Traffic Congestion and Infant Health: Evidence from E-ZPass*

Motor vehicles are a major source of air pollution. Nationally they are responsible for over 50% of carbon monoxide (CO), 34 percent of nitrogen oxide (NO

traffic congestion policies could be significantly impacted by evidence that traffic congestion has a deleterious effect on fetal health. Second, the study of newborns overcomes several difficulties in making the connection between pollution and health because, unlike adult diseases that may reflect pollution exposure that occurred many years ago, the link between cause and effect is immediate. Third, E-ZPass is an interesting policy experiment because, while pollution control

electronic toll plaza before and after implementation of E-ZPass to those living near a major highway but further away from a toll plaza. Specifically, we compare mothers within 2 kilometers of a toll plaza to mothers who are between 2 and 10 km from a toll plaza but still within 3 kilometers of a major highway before and after the adoption of E-ZPass in New Jersey and Pennsylvania.

New Jersey and Pennsylvania provide a compelling setting for our particular research design. First, both New Jersey and Pennsylvania are heavily populated, with New Jersey being

We find significant effects on infant health. The difference-in-difference models suggest that prematurity fell by 6.4-8.6% among mothers within 2km of a toll plaza, while the incidence of low birth weight fell by 7-9.3%. We argue that these are large but not implausible effects given previous studies. In contrast, we find that there are no signit eff ects of E-ZPass adoption on the demographic characteristics of mothers in the vicinity of a toll plaza. We also find no immediate effect on housing prices, suggesting that the composition of women and ch

al. (2008); Slama et al. (2007); Beatty and Shimshack (2009); Knittel, Miller, and Sanders (2009)).

At the same time, researchers have documented many differences between people who are exposed to high volumes of traffic and others (Gunier et al, 2003). A correlational study cannot demonstrate that the effect of pollution is causal. Women living close to busy roadways

Several previous studies are especially relevant to our work because they address the problem of omitted confounders by focusing on "natural experiments." Chay and Greenstone [2003a,b] examine the implementation of the Clean Air Act of 1970 and the recession of the early 1980s. Both events induced sharper reductions in particulates in some counties than in others, and they use this exogenous variation in pollution at the county-year level to identify its effects. They estimate that a one unit decline in particulates caused by the implementation of the

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lonfounders. They find that CO is partilularly implicated in negative birth outcomes. In pregnant women, exposure to CO reduces the availability of oxygen to be transported to the fetus. Carbon monoxide readily crosses the placenta and binds to fetal haemoglobin more

SO . But we will demonstrate below that data from this monitor also suggests a sharp decline in NO, which is produced by cars, following E-ZPass adoption.

from a toll plaza; and those who lived 10km or more away from a toll plaza. Our treatment group in the difference-in-difference design is the mothers living within 2km of a toll plaza, while the control group is those who live close to a highway, but between 2km and 10km from a toll plaza. We drop mothers who live more than 10km away from a toll plaza. We also drop births that occurred more than 3 years before or after the E-ZPass conversion of the nearest plaza, in an effort to focus on births that occurred around the changes. All of the mothers in the sample are assigned to their nearest toll plaza.

Figure 2 illustrates the way that we created the treatment

information about address, square footage, age of structures, whether the unit is a condominium, assessed value of the land, and assessed value of the structures. We will use these data to see if housing prices changed in the neighborhood of toll plazas in response to amenity benefits generated from reduced traffic congestion and increased air quality surrounding E-ZPass implementation.

Means of the outcomes we examine (prematurity and low birth weight) and of the independent variables are shown in Table 1 for all of these groups. Panel A shows mea4.5(d)4.5(s for)]TJ-21.1

the control areas. The fraction of births that were low birth

square footage, age of structure, municipality and whether it is a condominium) reduces this estimate to statistical insignifican

stripping at a cost of $500 million (New Jersey Department of Transportation, 1998). In one recent example, the toll plaza for the I-78 Toll Bridge is being upgraded to E-ZPass. Construction is scheduled to take place between early January 2010 and Memorial Day, approximately 5 months

[3] In the meantime, commuters are being advised to use an alternat tso In5-2.1(-5(t(a)-

way following the introduction of E-ZPass, then we would need to take account of this selection when assessing the effects of E-ZPass on health outcomes.

We also estimate models of the effects of E-ZPass on housing prices. These models are similar to (1) above except that they control for whether it is a condomin

that is different from other areas (e.g. racial composition), but as we shall see, this does not seem to affect our estimates. Third, we estimated models of the propensity to live close to a toll plaza to see whether mothers were more or less likely to live near a toll plaza before or after E-ZPass adoption. These models included zip code fixed effects, all of the maternal and child characteristics listed above, and interactions of these variables.[4] We then excluded all observations with a propensity le

of mothers is to estimate models with mother fixed effects. These models take the following form:

be felt. These results suggest that the estimated health effects of E-ZPass are not due to changes in the composition of mothers who live close to toll plazas.

Table 3 shows our estimates of (2). Again, each coefficient is an estimate of b_4 from a separate regression. The first and third column shows a model that controls only for month and year of birth, toll plaza fixed effects, and distance to highway. These estimates are somewhat h- differences the

important to control for time trends and regional d

add maternal characteristics as in equation (2). A

and a linear time trend to the model. These interactions capture any differences in the evolution of areas near toll plazas and ot

Columns 1 and 2 of Table 7 shows difference in difference estimates of the effects of E-ZPass on daily mean NO_2 and SO_2 levels at the one monitor that

We provide the first estimates of the effect of improvements in traffic congestion on

6.4-8.6% reduction in the risk of prematurity (from a baseline of around 50%) in the 29,677

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Figure 3

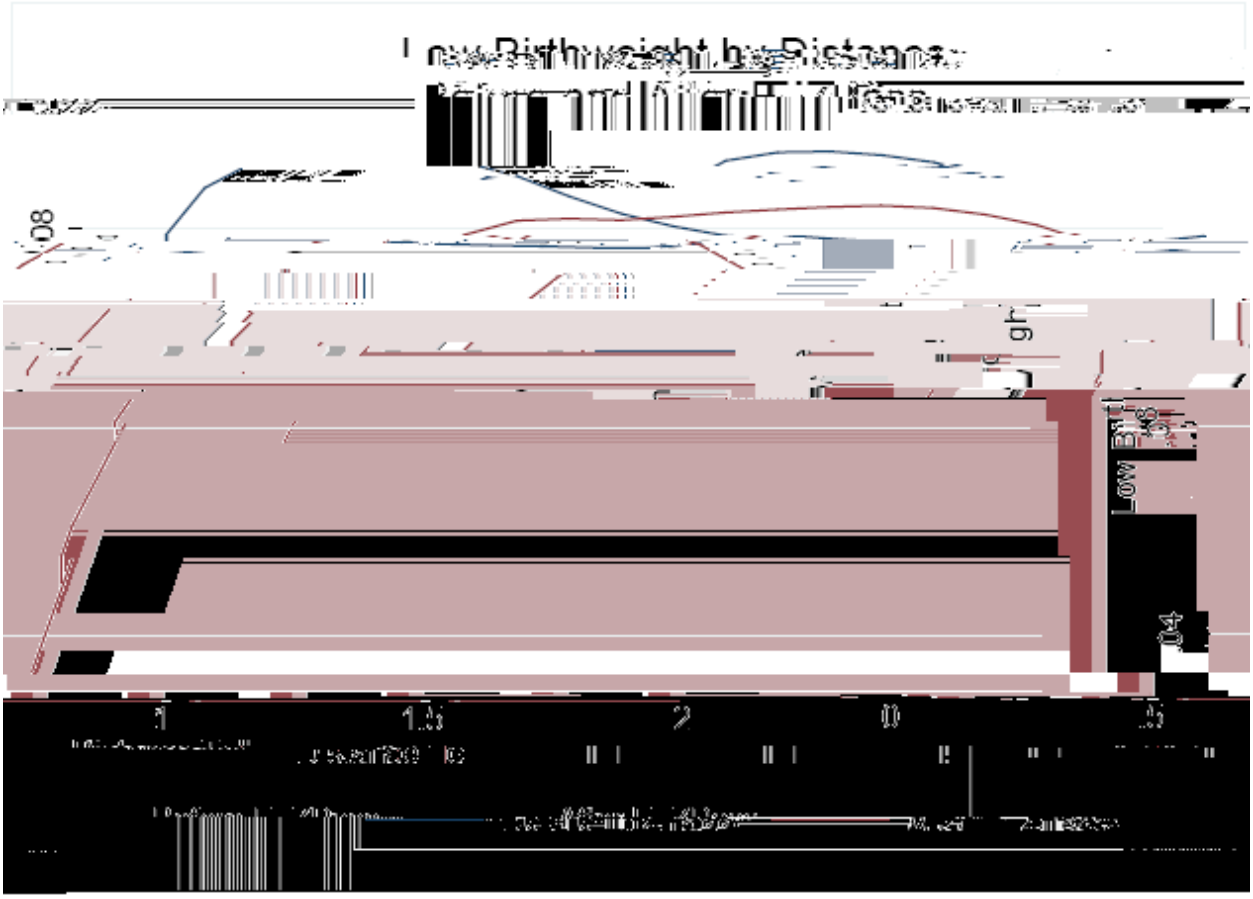

Figure 4

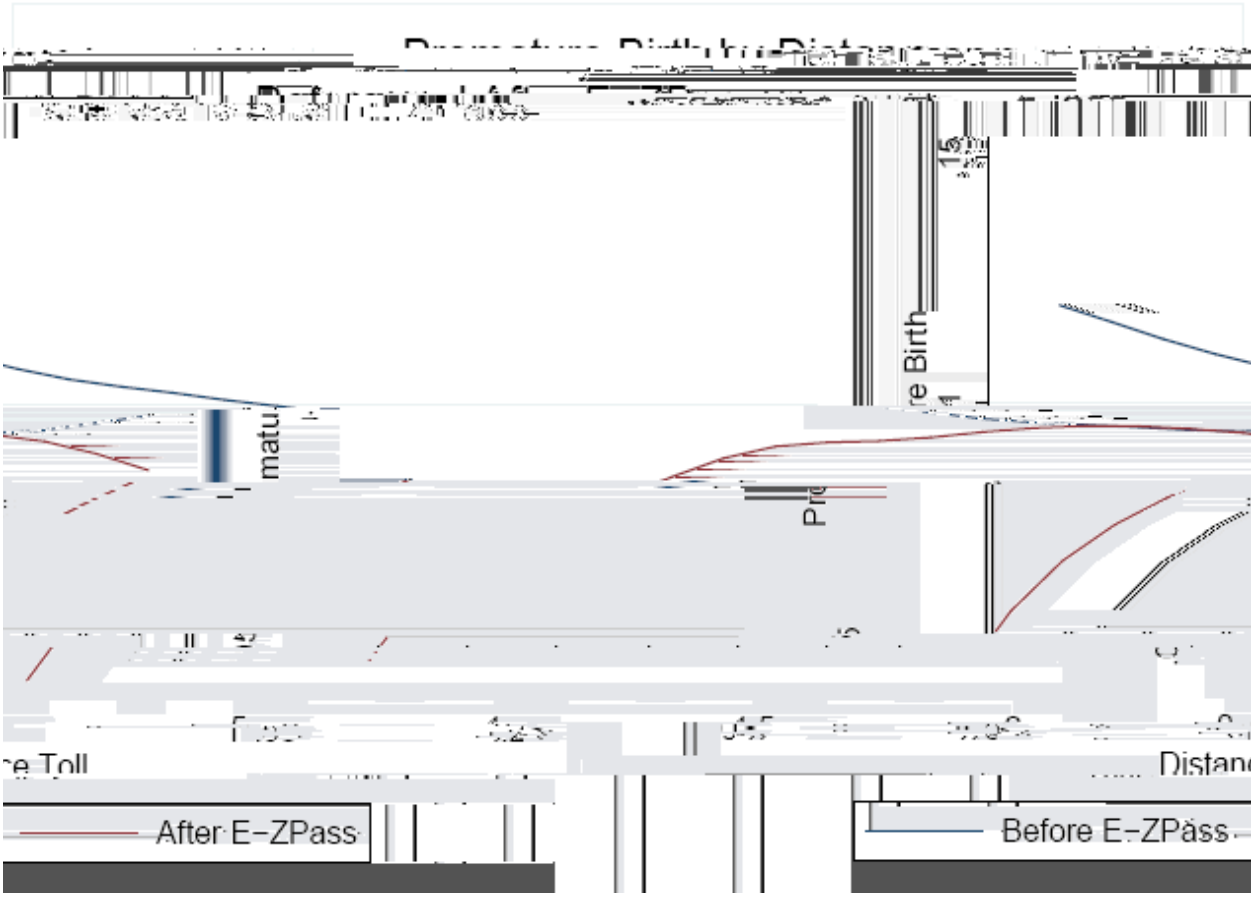

Table 2: "Placebo Regressions" of Maternal Characteristics on E-Zpass Adoption
Difference in Difference Specification

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Panel 1	**Black**	**Hispanic**	**Mother Yrs. Ed**	**Dropout**	**Teen Mother**	**Mother Smoked**	**Housing Sale Price**
<2km toll*after E-Zpass	-0.011	-0.01	0.03o	-0.00o	-0.001	.005*	0.149
	[0.011]	[0.010]	[0.040]	[0.005]	[0.005]	[0.003]	[0.103]
# observations	397,201	406,641	406,198	397,201	412,8841(Tee[0.,2,590ed)73844.252,343cePane2(Y)TJ/TT4 1 TT*D[911<2km toll*a		

Table 4: Robustness Checks, Birth Outcomes on E-Zpass Adoption
Difference in Difference Specification

	[1]	[2]
Panel 1: All obs. within 5km toll plaza	**Prematurity**	**LBW**
<2km toll*after E-Zpass	-0.0064	-0.007
	[0.0035]*	[0.0028]**
R-squared	0.104	0.1224
# Obs.	255,711	258,226
Panel 2: Add time trend for areas near toll plazas		
<2km toll*after E-Zpass	-0.0074	-0.0084
	[0.0035]**	[0.0029]**
R-squared	0.1053	0.1222
# Obs.	405,802	409,673
Panel 3: Propensity Trimmed, .1<=P(near toll)<=.9		
<2km toll*after E-Zpass	-0.0079	-0.0086
	[0.0037]**	[0.0036]**
R-squared	0.1011	0.1222
# Obs.	123,467	124,672
Panel 4: Non-African Americans Only		
<2km toll*after E-Zpass	-0.0052	-0.0059
	[0.0035]	[0.0029]**
R-squared	0.1078	0.1267
# Obs.	311,038	314,269
Panel 5: African-Americans Only		

Table 6: Mother Fixed Effects Estimates of the Effects of E-Zpass

Panel A	**Prematurity**	**Low Birth Weight**
<2km toll * after E-Zpass	-0.0131	-0.0107
	[0.0042]**	[0.0025]**
R-squared	0.195	0.192
<2km toll *3809er E-Zp5ss		-0.011195

Table 7: Difference-in-Differences Estimates of Effects of E-Zpass on Pollution

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
	NOx	SO_2	NOx	NOx	NOx	NOx	NOx