Separate Online Appendix to:

"The Fundamental Law of Road Congestion: Evidence from US cities"

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I. Supplemental estimations providing direct evidence for the Fundamental Law of Road Congestion

The four specifications in appendix table 1 replicate those of table 2 and columns 1-3 of table 3 in the main text for different samples and types of roads. Panel A provides results for MSA interstates on the more restricted sample of 192 MSAs with urban interstates throughout the period. In column 1, the elasticity is the same as in the corresponding result of table 3. In columns 2-4, it is slightly lower. Panel B uses the same sample of 192 MSAs but the dependent variable and the measure of roads are now based on *urban* interstates. The estimations in panel B suggest that the elasticity of urban interstate VKT with respect to urban interstate lane kilometers is close to one and slightly larger than for all interstates. Panels C and D of appendix table 1 are also similar, but investigate major urban roads and non-urban interstates. These results are slightly above those presented in panel A. Because the boundaries of urbanized areas within MSAs changed over the 1983-2003 period, the results of panels B-D must be interpreted with some caution.

Appendix table 2 is similar to panel A of table 5 in the main text, but examines the two cross-sections of first differences separately. This table reports results for six first difference

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specifications for the 1983-1993 period and six corresponding regressions for 1993-2003. The results are similar to those reported in table 5 of the main text. The only novel feature relative to table 5 is a slight decline in the roadway elasticity of VKT over time (as already evidenced in table 3 in the main text).

In appendix table 3, we perform a first simple falsification exercise. We run the same six regressions as in columns 7-12 of appendix table 2 for changes in VKT between 1993 and 2003. In the first six columns we use earlier changes in lane kilometers of interstate highways for 1983-1993 instead of (contemporaneous) changes for 1993-2003. In columns 7-12, we use both changes in lane kilometers of interstates for 1983-1993 and 1993-2003. Reassuringly, earlier changes in lane kilometers are never significant even though the effect is always precisely estimated. Furthermore, the coefficient on the change in roads for 1993-2003 is not affected by the presence of the 1983-1993 change.

In appendix table 4, we perform another simple falsification exercise. We run the same six regressions as in columns 1-6 of appendix table 2 for changes in VKT between 1983 and 1993. In the first six columns we use later changes in lane kilometers of interstate highways for 1993-2003. In columns 7-12, we use both changes in lane kilometers of interstates for 1983-1993 and 1993-2003. Reassuringly again, later changes in lane kilometers are never significant when used alone in columns 1-6 and the effect of contemporaneous changes is unaffected by the inclusion of later changes in column 7-12. In these columns, the coefficient on later changes is small at around 0.15 but marginally significant. This suggests either some serial correlation in roadway changes or a lagged response in the supply of roadway.

II. Supplemental estimations providing indirect evidence for the Fundamental Law of Road Congestion

Appendix table 5 presents estimations based on columns 2, 3, 4 and 9 of table 7 in the main text. However, unlike table 7 in the main text, appendix table 5 examines the effect of buses for each of our three cross-sections individually. The results in appendix table 5 are consistent with those suggested by table 7 in the main text: the count of large buses in an MSA has at most a very small effect on total interstate VKT and on urban interstate VKT. As in other regressions we continue to

find lane kilometers elasticities of VKT close to one.

Appendix table 6 is identical to table 7 in the main text, but measures an MSA's public transit network as the sum of the number of large buses and rail cars whereas table 7 in the main text measures transit only as the count of large buses. The results presented in appendix table 6 are almost indistinguishable from those in table 7 of the main text.

Appendix table 7 is similar to table 8 in the main text, but examines ADDT in: urbanized area major roads (Panel A), urbanized area interstate highways (Panel B), and non-urbanized area interstate highways (Panel C). Remarkably, for each type of road, appendix table 7 suggests convergence in traffic levels. Note that, column 6 of appendix table 7 presents IV regressions in which we instrument for population changes using the predicted population change variable described in the main text. Since we have one instrument and one endogenous dependent variable no over-identification test is possible.

III. Supplemental estimations providing evidence for sources of VKT

Appendix table 8 reproduces columns 1, 2, 3, and 5 of table 9 in the main text, but examines each cross-section independently. Appendix table 8 also extends table 9 in the main text by examining urban and non-urban interstate highways separately. The results presented in this table suggest that interstate truck VKT is probably more responsive to interstate lane kilometers than is all interstate VKT, and that major road truck VKT is probably less responsive to major road lane kilometers than is all major road VKT.

As described in the main text, we also rely on County Business Patterns for 1983, 1993, and 2003 to describe commercial travel activity. These data provide county level information on employment in "Motor freight transportation and warehousing" (SIC 42), an indirect measure of commercial traffic.

Appendix table 9 presents the results of regressions predicting log MSA employment in trucking and warehousing for the 228 MSAs in our sample and pooling all three cross-sections. In all regressions, our dependent variable is the log of the count of MSA employment in trucking and warehousing. In panel A the dependent variable of interest is all interstate highway lane kilometers. In columns 1-4 we conduct OLS regressions and in columns 5 and 6 we conduct

instrumental variables estimations. In our first three OLS specifications we find a positive significant relationship between interstate highway lane kilometers and trucking and warehousing employment. When we introduce an MSA fixed effect in column 4, the effect of roads on trucking and warehousing is not distinguishable from zero. In our IV estimates in columns 5 and 6 we find positive coefficients, that are not quite different from zero at standard confidence levels. Panel B of table 9 is similar to those in panel A but includes both urbanized and non-urbanized interstate highway lane kilometers as explanatory variables. We see that coefficients on urbanized interstate highway lane kilometers are similar to panel A, but the effect of non-urbanized interstate highway lane kilometers is uniformly positive, larger than urbanized interstate, and generally different from zero at standard confidence levels. This suggests that trucking and warehousing employment is more sensitive to non-urban interstate highways. Table 9 does not report IV in panel B because we are not able to instrument for the two road variables simultaneously. As a check, appendix table 10 reproduces the estimations from columns 1-3 and 6 in panel A of appendix table 9 in each of our cross-sections. These results are consistent with those reported in appendix table 9.

Appendix table 11 presents estimations corresponding to those presented in table 11 in the main text but examines each cross-section individually. Appendix table 12 presents the results of first difference regression corresponding to those presented in table 11 in the main text. These supplemental results confirm the results of table 11 in the main text. In particular, individual cross-sections and the time series variation in our data confirm that an extension of one of our classes of roads has very little impact on VKT on the others.

APPENDIX TABLE 1—VKT AS A FUNCTION OF LANE KILOMETERS, POOLED OLS.

	[1]	[2]	[3]	[4]
Panel A. Dependent variable: ln VKT for Interstate Highways, 192 entire MSAs				
ln(IH lane km)	1.25[a]	0.72[a]	0.76[a]	0.75[a]
	(0.03)	(0.05)	(0.04)	(0.05)
ln(population)		0.54[a]	0.50[a]	0.46[a]
		(0.04)	(0.04)	(0.12)
Elevation range			-0.030	-0.025
			(0.058)	(0.050)
Ruggedness			5.64[c]	4.20
			(3.13)	(2.92)
Heating degree days			-0.013[a]	-0.015[a]
			(0.003)	(0.004)
Cooling degree days			-0.016[b]	-0.019[c]
			(0.008)	(0.010)
Sprawl			0.0048	0.0033
			(0.0029)	(0.0031)
Census divisions			Y	Y
Past populations				Y
Socio-econ. charac.				Y
Panel B. Dependent variable: ln VKT for interstate highways, urbanized areas within MSAs				
ln(IHU lane km)	1.23[a]	0.98[a]	1.00[a]	1.01[a]
	(0.02)	(0.03)	(0.02)	(0.03)
Panel C. Dependent variable: ln VKT for Major Roads, urbanized areas within MSAs				
ln(MRU lane km)	1.12[a]	0.83[a]	0.84[a]	0.84[a]
	(0.01)	(0.04)	(0.04)	(0.04)
Panel D. Dependent variable: ln VKT for interstate highways, outside urbanized areas within MSAs				
ln(IHNU lane km)	1.03[a]	0.82[a]	0.84[a]	0.83[a]
	(0.03)	(0.03)	(0.03)	(0.02)

Notes: The same regressions for different types of roads are performed in all four panels. All regressions include a constant and year effects. Robust standard errors clustered by MSA in parentheses. 576 observations corresponding to 192 MSAs for each regression in all panels.
[a]: Significant at the 1 percent level.
[b]: Significant at the 5 percent level.
[c]: Significant at the 10 percent level.

APPENDIX TABLE 2—CHANGES IN VKT AS A FUNCTION OF CHANGES IN LANE KILOMETERS BY DECADE, OLS.

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Period:	83-93	83-93	83-93	83-93	83-93	83-93	93-03	93-03	93-03	93-03	93-03	93-03
Dependent variable: Δ ln VKT for Interstate Highways, entire MSAs												
Δ ln(IH lane km)	1.07[a]	1.07[a]	1.03[a]	1.06[a]	1.00[a]	0.93[a]	0.85[a]	0.86[a]	0.87[a]	0.85[a]	0.85[a]	0.85[a]
	(0.05)	(0.05)	(0.04)	(0.05)	(0.04)	(0.05)	(0.06)	(0.06)	(0.06)	(0.07)	(0.06)	(0.06)
Δ ln(population)		0.36[a]	0.41[a]	0.49[a]	0.54[a]	0.55[a]		0.28[a]	0.34[a]	0.32[a]	0.40[a]	0.38[a]
		(0.13)	(0.12)	(0.18)	(0.16)	(0.20)		(0.09)	(0.09)	(0.11)	(0.11)	(0.14)
ln(initial IH VKT)			-0.057[a]		-0.069[a]	-0.14[a]			-0.032[a]		-0.035[a]	-0.057[a]
			(0.011)		(0.012)	(0.03)			(0.011)		(0.007)	(0.020)
Geography				Y	Y	Y				Y	Y	Y
Census divisions				Y	Y	Y				Y	Y	Y
Socio-econ. charac.						Y						Y
Past populations						Y						Y
R^2	0.88	0.89	0.91	0.91	0.92	0.94	0.66	0.68	0.72	0.71	0.74	0.75

Notes: All regressions include a constant. Robust standard errors in parentheses. 228 observations for each regression.
[a]: Significant at the 1 percent level.
[b]: Significant at the 5 percent level.
[c]: Significant at the 10 percent level.

APPENDIX TABLE 3—CHANGES IN VKT AS A FUNCTION OF EARLIER CHANGES IN LANE KILOMETERS, OLS.

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Period:	93-03	93-03	93-03	93-03	93-03	93-03	93-03	93-03	93-03	93-03	93-03	93-03
Dependent variable: Δ ln VKT for Interstate Highways, entire MSAs												
Δ_{03-93} ln(IH lane km)							0.85[a]	0.86[a]	0.87[a]	0.85[a]	0.85[a]	0.85[a]
							(0.06)	(0.06)	(0.06)	(0.07)	(0.06)	(0.06)
Δ_{93-83} ln(IH lane km)	0.014	0.014	0.023	0.024	0.028	0.034	0.0040	0.0042	0.015	0.014	0.018	0.013
	(0.025)	(0.025)	(0.023)	(0.027)	(0.026)	(0.027)	(0.015)	(0.013)	(0.012)	(0.015)	(0.014)	(0.015)
Δ ln(population)		0.18	0.23	0.56[a]	0.64[a]	0.43[c]		0.28[a]	0.34[a]	0.31[a]	0.39[a]	0.39[a]
		(0.17)	(0.17)	(0.15)	(0.15)	(0.23)		(0.09)	(0.09)	(0.11)	(0.11)	(0.14)
ln(initial IH VKT)			-0.028[a]		-0.036[a]	-0.11[a]			-0.033[a]		-0.036[a]	-0.058[a]
			(0.009)		(0.010)	(0.03)			(0.005)		(0.007)	(0.020)
Geography				Y	Y	Y				Y	Y	Y
Census divisions				Y	Y	Y				Y	Y	Y
Socio-econ. charac.						Y						Y
Past populations						Y						Y
R^2	0.00	0.01	0.04	0.13	0.17	0.22	0.66	0.68	0.72	0.71	0.75	0.76

Notes: All regressions include a constant. Robust standard errors in parentheses. 228 observations for each regression.
[a]: Significant at the 1 percent level.
[b]: Significant at the 5 percent level.
[c]: Significant at the 10 percent level.

APPENDIX TABLE 4—CHANGES IN VKT AS A FUNCTION OF LATER CHANGES IN LANE KILOMETERS, OLS.

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Period:	83-93	83-93	83-93	83-93	83-93	83-93	83-93	83-93	83-93	83-93	83-93	83-93
Dependent variable: Δ ln VKT for Interstate Highways, entire MSAs												
Δ_{03-93} ln(IH lane km)	0.24	0.26	0.25	0.30	0.30	0.34	0.14[c]	0.16[b]	0.17[b]	0.17[b]	0.17[b]	0.14[c]
	(0.23)	(0.23)	(0.23)	(0.28)	(0.28)	(0.27)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
Δ_{93-83} ln(IH lane km)							1.07[a]	1.07[a]	1.08[a]	1.06[a]	1.06[a]	1.07[a]
							(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Δ ln(population)		0.27	0.24	0.063	0.076	-0.073		0.38[a]	0.43[a]	0.46[b]	0.50[a]	0.30
		(0.26)	(0.26)	(0.409)	(0.394)	(0.405)		(0.12)	(0.12)	(0.18)	(0.18)	(0.24)
ln(initial IH VKT)			0.028		-0.015	0.078			-0.037[a]		-0.047[a]	-0.013
			(0.040)		(0.033)	(0.092)			(0.011)		(0.012)	(0.035)
Geography				Y	Y	Y				Y	Y	Y
Census divisions				Y	Y	Y				Y	Y	Y
Socio-econ. charac.						Y						Y
Past populations						Y						Y
R^2	0.01	0.01	0.01	0.20	0.20	0.29	0.89	0.89	0.90	0.91	0.91	0.92

Notes: All regressions include a constant. Robust standard errors in parentheses. 228 observations for each regression.
[a]: Significant at the 1 percent level.
[b]: Significant at the 5 percent level.
[c]: Significant at the 10 percent level.

APPENDIX TABLE 5—VKT AS A FUNCTION OF LANE KILOMETERS AND BUSES, BY DECADE.

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
	OLS	OLS	OLS	LIML	OLS	OLS	OLS	LIML	OLS	OLS	OLS	LIML
Year:	1983	1983	1983	1983	1993	1993	1993	1993	2003	2003	2003	2003
Panel A. Dependent variable: ln VKT for Interstate Highways, entire MSAs												
ln(IH lane km)	0.92[a]	0.95[a]	0.93[a]	1.20[a]	0.73[a]	0.76[a]	0.78[a]	1.11[a]	0.71[a]	0.75[a]	0.77[a]	0.93[a]
	(0.06)	(0.06)	(0.05)	(0.14)	(0.04)	(0.04)	(0.04)	(0.16)	(0.05)	(0.04)	(0.04)	(0.14)
ln(bus)	-0.025	0.044[c]	0.049[c]	0.055	-0.012	0.031[c]	0.046[b]	0.14[c]	-0.044[c]	-0.0058	0.022	0.11
	(0.023)	(0.025)	(0.026)	(0.131)	(0.017)	(0.018)	(0.020)	(0.085)	(0.024)	(0.029)	(0.033)	(0.10)
ln(population)	0.48[a]	0.34[a]	1.01[a]	0.13	0.56[a]	0.46[a]	0.39	0.017	0.59[a]	0.50[a]	0.35	0.20
	(0.06)	(0.07)	(0.36)	(0.28)	(0.05)	(0.05)	(0.25)	(0.216)	(0.05)	(0.06)	(0.36)	(0.21)
Geography		Y	Y	Y		Y	Y	Y		Y	Y	Y
Census divisions		Y	Y	Y		Y	Y	Y		Y	Y	Y
Past populations			Y				Y				Y	
Socio-econ. charac.			Y				Y				Y	
R^2	0.93	0.94	0.95	-	0.94	0.95	0.96	-	0.94	0.96	0.96	-
Overidentification p-value				0.23				0.69				0.99
First stage statistic				7.17				5.41				5.73
Panel B. Dependent variable: ln VKT for Interstate Highways, urbanized areas within MSAs												
ln(IHU lane km)	1.04[a]	1.06[a]	1.07[a]	1.36[a]	0.94[a]	0.96[a]	0.98[a]	1.39[a]	0.93[a]	0.94[a]	0.97[a]	1.08[a]
	(0.03)	(0.03)	(0.03)	(0.17)	(0.03)	(0.03)	(0.03)	(0.33)	(0.03)	(0.03)	(0.04)	(0.15)
ln(bus)	-0.015	0.054[b]	0.059[b]	0.020	0.0079	0.044[b]	0.055[a]	0.14	-0.022	0.0087	0.033	0.025
	(0.023)	(0.025)	(0.024)	(0.095)	(0.020)	(0.021)	(0.021)	(0.11)	(0.028)	(0.034)	(0.035)	(0.074)
ln(population)	0.36[a]	0.23[a]	1.04[a]	-0.054	0.38[a]	0.29[a]	0.37	-0.35	0.40[a]	0.32[a]	0.55	0.15
	(0.05)	(0.06)	(0.39)	(0.287)	(0.05)	(0.05)	(0.34)	(0.49)	(0.05)	(0.06)	(0.46)	(0.20)
R^2	0.96	0.97	0.97	-	0.97	0.97	0.98	-	0.97	0.98	0.98	-
Overidentification p-value				0.79				0.97				0.93
First stage statistic				6.39				1.92				3.48

Notes: All regressions include a constant. Robust standard errors in parentheses. 228 observations for each regression in panel A and 192 in panel B. Instruments for buses and lane kilometers are ln 1898 railroads, ln 1947 planned interstates, and 1972 presidential election share of democratic vote.

[a]: Significant at the 1 percent level.

[b]: Significant at the 5 percent level.

[c]: Significant at the 10 percent level.

APPENDIX TABLE 6—VKT AS A FUNCTION OF LANE KILOMETERS AND ALL TRANSIT CARS, POOLED REGRESSIONS.

	[1] OLS	[2] OLS	[3] OLS	[4] OLS	[5] OLS	[6] OLS	[7] LIML	[8] LIML	[9] LIML	[10] LIML
Dependent variable: ln VKT for Interstate Highways, entire MSAs										
ln(IH lane km)	1.08[a]	0.82[a]	0.86[a]	0.86[a]	1.06[a]	1.06[a]	1.38[a]	0.95[a]	1.12[a]	1.22[a]
	(0.04)	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.07)	(0.11)	(0.14)	(0.18)
ln(transit)	0.13[a]	-0.027[c]	0.020	0.031[c]	0.024[a]	0.015[b]	-0.035	-0.079[c]	0.14	0.22
	(0.02)	(0.016)	(0.017)	(0.017)	(0.009)	(0.007)	(0.050)	(0.046)	(0.11)	(0.15)
ln(population)		0.52[a]	0.41[a]	0.27[b]		0.31[a]		0.51[a]	0.030	-0.24
		(0.05)	(0.05)	(0.12)		(0.10)		(0.12)	(0.238)	(0.33)
Geography			Y	Y					Y	Y
Census divisions			Y	Y					Y	Y
Socio-econ. charac.				Y						Y
Past populations				Y						Y
MSA fixed effects					Y	Y				
R^2	0.90	0.94	0.95	0.96	0.94	0.94	0.86	-	-	-
Overidentification p-value							0.88	0.39	0.58	0.57
First stage statistic							22.3	18.9	7.16	3.93

Notes: All regressions include a constant and year effects. Robust standard errors clustered by MSA in parentheses. 684 observations corresponding to 228 MSAs for each regression. Instruments for buses and lane kilometers are ln 1898 railroads, ln 1947 planned interstates, and 1972 presidential election share of democratic vote.
[a]: Significant at the 1 percent level.
[b]: Significant at the 5 percent level.
[c]: Significant at the 10 percent level.

APPENDIX TABLE 7—CONDITIONAL CONVERGENCE IN DAILY TRAFFIC.

	[1] OLS	[2] OLS	[3] OLS	[4] OLS	[5] OLS, FE	[6] TSLS
Panel A. Dependent variable: Change in ln daily traffic (AADT) for Major Roads, urbanized areas within MSAs.						
Initial MRU AADT level	-0.16[a]	-0.21[a]	-0.36[a]	-0.55[a]	-1.26[a]	-0.40[a]
	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)
Δ ln(population)		0.42[a]	0.49[a]	0.31[a]		0.94[a]
		(0.06)	(0.08)	(0.09)		(0.31)
Geography			Y	Y		Y
Census divisions			Y	Y		Y
Initial Share Manuf.				Y		Y
Past populations				Y		
Socio-econ. charac.				Y		
R^2	0.11	0.18	0.30	0.42	0.80	-
First stage statistic						32.7
Panel B. Dep. var.: Change in ln daily traffic for Interstate Highways, urbanized areas within MSAs.						
Initial IHU AADT level	-0.16[a]	-0.18[a]	-0.23[a]	-0.28[a]	-1.07[a]	-0.24[a]
	(0.02)	(0.02)	(0.02)	(0.03)	(0.09)	(0.02)
Δ ln(population)		0.44[a]	0.62[a]	0.44[a]		1.10[b]
		(0.07)	(0.11)	(0.14)		(0.49)
R^2	0.27	0.33	0.40	0.44	0.77	-
First stage statistic						34.0
Panel C. Dependent variable: Change in ln daily traffic (AADT) for Interstate Highways, non-urbanized areas within MSAs.						
Initial IHNU AADT level	-0.043[b]	-0.052[a]	-0.11[a]	-0.16[a]	-0.99[a]	-0.14[a]
	(0.019)	(0.018)	(0.02)	(0.03)	(0.05)	(0.03)
Δ ln(population)		0.36[a]	0.34[a]	0.16		0.99[b]
		(0.09)	(0.11)	(0.13)		(0.47)
R^2	0.14	0.18	0.31	0.38	0.80	-
First stage statistic						34.7

Notes: All regressions include decade effects. Robust standard errors in parentheses (clustered by MSA). 384 observations corresponding to 192 MSAs for each regression. Instrument for Δ ln(population) is expected population growth based on initial composition of economic activity interacted with national sectoral growth.
[a]: Significant at the 1 percent level.
[b]: Significant at the 5 percent level.
[c]: Significant at the 10 percent level.

APPENDIX TABLE 8—TRUCK VKT AS A FUNCTION OF LANE KILOMETERS, OLS BY DECADE.

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Year:	1983	1983	1983	1983	1993	1993	1993	1993	2003	2003	2003	2003
Panel A. Dependent variable: ln truck VKT for Interstate Highways, entire MSAs												
ln(IH lane km)	1.51[a]	1.44[a]	1.50[a]	1.38[a]	1.15[a]	0.84[a]	1.01[a]	1.00[a]	1.22[a]	0.94[a]	1.01[a]	1.11[a]
	(0.15)	(0.21)	(0.23)	(0.23)	(0.05)	(0.08)	(0.17)	(0.18)	(0.09)	(0.17)	(0.15)	(0.20)
ln(population)		0.095	0.011	-3.65[c]		0.32[a]	0.20	-0.15		0.28[a]	0.23[b]	1.97[c]
		(0.132)	(0.19)	(1.89)		(0.06)	(0.13)	(0.94)		(0.09)	(0.09)	(1.11)
Geography.			Y	Y			Y	Y			Y	Y
Census divisions			Y	Y			Y	Y			Y	Y
Past populations				Y				Y				Y
Socio-econ. charac.				Y				Y				Y
R^2	0.47	0.47	0.55	0.64	0.52	0.54	0.59	0.63	0.58	0.60	0.67	0.69
Panel B. Dependent variable: ln truck VKT for Interstate Highways, urbanized areas within MSAs												
ln(IHU lane km)	1.24[a]	1.37[a]	1.35[a]	1.34[a]	1.10[a]	1.09[a]	1.10[a]	1.11[a]	1.01[a]	0.75[a]	0.80[a]	0.81[a]
	(0.09)	(0.23)	(0.21)	(0.23)	(0.05)	(0.21)	(0.19)	(0.21)	(0.03)	(0.06)	(0.07)	(0.08)
Panel C. Dependent variable: ln truck VKT for Major Roads, urbanized areas within MSAs												
ln(MRU lane km)	1.04[a]	0.73[a]	0.73[a]	0.76[a]	1.03[a]	0.21	0.41	0.30	1.07[a]	0.44[a]	0.50[a]	0.56[a]
	(0.04)	(0.11)	(0.09)	(0.09)	(0.06)	(0.24)	(0.29)	(0.30)	(0.03)	(0.09)	(0.09)	(0.10)
Panel D. Dependent variable: ln truck VKT for Interstate Highways, outside urbanized areas within MSAs												
ln(IHNU lane km)	1.05[a]	0.86[a]	1.00[a]	0.99[a]	1.09[a]	0.94[a]	1.03[a]	1.00[a]	1.06[a]	0.85[a]	0.89[a]	0.89[a]
	(0.06)	(0.09)	(0.08)	(0.08)	(0.06)	(0.09)	(0.08)	(0.09)	(0.06)	(0.08)	(0.09)	(0.10)

Notes: The same regressions for different types of roads are performed in all four panels. All regressions include a constant. Robust standard errors in parentheses. 228 observations for each regression in panel A and 192 in panels B-D.
[a]: Significant at the 1 percent level.
[b]: Significant at the 5 percent level.
[c]: Significant at the 10 percent level.

APPENDIX TABLE 9—TRUCKING AND WAREHOUSING EMPLOYMENT AS A FUNCTION OF LANE KILOMETERS.

	[1] OLS	[2] OLS	[3] OLS	[4] OLS	[5] TSLS	[6] TSLS
Panel A. Dependent variable: ln MSA trucking and warehousing employment as a function of all MSA interstate lane km						
ln(IH lane km)	0.17[a]	0.16[a]	0.13[a]	0.0085	0.28[b]	0.25[c]
	(0.05)	(0.05)	(0.05)	(0.0404)	(0.14)	(0.14)
ln(population)	0.92[a]	0.94[a]	1.06[a]	0.75[a]	0.84[a]	0.87[a]
	(0.04)	(0.05)	(0.15)	(0.14)	(0.10)	(0.11)
Geography		Y	Y			Y
Census divisions		Y	Y			Y
Socio-econ. charac.			Y			Y
MSA fixed effects				Y		
R^2	0.84	0.86	0.89	0.73	-	-
Overidentification p-value					0.03	0.34
First stage Stat					16.5	11.8
Panel B. Dependent variable: ln MSA trucking and warehousing employment as a function of MSA interstate lane km in urbanized and non urbanized areas						
ln(IHU lane km)	0.15[a]	0.084[b]	0.094[b]	0.031		
	(0.040)	(0.038)	(0.042)	(0.057)		
ln(IHNU lane km)	0.092[b]	0.12[a]	0.099[b]	0.065		
	(0.039)	(0.04)	(0.038)	(0.058)		
ln(population)	0.80[a]	0.86[a]	1.16[a]	0.79[a]		
	(0.05)	(0.06)	(0.18)	(0.16)		
R^2	0.85	0.86	0.89	0.72		

Notes: All regressions include a constant and year effects. Robust standard errors clustered by MSA in parentheses. 684 observations corresponding to 228 MSAs for each regression in panel A and 576 (192 MSAs) in panel B. Instruments in panel A are ln 1835 exploration routes, ln 1898 railroads, and ln 1947 planned interstates.
[a]: Significant at the 1 percent level.
[b]: Significant at the 5 percent level.
[c]: Significant at the 10 percent level.

APPENDIX TABLE 10—ln MSA TRUCKING AND WAREHOUSING EMPLOYMENT AS A FUNCTION OF LANE KILOMETERS BY DECADE.

	1983				**1993**				**2003**			
	OLS	OLS	OLS	TSLS	OLS	OLS	OLS	TSLS	OLS	OLS	OLS	TSLS
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
ln(IH lane km)	0.12[a]	0.12[a]	0.12[b]	0.17	0.25[a]	0.25[a]	0.20[b]	0.28	0.20[a]	0.15[b]	0.15[b]	0.35[b]
	(0.04)	(0.04)	(0.05)	(0.14)	(0.07)	(0.08)	(0.08)	(0.20)	(0.05)	(0.06)	(0.06)	(0.15)
ln(population)	1.00[a]	1.01[a]	1.58[a]	0.98[a]	0.87[a]	0.87[a]	1.06[b]	0.84[a]	0.85[a]	0.90[a]	2.99[a]	0.73[a]
	(0.04)	(0.05)	(0.43)	(0.11)	(0.06)	(0.08)	(0.46)	(0.17)	(0.04)	(0.06)	(0.62)	(0.13)
Geography		Y	Y	Y		Y	Y	Y		Y	Y	Y
Census divisions		Y	Y	Y		Y	Y	Y		Y	Y	Y
Socio-econ. charac.			Y	Y			Y	Y			Y	Y
Past populations			Y	Y			Y	Y			Y	Y
R^2	0.83	0.85	0.88	-	0.80	0.83	0.87	-	0.85	0.88	0.91	-
Overidentification p-value				0.52				0.24				0.20
First stage statistic				8.55				10.2				10.0

Notes: All regressions include a constant. Robust standard errors in parentheses. 228 observations for each regression. Instruments are ln 1947 planned interstates and ln 1898 railroads.

[a]: Significant at the 1 percent level.

[b]: Significant at the 5 percent level.

[c]: Significant at the 10 percent level.

APPENDIX TABLE 11—VKT AS A FUNCTION OF LANE KILOMETERS FOR DIFFERENT ROADS, OLS BY DECADE.

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Year:	1983	1983	1983	1983	1993	1993	1993	1993	2003	2003	2003	2003
Panel A. Dependent variable: ln VKT for Interstate Highways, urbanized areas within MSAs												
ln(IHU lane km)	1.17[a]	1.07[a]	1.11[a]	1.11[a]	1.06[a]	0.98[a]	1.00[a]	1.01[a]	1.00[a]	0.97[a]	0.99[a]	0.99[a]
	(0.04)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
ln(MRU lane km)	0.15[a]	-0.074	-0.11[c]	-0.11[c]	0.26[a]	-0.17[c]	-0.14	-0.081	0.29[a]	-0.24[a]	-0.21[b]	-0.11
	(0.052)	(0.05)	(0.06)	(0.06)	(0.05)	(0.09)	(0.09)	(0.081)	(0.04)	(0.08)	(0.09)	(0.08)
ln(IHNU lane km)	0.0035	-0.062	-0.087[b]	-0.10[a]	-0.048	-0.095[a]	-0.096[a]	-0.12[a]	-0.038	-0.10[a]	-0.099[a]	-0.094[a]
	(0.043)	(0.040)	(0.039)	(0.03)	(0.039)	(0.031)	(0.029)	(0.03)	(0.023)	(0.02)	(0.022)	(0.021)
ln(population)		Y	Y	Y		Y	Y	Y		Y	Y	Y
Geography.			Y	Y			Y	Y			Y	Y
Census divisions			Y	Y			Y	Y			Y	Y
Socio-econ. charac.				Y				Y				Y
Past populations				Y				Y				Y
R^2	0.96	0.96	0.97	0.98	0.96	0.97	0.97	0.98	0.97	0.98	0.98	0.98
Panel B. Dependent variable: ln VKT for Major Roads, urbanized areas within MSAs												
ln(IHU lane km)	0.032	-0.033	-0.045[c]	-0.036	0.019	-0.047[c]	-0.051[a]	-0.060[a]	-0.027	-0.053[a]	-0.043[b]	-0.054[a]
	(0.027)	(0.025)	(0.025)	(0.027)	(0.026)	(0.024)	(0.019)	(0.019)	(0.025)	(0.018)	(0.018)	(0.017)
ln(MRU lane km)	1.03[a]	0.87[a]	0.87[a]	0.84[a]	1.10[a]	0.74[a]	0.80[a]	0.81[a]	1.15[a]	0.68[a]	0.68[a]	0.73[a]
	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)
ln(IHNU lane km)	0.068[a]	0.024	0.021	0.010	0.023	-0.016	-0.010	-0.019	0.036	-0.020	-0.016	-0.013
	(0.021)	(0.020)	(0.020)	(0.018)	(0.024)	(0.020)	(0.016)	(0.016)	(0.024)	(0.019)	(0.016)	(0.015)
Panel C. Dependent variable: ln VKT for Interstate Highways, outside urbanized areas within MSAs												
ln(IHU lane km)	0.10[a]	0.015	0.038	0.046	-0.0067	-0.092[b]	-0.077[b]	-0.060	-0.033	-0.066	-0.052	-0.039
	(0.04)	(0.040)	(0.038)	(0.038)	(0.040)	(0.038)	(0.037)	(0.040)	(0.047)	(0.044)	(0.042)	(0.042)
ln(MRU lane km)	0.14[a]	-0.067	-0.031	-0.045	0.26[a]	-0.21[a]	-0.083	0.019	0.30[a]	-0.28[a]	-0.15	-0.053
	(0.05)	(0.050)	(0.054)	(0.055)	(0.06)	(0.08)	(0.080)	(0.079)	(0.06)	(0.10)	(0.11)	(0.104)
ln(IHNU lane km)	0.88[a]	0.82[a]	0.84[a]	0.83[a]	0.86[a]	0.81[a]	0.84[a]	0.83[a]	0.87[a]	0.81[a]	0.83[a]	0.83[a]
	(0.05)	(0.05)	(0.04)	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)

Notes: The same regressions for different types of roads are performed in all four panels. All regressions include a constant. Robust standard errors in parentheses. 192 observations for each regression.
[a]: Significant at the 1 percent level.
[b]: Significant at the 5 percent level.
[c]: Significant at the 10 percent level.

APPENDIX TABLE 12—CHANGE IN VKT AS A FUNCTION OF CHANGE IN LANE KILOMETERS FOR DIFFERENT ROADS, POOLED OLS.

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Panel A. Dependent variable: Δ ln VKT for interstate highways, urbanized areas within MSAs										
Δ ln(IHU lane km)	0.96[a]	0.96[a]	0.92[a]	0.95[a]	0.91[a]	0.94[a]	0.89[a]	0.89[a]	0.89[a]	0.89[a]
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)	(0.05)	(0.05)
Δ ln(IHNU lane km)	0.035	0.033	0.016	0.027	0.019	0.015	0.014	-0.030	-0.027	-0.030
	(0.029)	(0.030)	(0.030)	(0.032)	(0.030)	(0.031)	(0.031)	(0.045)	(0.045)	(0.042)
Δ ln(MRU lane km)	-0.015	-0.017	0.0067	-0.013	0.0014	-0.0025	-0.0043	0.032	0.038	0.044
	(0.030)	(0.030)	(0.027)	(0.030)	(0.027)	(0.028)	(0.026)	(0.038)	(0.036)	(0.039)
Δ ln(population)		0.24[b]	0.34[a]	0.41[a]	0.54[a]	0.40[a]	0.54[a]		0.24	0.33
		(0.09)	(0.08)	(0.12)	(0.12)	(0.15)	(0.15)		(0.24)	(0.22)
ln(initial VKT)			-0.042[a]		-0.051[a]		-0.079[a]			
			(0.004)		(0.005)		(0.016)			
Geography				Y	Y	Y	Y			
Census divisions				Y	Y	Y	Y			
Socio-econ. charac.						Y	Y			Y
Past populations						Y	Y			
MSA fixed effects								Y	Y	Y
R^2	0.81	0.81	0.84	0.82	0.85	0.85	0.86	0.81	0.81	0.82
Panel B. Dependent variable: Δ ln VKT for interstate highways, outside urbanized areas within MSAs										
Δ ln(IHU lane km)	-0.011	-0.017	-0.023	-0.028	-0.034	-0.030	-0.036	-0.057[c]	-0.057[c]	-0.059[c]
	(0.024)	(0.023)	(0.022)	(0.022)	(0.021)	(0.024)	(0.023)	(0.032)	(0.032)	(0.035)
Δ ln(IHNU lane km)	0.95[a]	0.95[a]	0.94[a]	0.94[a]	0.93[a]	0.94[a]	0.93[a]	0.92[a]	0.92[a]	0.91[a]
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)
Δ ln(MRU lane km)	-0.0090	-0.011	-0.0018	-0.0072	0.0027	-0.011	-0.0028	0.0023	0.0032	0.011
	(0.027)	(0.026)	(0.027)	(0.026)	(0.026)	(0.027)	(0.025)	(0.033)	(0.032)	(0.034)
R^2	0.80	0.80	0.81	0.82	0.83	0.83	0.84	0.80	0.80	0.81
Panel C. Dependent variable: ln VKT for Major Roads, urbanized areas within MSAs										
Δ ln(IHU lane km)	-0.024	-0.031	-0.030	-0.031	-0.031	-0.039	-0.026	-0.038	-0.039	-0.043
	(0.024)	(0.025)	(0.025)	(0.026)	(0.026)	(0.029)	(0.027)	(0.039)	(0.040)	(0.038)
Δ ln(IHNU lane km)	0.016	0.013	0.014	0.016	0.015	0.016	0.0025	-0.0073	-0.0063	-0.022
	(0.022)	(0.020)	(0.020)	(0.021)	(0.021)	(0.021)	(0.021)	(0.031)	(0.031)	(0.032)
Δ ln(MRU lane km)	0.82[a]	0.82[a]	0.82[a]	0.82[a]	0.82[a]	0.82[a]	0.66[a]	0.78[a]	0.78[a]	0.79[a]
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)
R^2	0.79	0.80	0.80	0.80	0.81	0.81	0.84	0.77	0.77	0.78

Notes: All regressions include a constant and period effects. Robust standard errors clustered by MSA in parentheses. 384 observations (192 MSAs) for each regression.
[a]: Significant at the 1 percent level.
[b]: Significant at the 5 percent level.
[c]: Significant at the 10 percent level.