

Highway to Success: The Impact of Golden Quadrilateral Project on Indian Manufacturing

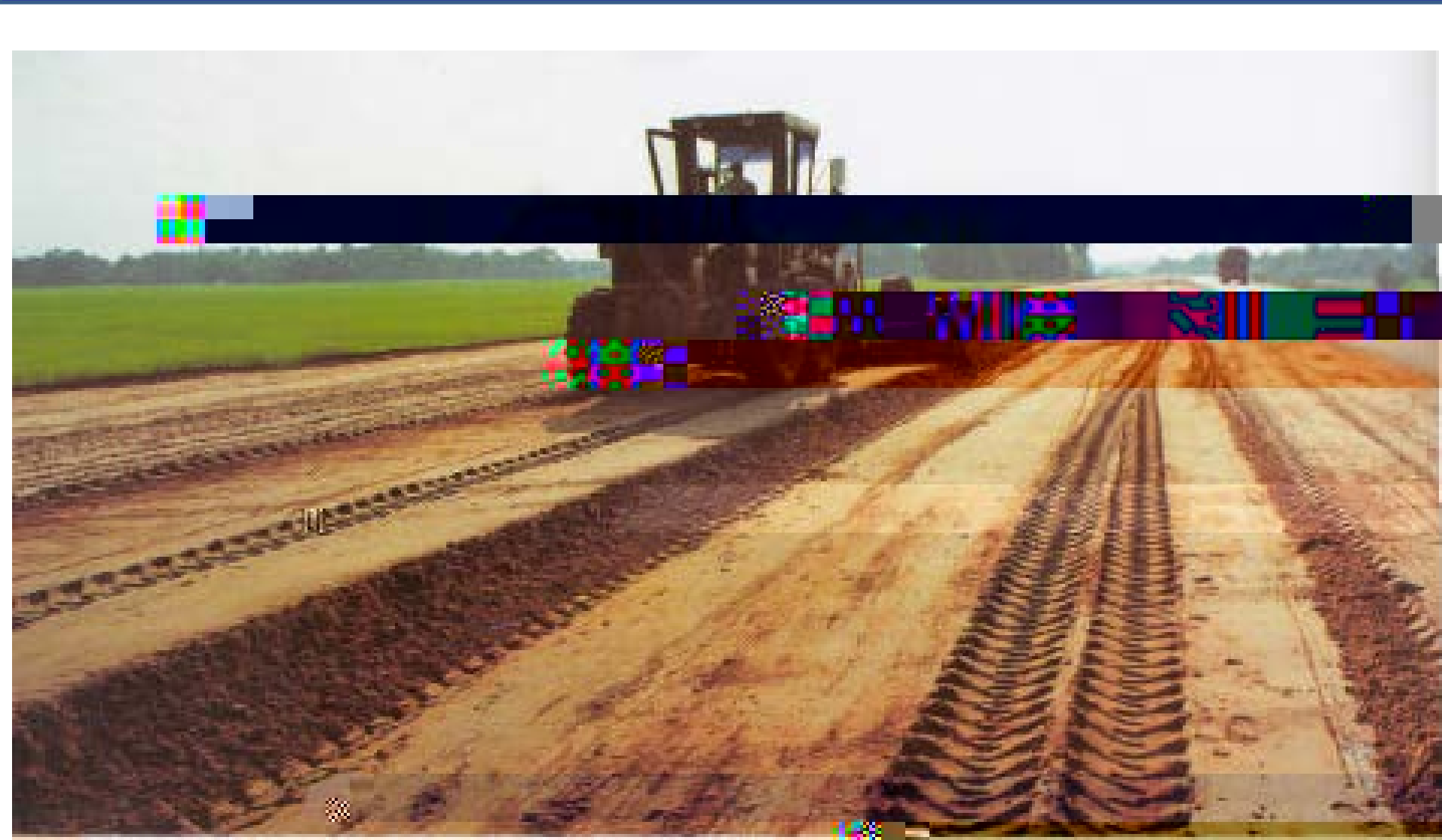
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Annual Bank Conference on Development Economics

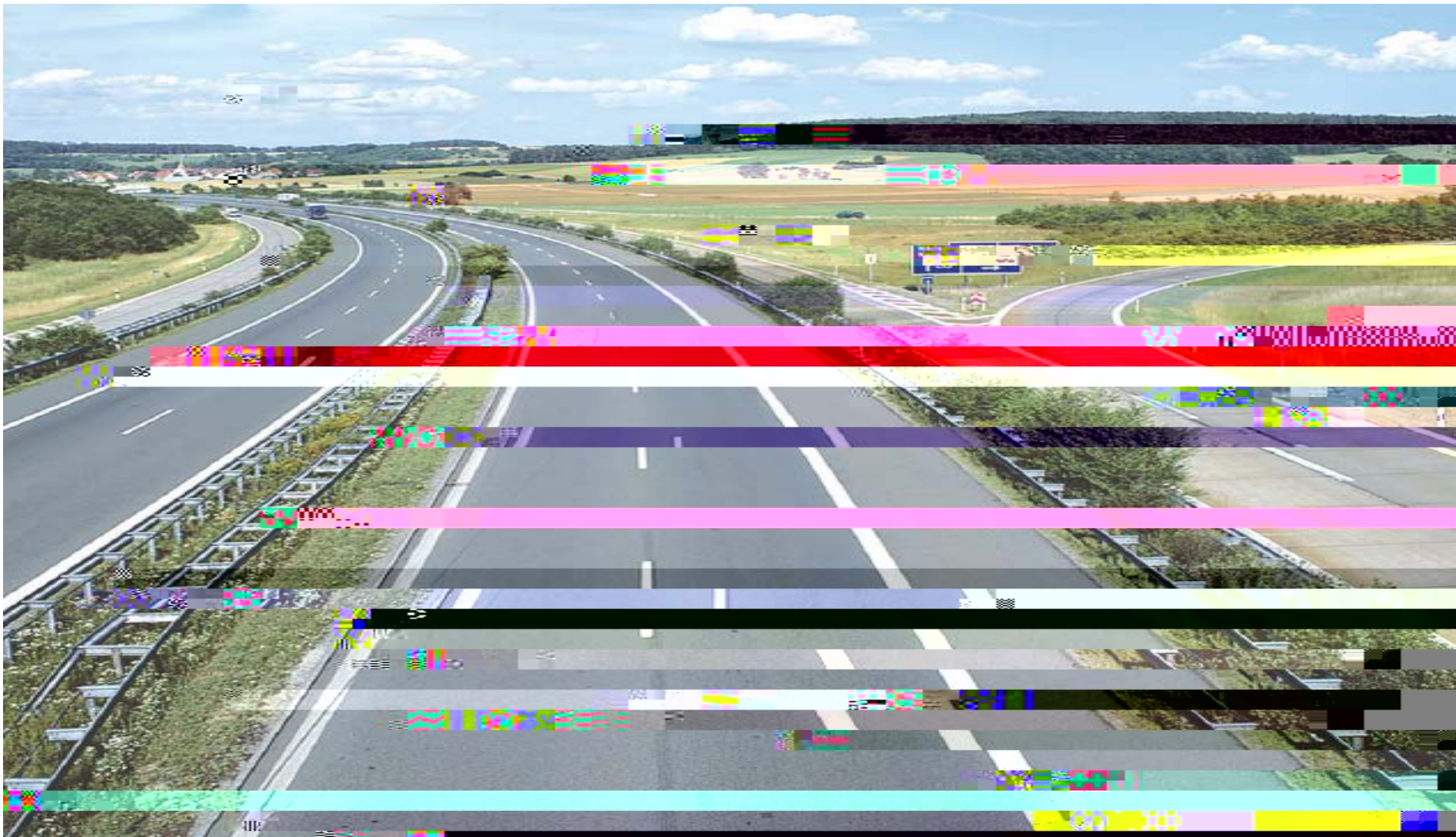
June 15-16, 2015

Mexico City

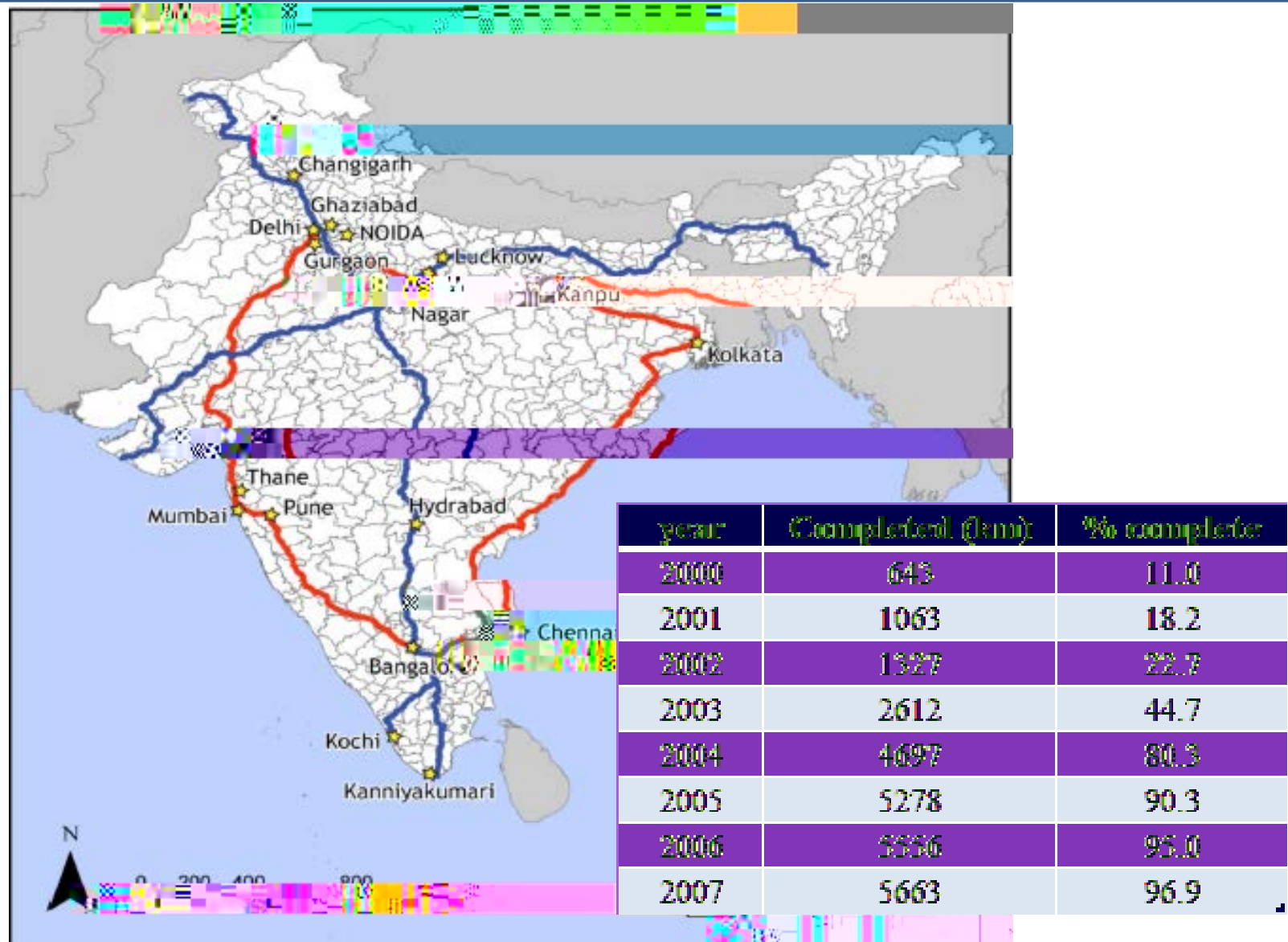
Highways in India, 2000 Snapshot



Highways in India, 2007 Snapshot



Highways in India: GQ and NS-EW



GQ and the Organization of Manufacturing

Our Contribution

- Use plant-level data to analyze the impact of highways on:
 - Entry and exit outcomes
 - Productivity consequences
 - Entrant vs. incumbent growth
 - Allocative efficiency
 - Contribution to urbanization/de-urbanization

- Quantify the impact from investments into improving networks
 - [vs. the existence of transportation networks]
 - Comparison to the NS-EW placebo highway
 - Dynamics around upgrades
 - Comparison across urban and rural locations

Data

- Annual Survey of Industries (ASI) for organized manufacturing

Output



Young Output



Diff in Diff estimations: Entry Rates

Total GQ organized sector effect,			Columns 1-3 in urban areas			Columns 1-3 in rural areas		
Plants	Employment	Output	Plants	Employment	Output	Plants	Employment	Output
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

A. Base spatial horizon measuring effects relative to districts 50+ km from the GQ network

Post GQ upgrades *	0.702	1.167	1.647+	-0.388	0.631	0.383	-0.165	0.203	0.723		
	(0.723)	(0.692)	(0.804)	(1.215)	Nodal district	(0.662)	(0.814)	(0.951)	(0.433)	(0.566)	
0.231	0.443	0.477++	0.597++	1.059+++	Post GQ upgrades *	0.436++	0.477++	0.929+++	0.319+		
(0.176)	(0.252)	(0.380)	(0.183)	(0.260)	(0.389)	District 0-10 km from GQ	(0.172)	(0.239)	(0.346)		
2	-0.056	-0.263	-0.009	-0.056	-0.351	-0.015	0.006	-0.126	Post GQ upgrades *	-0.011	
Yes	Yes	Yes	District and year fixed effects			Yes	Yes	Yes	Yes	Yes	Yes
164	1164	1164	Observations			1248	1248	1248	1112	1112	1112

Sample counts by distance band: 9, 70, 42, and 196

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0.031	0.443	0.449++	0.597++	1.059+++	Post GQ upgrades *	0.436++	0.471++	0.029+++	0.319+	
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Diff in Diff estimations: Entry Rates

		Total GQ organized sector effect		Columns 1-3 in urban areas		Columns 1-3 in rural areas		
(8)	(9)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
network								
A. Base spatial horizon measuring effects relative to districts 50+ km from the GQ								
0.011	Post GQ upgrades *	0.081	0.033	0.077	0.010	0.126	0.167	
	Nodal district	(0.135)	(0.033)	(0.145)	(0.043)	(0.264)	(0.167)	
	Post GQ upgrades *	0.177+	0.086++	0.165	0.098	0.198++	0.099	
	District 0-10 km from GQ	(0.093)	(0.042)	(0.139)	(0.066)	(0.099)	(0.056)	
	District 10-50 km from GQ	(0.093)	(0.042)	(0.139)	(0.066)	(0.099)	(0.056)	
Yes	Yes	District and year fixed effects		Yes	Yes	Yes	Yes	
1160	1160	Observations		1248	1244	1108	1100	

Sample counts by distance band: 9, 70, 42, and 196

Methodology: Long differences

- Non-parametric approach using long-difference estimations

$$\Delta Y_i = \sum_{d \in D} \beta_d \cdot (0, 1)GQDist_{i,t} + \alpha_i X_i + \epsilon_i$$

- X_i controls include:
 - Measures of initial levels Y_i
 - Access to national highway, state highway, or railroad in terms of log distance
 - Traits from 2000 Census: population, age profile, female-male ratio, urbanization rate, SC/ST rate, literacy, and within-district infrastructure measure

Long Differences

Sample counts by distance band: 9 0 3 5g

Long Differences

DV: Change in manufacturing trait			Log levels of total activity		Log levels of young firm activity			Log labor	Total factor	Log average	Log cost per	
productivity	productivity	wage	employee	employee	Plants	Employment	Output	Plants	Employment	Output	Output	
(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)		(1)	(2)		
Panel A: Baseline manufacturing productivity in districts 50 km from the GQ controls as follows:												
0.065	0.069				(0.496)	(0.464)	(0.480)	(0.499)	(0.543)	(0.621)	(0.111)	(0.195)
0.098	0.095				(0.128)	(0.144)	(0.165)	(0.161)	(0.198)	(0.215)	(0.143)	(0.192)
				(0.1) District 10-50 km from GQ	-0.199	-0.325	-0.175	-0.238	-0.087	-0.281	0.157	-0.286
Panel B: Panel A including controls for initial district conditions and additional road and railroad traits:												
0.0831	0.064	0.077	0.004	1.367	0.239	0.249	(0.1) Market district	0.341	0.468	0.493		
(0.0718)	(0.0338)	(0.0377)	(0.1676)	(0.2836)	(0.0961)	(0.1108)		(0.3976)	(0.6971)	(0.6771)		
0.129	0.120	0.127	0.173	0.392	0.126	0.095	(0.1) District 10-50 km from GQ	0.292	0.322	0.322	0.173	0.173
(0.124)	(0.120)	(0.127)	(0.173)	(0.392)	(0.126)	(0.095)		(0.292)	(0.322)	(0.322)	(0.173)	(0.173)
0.155	0.110	0.117	0.137	0.202	0.024	0.115	0.035	0.404	0.427	0.402	0.152	0.152
(0.110)	(0.032)	(0.035)	(0.107)	(0.157)	(0.083)	(0.087)		(0.377)	(0.377)	(0.377)	(0.161)	(0.161)

Sample counts by distance band: 9, 70, 42, and 196

Long Differences

DV: Change in manufacturing trait			Log levels of total activity		Log levels of young firm activity			Log labor	Total factor	Log average	Log cost per	
productivity	productivity	wage	employee	employee	listed in column header	Plants	Employment	Output	Plants	Employment	Output	
(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)		(1)	(2)		
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0.098	0.095	(0.1)	District 10-50 km from GQ	-0.199	-0.325	-0.175	-0.238	-0.087	-0.281	0.157	-0.286	
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0.124	0.120	(0.127)	(0.127)	(0.127)	(0.127)	(0.127)	(0.127)	(0.127)	(0.127)	(0.127)	(0.127)	(0.127)
0.155	0.155	0.155	0.155	0.155	0.155	0.155	0.155	0.155	0.155	0.155	0.155	0.155

Sample counts by distance band: 9, 70, 42, and 196

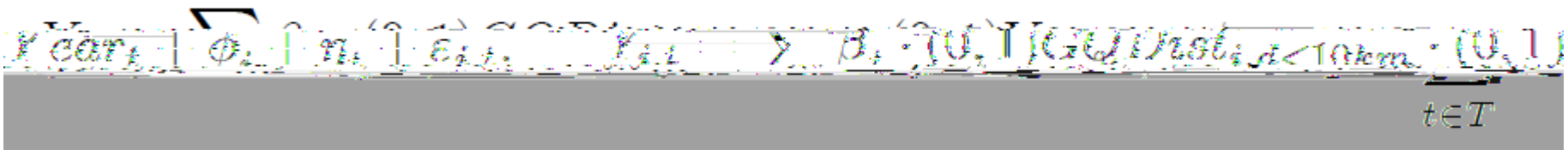
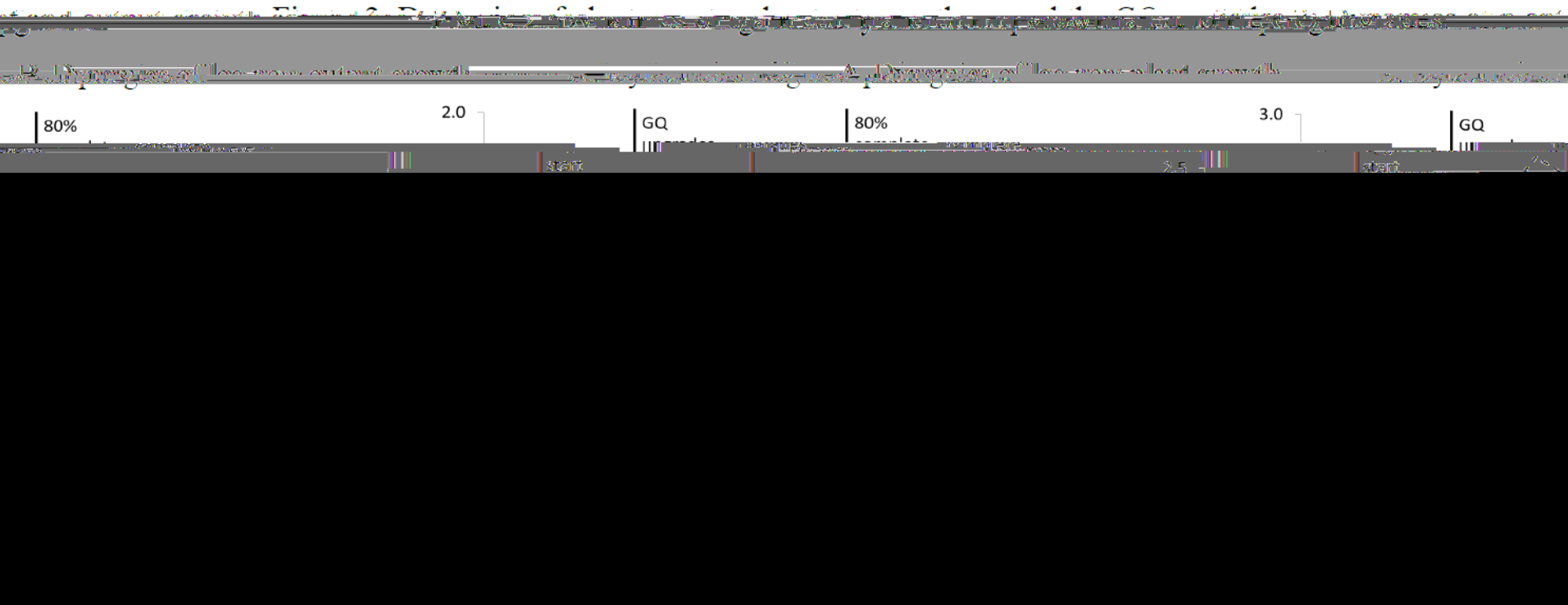
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Panel B: Panel A including controls for initial district conditions and additional road and railroad traits:												
0.0831	0.064	0.077	0.004	1.367	0.239	0.249						
0.0718	0.038	0.037	0.167	0.280	0.096	0.100						
0.124	0.120	0.127	0.173	0.392	0.126	0.093						
0.100	0.100	0.100	0.100	0.100	0.100	0.100						

Sample counts by distance band: 9, 70, 42, and 196



Dynamic Specifications: Young Activity



Parallel work with average spread in states of completion times is 6.4 years

GQ and Urban Rural transformation for Unorganized Sector

- Diff in diff for unorganized: non-nodal districts close to the GQ system behave similarly to those located farther away
- Diff in diff on urban shares: GQ accelerated spatial shift for organized sector but observe no changes in the urbanization

Conclusions

- GQ upgrades connected to enhancements in organized sector activity
- Additionally, GQ helped increase allocative efficiency, facilitated a more natural spatial sorting of industries, and encouraged decentralization to intermediate cities
- Impact on organized sector is balanced between urban/rural settings, with the exception being that rural areas receive relatively more stimulus in terms of net output growth.
- Unorganized sector of manufacturing is not closely linked to the GQ developments in either location