Comment on "The Macroeconomic Consequences of Infrastructure Investment"

By Jason Furman[1]

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"Macroeconomists like infrastructure investment a lot more than the people who know something about it."
--Ed Glaeser at some conference (according to the author's recollections)

Macroeconomists, myself sometimes included, have tended to see infrastructure investment as a solution to a wide range of economic concerns. What to do if the economy is in a recession and needs countercyclical help? Infrastructure. Worried about slower long-run growth? Infrastructure? Declining male employment rates? Infrastructure. Some of these same macroeconomists, who would otherwise never be caught citing an advocacy/lobbying group as an authority, have even been known to cite the American Society of Civil Engineers' grade of D+ for American infrastructure as, somehow, an authoritative assessment (2017). In contrast, many economists who specialize on infrastructure often tend to stress a variety of downsides: the examples of cities with ample infrastructure but no growth (Glaeser 2008), the fact that transit may shift economic activity more than it augments it (Gonzales-Navarro and Turner 2018), and that the benefits of highway construction may be small relative to its costs (Duranton and Turner 2012).

Valerie Ramey steps into this debate with both of her feet firmly planted in macroeconomics with analysis grounded in aggregate production and demand functions with none of the texture afforded by the microeconomic literature (beyond including a more realistic "time to build" for infrastructure investment). But she approaches it with none of the wishful thinking and advocacy that has sometimes plagued macroeconomic pronouncements. Instead she has produced what should become the definitive assessment of both the theory and empirics of infrastructure, especially its short-run impacts.

In my original discussion of the conference draft I used her paper as a launching point for a broader reflection on infrastructure, economic policy and economic research while also making some specific critiques of Ramey's models and analysis. Unfortunately, Ramey responded to and incorporated almost all of my critiques (for what they were worth), leaving me with just the broader reflections on infrastructure, economic policy and economic research that I will make in the following four points:

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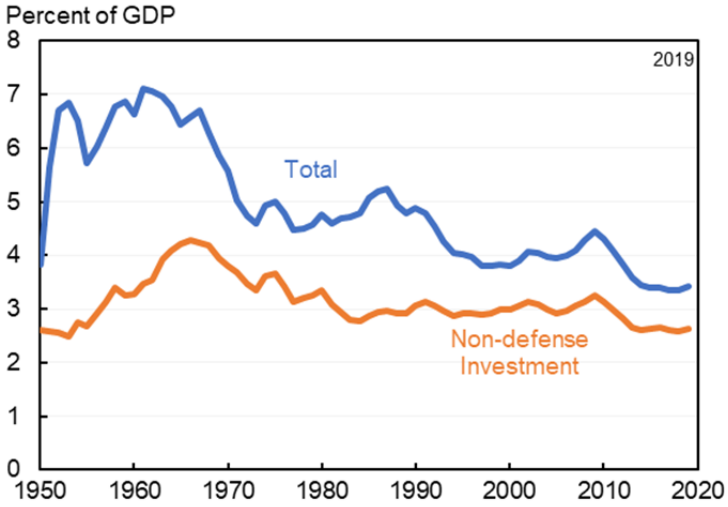
1. U.S. public investment is relatively low but U.S. infrastructure quality is relatively high

Gross government investment has fallen from its post-World War II peak of 7.1 percent of GDP in the 1960s to a near postwar low of 3.4 percent in 2019 as shown in Figure 1. Excluding defense investment the trend is similar, with a peak of 4.3 percent in the 1960s to a near-postwar low of 2.6 percent of GDP in 2019. The United States is also below average compared with other advanced economies in the OECD, as shown in Figure 2a which shows overall public investment and Figure 2b which excludes defense.

Figure 1
U.S. Gross Government Investment



Source: Bureau of Economic Analysis; Macrobond; author's calculations.

Figure 2a
Public Gross Fixed Capital Formation in Advanced OECD Countries, 2018

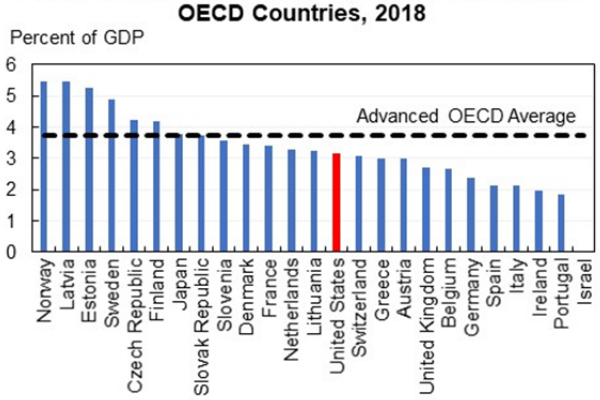
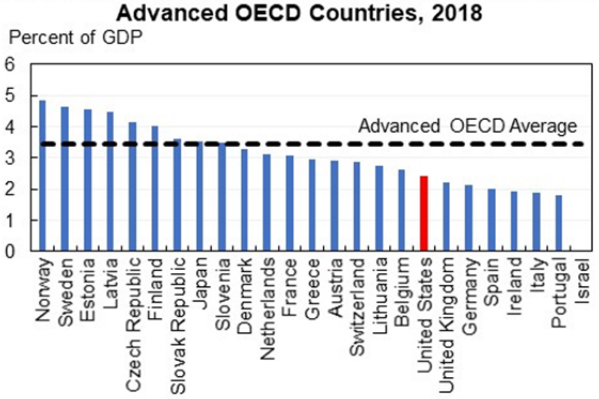


Figure 2b
Public Non-defense Gross Fixed Capital Formation in Advanced OECD Countries, 2018



Source: Organisation for Economic Co-operation and Development; author's calculations.

The low levels of public investment do not appear to translate into worse outcomes, at least in key measurable aspects of transportation infrastructure. Turner (2019) has shown that lane miles of interstate highway grew nearly continuously from 1980 to 2008 while the average

smoothness of roads improved enormously over that period. The World Economic Forum rates U.S. transportation infrastructure as better than the G7 average across multiple measures, except for railroad density, and ranks U.S. road, air and liner shipping connectivity as the best in the world, as shown in Table 1.

Table 1
Quality of Transportation Infrastructure in G-7 Countries

	Canada	France	Germany	Italy	Japan	United Kingdom	United States	G7 Average
Overall	66	83	84	73	88	81	80	79
Road Connectivity	99	97	95	86	78	91	100	92
Quality of Road Infrastructure	67	74	72	57	85	64	75	70
Railroad Density	13	100	100	100	100	100	41	79
Efficiency of Train Services	58	66	65	52	96	55	69	66
Airport Connectivity	96	96	100	97	100	100	100	98
Efficiency of Air Transport Service	72	75	75	65	87	72	80	75
Liner Shipping Connectivity	52	84	97	67	77	96	97	81
Efficiency of Seaport Services	68	69	71	61	80	69	76	71

Note: Scores are on a scale of 0 to 100, where 100 represents the frontier.
Source: Schwab (2019); author's calculations.

2. The optimal level of public investment likely varies across types and any assessment should factor in market failures and distortions

Ramey does a simple, back-of-the-envelope assessment of the optimal level of the U.S. public capital stock and finds that it is very dependent on the elasticity of output relative to the public capital stock. Unfortunately, Ramey's review and critique of the literature leads to more, not less, mystery on this parameter. With an elasticity of 0.05 the U.S. public capital stock is a little higher than optimum but with an elasticity of 0.11 found by Bom and Ligthart (2014) it is well below optimal. More work is needed to identify this parameter, including taking into account the timeframe for output, spillovers across regions, and a range of econometric problems that result from the fact that public investment is both a cause of and consequence of output and GDP growth.

The basic neoclassical model, however, provides a relatively small envelope for this back-of-the-envelope calculation and a number of additional considerations would be worth taking into account in future work:

- To the degree there are tax distortions associated with funding public investment that would suggest even lower public investment. But to the degree that the funding of public investment addresses other distortions (e.g., a gas tax addressing some externalities associated with gasoline use) then it would be higher.

- Private investment may be suboptimal due to distortions associated with capital taxation, monopoly power, and failure to take into account positive spillovers. All these considerations indicate more public investment than the simple Ramsey calculation would suggest.

- Public capital is highly differentiated and may not be exactly what one would think. Highways and streets, for example, are smaller than either intellectual property products of equipment as shown in Table 2. All of these forms of capital should be accounted for separately with their own output elasticities and optimal levels in any more complete analysis.

Table 2
Composition of U.S. Government Investment in Fixed Capital, 2018

Type	Percent
Equipment	22
Intellectual Property Products	30
Structures	47
Highways and streets	14
Educational	12
Transportation	4
Offices	4
Other	13

Source: Bureau of Economic Analysis; author's calculations.

- To the degree there are labor market failures that are reflected in the large long-term decline in non-college graduate prime-age male employment rates, then additional infrastructure investments may shift the composition of aggregate demand and these additional jobs should be reflected in any optimization exercise.

- Finally, parameterizing any optimization exercise against historical data implicitly identifies the optimal quantity conditional on the historical average quality of infrastructure (as reflected in the output elasticity). Should the analysis explore and try to understand how improvements in quality would increase the optimum level and what those improvements might be?

I do not know what a more complete optimization exercise addressing these points would show, but based on a range of evidence and experience I would hazard the following guesses: (1) the composition of transportation investment matters much more than the level, including more user funding, shifting from rural to urban, more transit and less highway, and possibly more maintenance and less new construction. (2) If the composition can be improved then a higher level is justified. (3) The United States is underinvesting dramatically in research and development.

3. A more granular production function may matter for assessing public infrastructure multipliers

Ramey finds somewhat smaller multipliers than much of the previous literature, and much smaller multipliers than the roughly 3 found by Auerbach and Gorodnichenko (2012) for

public investment. Ramey's multipliers, however, need not mean a large shift in priors for anyone that was more pessimistic about infrastructure as short-run fiscal stimulus (e.g., Elmendorf and Furman (2008) wrote that infrastructure was "difficult to design in a manner that would generate significant short-term stimulus" and Furman (2020) wrote "recent studies… find larger tax multipliers than spending multipliers.")

Ramey mostly models public investment as an undifferentiated concept. In reality there are many types of public investment and they enter the production function in different ways. Econometric estimates of multipliers for each separate type of infrastructure are likely impossible but the Bureau of Economic Analysis's (BEA's) input-output matrix provides some clues about the relative impact of different forms of infrastructure investment, with state and local transit being twice as large as water, sewage and other as shown in Table 3.

Table 3
Input-Output Effects of Infrastructure Investment

Industry	Total Multiplier
Government Investment	
Federal nondefense	1.5
State and local passenger transit	3.2
State and local electric utilities	1.8
Core Infrastructure Investment	
Highways and streets	2.0
Electric power generation, transmission, and distribution	1.8
Water, sewage, and other systems	1.6

Source: Council of Economic Advisers (2016).

4. A full policy regarding countercyclical public investment needs to take into account more than multipliers

Although the short-run multiplier is not an encouraging argument for public investment as fiscal stimulus, several other considerations are also important. The most important, as argued forcefully by Haughwout (2019) is that current infrastructure investment is currently *procyclical*. This is because 63 percent of state highway funding is through user revenues and other taxes and fees while only 9 percent is funded by borrowing. With taxes and fees highly cyclical, this introduces a substantial procyclicality to state highway investment. Presumably the same logic implies that other forms of state investment are also very procyclical. As a result, introducing some countercyclicality into federal infrastructure investment (Haughwout 2019) or into federal financing for states more generally (Fiedler, Furman, and Powell 2019), could be thought of less as a way to get new stimulus in recessions and more as a way to smooth investment, preventing a precipitous decline that may otherwise occur.

I would love to see Ramey take her analytic machinery and employ it to answer the question of the optimal cyclical profile of public investment. It is unlikely that procyclical is optimal. In fact, a number of considerations—unrelated to multipliers—suggest that

countercyclical may be preferable. Specifically, the fact that, in recessions, interest rates are lower and material and labor costs may be lower, suggests that, if anything, shifting more investment into periods when the economy is weak could be desirable.

In particular any cost-benefit analysis of a new public transportation program needs to reckon with how it accounts for the employment effects of the plan. As any student of economics learns, in normal times the jobs should be disregarded because the program might be creating gross jobs but it is not creating them on net—it is just displacing some other form of employment. In a recession, however, net jobs are created and these have a social value to the extent that the marginal product of them exceeds the reservation wage. This could easily shift a project from failing a cost-benefit test to passing one. Understanding just how easily, however, depends on the number of net new jobs created—which can be benchmarked by the jobs per $100,000 of infrastructure spending. A range of estimates for this is provided in Table 4

Table 4
Estimates of New Jobs Created Per $100,000 of Infrastructure Spending

Standard Advocacy Estimates	2-4
Chodorow-Reich (2019)	2
Ramey (2019)	0.8
Garin (2019)	0.6

Conclusion

Ramey brings much clarity to the aggregate analysis of public investment. She largely confirms that it should not be a major component of short-run stimulus and that it does have major long-run benefits, but the relationship between the overall level and social optimum remains far from clear. Extending her machinery both to examine the heterogenous varieties of public investment and the many distortions and market failures in both public and private investment would be an exciting next step that further increases the ability of the modelling to yield concrete (so to speak) policy recommendations.

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