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The Local Effects of The American Recovery and Reinvestment Act on Traffic Safety

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Overview

In a joint paper with Erich Muehlleger of UC-Davis, I used data from the from Pro-Publica, Recovery.gov, and the Massachusetts DOT to measure the impact of ARRA funded transportation improvement projects on traffic safety. We found that ARRA transportation funds were not associated with differential trends in crashes or motor vehicle fatalities prior to the passage of the ARRA. Nevertheless, they were associated with statistically significant declines in the years immediately after the program (2011-2012). Specifically, we found that a one standard deviation increases in local per capita funds (for example $161.5 at the county level) was associated with a 10.8-14.6% reduction in the number of fatalities in those years, or a maximal reduction of 0.62 fatal crashes per 100,000 residents. These large and statistically significant effects decline in subsequent years and are statistically insignificant from 2013-2015.

Several competing hypotheses can explain this pattern. One explanation may be that the road improvements are effective for only a short period of time. A second explanation is that the reduction in accidents and fatalities was the result of decreased or slower traffic near the construction sites. A final explanation for the short run decline is that traffic increased following the construction, and that there are more accidents due to the higher volume. These competing hypotheses have very different implications for the literature, and we were strongly advised to disentangle them. As a result, we have held off on sending the draft out again for publication until we can address this issue. Recently, the Massachusetts Department of Transportation has made publicly available historical traffic volumes at the detector level.[1] We are currently investigating whether the historical data provides sufficient geographic coverage during our study period to allow us to disentangle the three hypotheses above.

We believe that the most likely explanation does not involve declines merely due to decreased volume during the construction period. This is due to several reasons. First, the declines are—if anything – stronger and more persistent in the places with the lowest initial number of crashes and fatalities. This suggests that the impact of ARRA funding was not a mechanical proportional decline. Second, we do not observe declines in the number of

[1] http://www.massdot.state.ma.us/highway/TrafficVolumeCounts.aspx

establishments near a construction site in the Business-Analyst database (we cannot reject zero impact). Again, this suggests local declines during construction are not the only effect. Still, we are working on obtaining some direct traffic data to lend further support to these tests.

As far as we are aware, this project is the first to attempt to evaluate the impact of the ARRA on road safety. This is an important question directly, but our research also highlights the challenges inherent in trying to address these questions. We believe our work is useful both to policymakers trying to understand the road safety impact of the ARRA and to researchers seeking to learn about the challenges of identifying these impacts.

Background

The American Recovery and Reinvestment Act of 2009 provided significant funds for transportation projects in Massachusetts, with restrictions aimed at ensuring the funds were spent quickly. These restrictions led to the funding of transportation projects across the state whose timing was unrelated to discrete changes in local trends. In this project, we used this variation in construction to estimate the marginal impact of transportation projects on road safety and quality of life of local communities. Using detailed geographic data on ARRA funded projects, car accidents, and local economic outcomes, we could identify the impact of ARRA funding with a difference in differences approach.

There is a surprising dearth of literature relating ARRA funding to improvements in road quality. While several studies examine the relationship between infrastructure investment and road safety (e.g., Noland and Oh (2004) and Noland (2003)), we are not aware of any study estimating the relationship between ARRA infrastructure investment and vehicle fatalities. In addition to estimating the specific effects of ARRA on traffic safety, our context also provides several advantages over the existing literature in estimating the broader question of how infrastructure investments impact vehicle fatalities. The investment and crash data we used are available at much finer levels of detail than used in the previous literature. Second, relative to typical infrastructure projects, the decisions of which to fund are endogenous, the federal government prioritized ARRA funding towards shovel-ready projects, accelerating many projects that would not have received funding otherwise. Thus, ARRA funding provides a

degree of exogenous variation with respect to the infrastructure investments made – aiding the "causal" identification of the effect of investment on traffic fatalities. This is of obvious importance to policy makers.

Massachusetts was ultimately awarded more than $400 million in recovery funds for highway and bridge projects and another nearly $360 million for projects to improve MBTA service throughout the state. Additional funds were received for rail and other improvements. Much of this money was spent quickly. By the end of 2010, nearly $220 million had been expended and over 30 highway projects completed. Key project included resurfacing Route 6, Route 7 improvements in Pittsfield, and Route 24 improvements and ramps in Fall River.

Several sources provided highly detailed geographic data on projects funded by the ARRA. Figure 1 below shows a sample of the projects reported on the Commonwealth's State Transportation Improvement Program website.

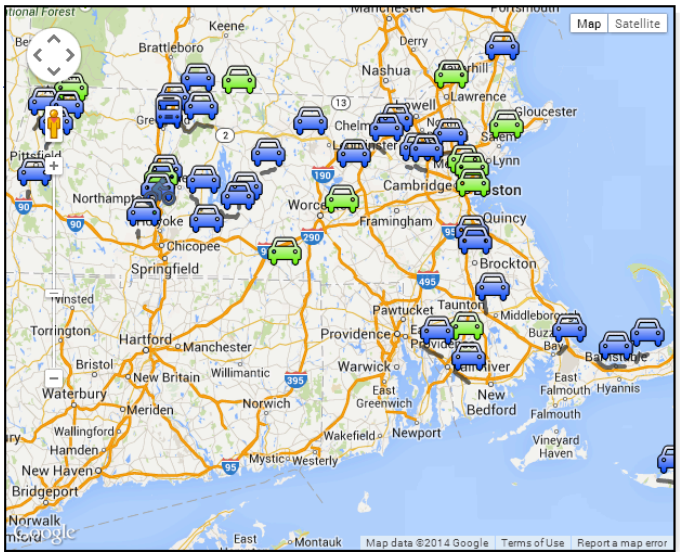
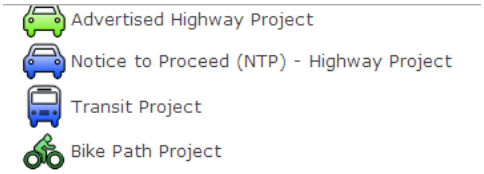


Figure 1: ARRA Projects in Massachusetts



Each project highlights a section of the roadway covered and a complete list is available, with information on cost, construction timing, contractor, and project details. Similar data were compiled by Pro-Publica and Recovery.gov.

We paired these data with data from the state of Massachusetts (for example RMV Crash Data System) on accidents and vehicle fatalities. This system contains information on 115-150 thousand crashes. Again, the data are available at highly refined levels. For example, the geocoded data for 2010 is plotted below.

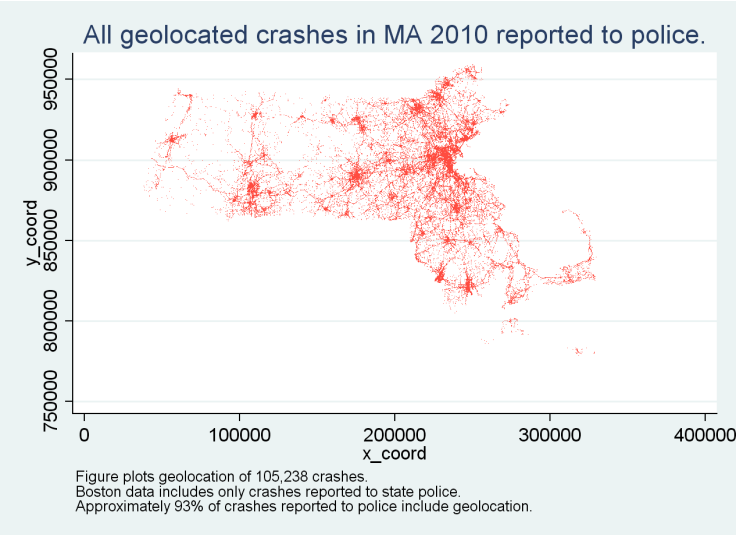


Figure 2: Massachusetts Car Accidents 2010

This let us explore the impact of these project using a difference-in-differences framework.

Framework

With these data in hand, we estimated models of the following form:

$$Y_{it}=\alpha_i + \alpha_t + \beta * \text{ARRA Funds}_i \times \alpha_t + \mu_{it}$$

where y_{it} could measure the number of accidents or fatalities. The fixed effects for location would control for baseline differences across comparable areas, the fixed effects for time would control for aggregate trends, and the coefficient of interest β would be identified off differential trends in ARRA affected neighborhoods. Since we do not have data on the exact date of

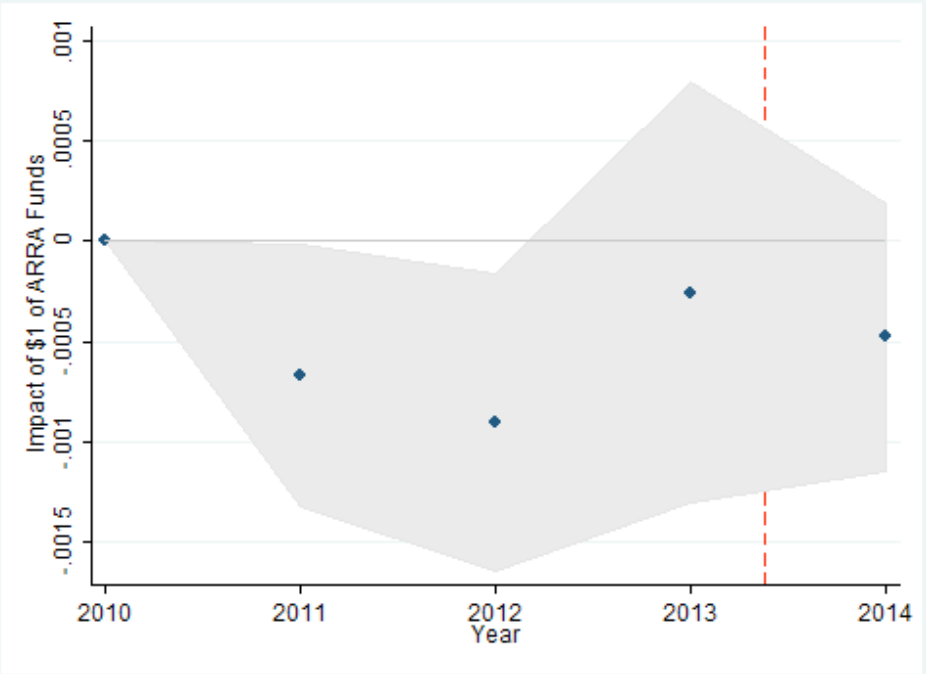
disbursement and construction, we interacted total ARRA funds with the time dummies to allow the data to estimate the differential impact at different dates.

The specification as written provides one of the central robustness tests for any difference-in-difference evaluation. To be precise, it tests for the existence of pre-trends. If ARRA funds were awarded to differentially to neighborhoods where traffic safety was improving or declining then our approach would be invalid. To further test the robustness of our results, we explore alternate scalings of the dependent variable (rates, in logs, etc.), and we conducted heterogeneity analyses based on prior accident rates. We clustered our standard errors at the county level to address the possibility of serial correlation.

Results

The graph and table below are representative of our general findings. First, we found no difference in pre-trends between places receiving a great deal of recovery funds and those receiving little. Formal tests showed no significant impact before 2010.

After 2010, however, there was a significant decline as can be seen in the graph below. A $1 per capita increase in local ARRA transportation funds was associated with a 0.09% decline in local fatalities. This is a relatively large impact, and the data reject the null hypothesis of zero impact at the 5% confidence level.



VARIABLES	(1) Log Fatalities	(2) Rate per 100,000
ARRA Funds Per Cap * Year 2008	-0.000106	-0.000457
	(0.000267)	(0.00205)
ARRA Funds Per Cap * Year 2009	-0.00177	-0.00500
	(0.00120)	(0.00491)
ARRA Funds Per Cap * Year 2010	-	-
	-	-
ARRA Funds Per Cap * Year 2011	-0.000672**	-0.00242
	(0.000297)	(0.00187)
ARRA Funds Per Cap * Year 2012	-0.000901**	-0.00387*
	(0.000336)	(0.00206)
ARRA Funds Per Cap * Year 2013	-0.000257	-0.000455
	(0.000476)	(0.00247)
ARRA Funds Per Cap * Year 2014	-0.000478	-0.00248
	(0.000304)	(0.00216)
ARRA Funds Per Cap * Year 2015	-0.000255	0.00331
	(0.00130)	(0.00745)
R-squared	0.912	0.642

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As can be seen in the figure and table, however, the results quickly disappear. This result is consistent at most levels of geography and specifications we explored. By 2013, the impact is once again statistically indistinguishable from zero.

Discussion

As described above there are several interpretations for this finding. It could be that the improvements themselves are real but fade quickly, it could be that the reduction just reflects a redirection of traffic during construction, or it could be that the fade away represents increased traffic after construction.

We have presented this initial research in several forums, including a faculty working group at UC-Davis, an industry conference, and in the classroom as part of Professor Shoag's class *Urban Economics* at Harvard and Professor Muehlegger's *Transportation Economics* class at the University of California-Davis.

The feedback we received from these presentations and from reviewers of our first manuscript draft was that disentangling these explanations would greatly improve the quality of the research. We are now in the process of trying to accomplish that.

Again, we believe that the most likely explanation does not involve declines merely due to decreased volume during the construction period. This is due to several reasons. First, the declines are—if anything – stronger and more persistent in the places with the lowest initial number of crashes and fatalities. This suggests that the impact of ARRA funding was not a mechanical proportional decline. Second, we do not observe declines in the number of establishments near a construction site in the Business-Analyst database (we cannot reject zero impact). Again, this suggests local declines during construction are not the only effect. Still, we

are working on obtaining some direct traffic data from Mass DOT to lend further support to these tests.

Our research offers several lessons, which should impact the literature evaluating the ARRA. First, it shows very large and significant impacts of construction projects on measures of roadway safety. There are robustly fewer accidents immediately after these projects are begun. These impacts fade relatively quickly and are statistically. As of now, however, we cannot be sure of the mechanism. We are working to determine this. Our work already provides some policy relevant results and guide for other researchers working on the topic. It's impact is expected to deepen as ongoing work clarifies our results. Future drafts of this work will be posted at https://scholar.harvard.edu/shoag and http://www.erichmuehlegger.com/