.458^{***} (df = 5; 14)

Note: $^{*}p<0.1;$ $^{**}p<0.05;$ $^{***}p<0.01$

Figure 2, Linear Regression of Infrastructure's Effect on GDP

The first regression utilizes 5 independent variables and their respective datasets. Each model progressively adds one variable until all five are met. These additional variables serve as instrumental variables for each sequential model to account for issues regarding endogeneity. Variables that were utilized included highway spending (HIGH), government expenditures (GOVEX), Producer Price Index of Railroad Rolling Stock (PINDEX), Hours Worked for Construction (HWORK), and Public Transit Ridership (RIDER). All variables were measured in percent change annually and each should not be inputs of each other to give an accurate comparison and to reduce endogeneity. There comes a point where the linear model became much more accurate through the R-squared value. This value indicates the coefficient of determination or the proportion in variance in the dependent variable which also indicates the goodness of fit. For example, model 4 of this table has an R-squared of 0.667 which indicates it has captured 66.7% of variance of the independent variable, which is a significant increase from 23.9% in model 3. Overall, the most significant independent variables in relation to GDP is government expenditures (GOVEX), Hours Worked for Construction (HWORK), and Public Transit Ridership (RIDER).

Unemployment and Infrastructure

	Dependent variable:				
			UNEMP		
	(1)	(2)	(3)	(4)	(5)
HIGH	-0.523	-0.856	1.253	1.034	-0.412
	(1.344)	(1.829)	(2.201)	(1.826)	(0.547)
GOVEX		-0.050	-0.070	-0.076	-0.129***
		(0.157)	(0.151)	(0.126)	(0.037)
PINDEX			-3.687	-2.562	2.371***
			(2.327)	(1.968)	(0.696)
HWORK				-4.163**	-3.443***
				(1.445)	(0.427)
RIDER					-2.205***
					(0.174)
Constant	3.772	5.162	8.589	6.889	-3.191
	(9.456)	(10.586)	(10.374)	(8.617)	(2.648)
Observations	21	20	20	20	20
R^2	0.008	0.017	0.150	0.453	0.956
Adjusted R^2	-0.044	-0.099	-0.009	0.307	0.940
Residual Std. Error	33.958 (df = 19)	35.736 (df = 17)	34.248 (df = 16)	28.382 (df = 15)	8.320 (df = 14)
F Statistic	0.151 (df = 1; 19)	0.145 (df = 2; 17)	0.942 (df = 3; 16)	3.103** (df = 4; 15)	61.002*** (df = 5; 14)

Note: $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Figure 3, Linear Regression of Infrastructure's Effect on Unemployment

Figure 3 displays the linear regression for Unemployment. Strangely, government expenditures (GOVEX) and Producer Price Index of Railroad Rolling Stock (PINDEX) also became significant with the addition of RIDER in model 5. R-squared values for these increase as an additional variable is added. Model 4 showcased the first notable signs of significance with Hours worked in Construction (HWORK). A 1-unit increase in hours worked is associated with a 4.163-unit decrease in unemployment, holding other variables constant. The R squared value

also increases to 0.453, a significant improvement from 0.150 shown in Model 3. With an R

square value of 0.956, Model 5 suggests that government expenditures (GOVEX) and Producer

Price Index of Railroad Rolling Stock (PINDEX) and Public Transit Ridership (RIDER)

significantly reduces unemployment (UNEMP).

CPI and Infrastructure

	Dependent variable:				
	CPI				
	(1)	(2)	(3)	(4)	(5)
HIGH	-3.432	-1.215	-2.163	-1.764	-0.561
	(10.524)	(14.191)	(18.364)	(18.821)	(19.859)
GOVEX		0.817	0.826	0.837	0.881
		(1.222)	(1.263)	(1.294)	(1.344)
PINDEX			1.658	-0.391	-4.497
			(19.416)	(20.285)	(25.255)
HWORK				7.587	6.988
				(14.898)	(15.512)
RIDER					1.835
					(6.315)
Constant	47.098	32.140	30.599	33.698	42.087
	(74.020)	(82.135)	(86.546)	(88.830)	(96.110)
Observations	21	20	20	20	20
R^2	0.006	0.027	0.028	0.044	0.050
Adjusted R^2	-0.047	-0.087	-0.155	-0.211	-0.290
Residual Std. Error	265.814 (df = 19)	277.257 (df = 17)	285.725 (df = 16)	292.577 (df = 15)	301.937 (df = 14)
F Statistic	0.106 (df = 1; 19)	0.236 (df = 2; 17)	0.151 (df = 3; 16)	0.173 (df = 4; 15)	0.147 (df = 5; 14)

Note: $^*p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Figure 4, Linear Regression of Infrastructure's Effect on CPI

Figure 4 displays the linear regression for CPI and Infrastructure. This table stands out since

none of our independent variables were marked as significant in any direction with relation to

CPI. The R-squared value remains very low in each model regardless of how many additional

variables are aggregated. These trends can be an indication that public investment in infrastructure and infrastructure projects in general do not have much causality with inflation.

Summary

The findings from these studies collectively reaffirm the importance of infrastructure in economic systems. Across various contexts, infrastructure has proven to be a driver of economic stability, growth, and competitiveness by generating lasting benefits. In the United States, infrastructure investment represents a strategic alternative to Federal Reserve monetary policy in stabilizing the economy. While monetary measures such as quantitative easing can temporarily inject liquidity into markets, they often result in speculative bubbles and widened inequalities. In contrast, infrastructure provides a foundational economic boost, with research demonstrating a return of nearly two dollars for every dollar invested. This significant multiplier effect stems from direct job creation, productivity gains, and improved economic efficiency. These findings align with the thesis that infrastructure can act as a stabilizing force by fostering sustainable economic growth through structurally sound investments. An analysis on BRICS nations extends this perspective by providing empirical backing to infrastructure's nuanced role in driving supply chain efficiency and as a stabilizing tool. With statistical findings indicating a 99.9% significance level, the relationship between infrastructure and these outcomes is robust.

The implications are clear: Despite the risks from inadequate planning and implementation, infrastructure should be at the forefront of economic policy. It offers a pathway to long-term resilience, fostering national competitiveness and inclusivity. By aligning infrastructure initiatives with unique national challenges, policymakers can ensure that these

investments act as catalysts for economic sustainability and inclusivity, allowing the United

States to be less reliant on the Federal Reserve.

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