

Roads to Prosperity? Assessing the Local Economic Effects of Mexico's Early Highway Network

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Megaprojects



Theoretical Framework

- Redding & Turner (2015): Transport infrastructure can either concentrate or disperse economic activity, depending on the context.

Railroad Studies

- Berger & Enflo (2017): Railroads in Sweden increased manufacturing output, with effects persisting for 150+ years.
- Donaldson (2018): Colonial Indian railroads reduced trade costs, increasing agricultural income by $\sim 16\%$.
- Jedwab & Moradi (2016): African colonial railways created persistent spatial development patterns, lasting decades after operations ceased.

Highway/Road Networks

- Faber (2014): China's highways unexpectedly reduced industrial growth in peripheral connected areas.
- Baum-Snow et al. (2017): Roads decentralized Chinese urban populations, while railroads concentrated industry. Highways led to central city population decline in the US (7-9% per highway ray).
- Rothstein (2017) Documents how US Interstate Highway System deliberately routed through Black neighborhoods, displacing communities.
- Banerjee, Duflo & Qian (2020): Proximity to transport networks significantly impacts regional GDP per capita.

Urban & Regional Effects

- Duranton & Turner (2012): A 10% increase in highway stock → 1.5% employment growth over 20 years.
- Michaels (2008): The US Interstate System increased skilled labor demand in connected counties.
- Storeygard (2016): Lower transport costs accelerated urban growth in Sub-Saharan Africa.

Post-Revolutionary Mexican Infrastructure Project

- **Post-Mexican Revolution:** Infrastructure became a symbol of state legitimacy (Waters, 2006).
- **1918:** President Venustiano Carranza emphasized roads for national reconstruction (Bess, 2017).

Funding Sources

- Initially financed by **oil and tobacco taxes**.
- Later supported by State and municipal budget (SOP, 1976; Banobras, 1994).



Stages of Road Development in Mexico

First Stage 1930-1950

- **Semi-Random Construction** Connected municipalities to State capitals, and these to Mexico City (Bess, 2016a; SCT, 1991).
- Aimed to prevent independentist threats from northern and southern States (political and administrative centralization).
- Built as a **symbol of state legitimacy** after the **Mexican Revolution**.
- According to Waters (2006), the government saw roads as:

"[...] something that could help bring Mexicans together if controlled by the national government [...]."

Second Stage 1950-1980

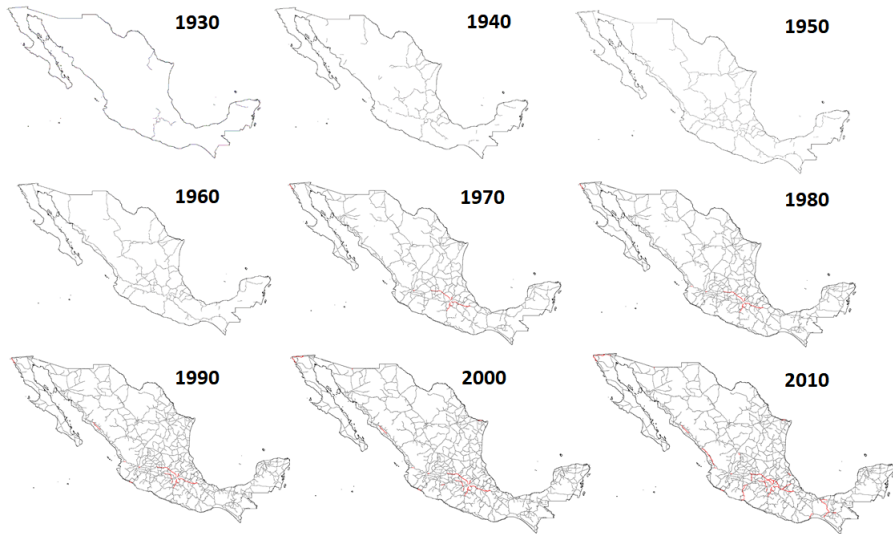
- Connected **municipalities** to State capitals, and these to Mexico City.
- Aimed to reinforce political and administrative centralization.

Third Stage post-1980

- Connected **municipalities** to **State capitals**, and these to **Mexico City**.
- Aimed to reinforce **political and administrative centralization**.

Mexican Highway Network, 1930-2010

The Mexican Highway Network, 1930-2010



Notes: The maps display the decadal evolution of the highway network – depicted with thick lines–. The gray lines depict the

Research questions

- Do major infrastructure projects contribute to economic disparities between connected and non-connected areas?
- Did the highways facilitate industrial growth and urbanization in certain regions?
- What role did infrastructure play in shaping regional economic disparities?

- Population Censuses 1930-2010 (INEGI).
- Road Network System 2015 (Sistema Nacional de Caminos, SNC) (SCT, 2015).
- Georeferenced measures of multi- modal transport infrastructure at the municipality level (e.g., length, and distances).
- Historical maps and archival records from the Private Collections of the SCT, the National Historical
- INEGI's cartography system.
- 1,700 municipalities for the year 1930-2010 (constant units of 1930).

Specification

The analysis employs a difference-in-differences (DiD) specification to assess the impact of highway connectivity:

$$Y_{it} = \delta_i + \delta_t + \beta_1 \cdot \text{ConnectFW}_{it} + \text{Post}_t + \beta_2 \cdot (\text{ConnectFW}_{it} \times \text{Post}_t) + X'\theta + \epsilon_{it}(1)$$

Variable definitions:

- (*ManuEmplymnt*): Logarithm of manufacturing employment.
- (*pop*): Logarithm of population size.
- (*pgr*): Logarithm of the annual population growth rate.
- *ConnectFW_{it}*: Dummy variable equal to 1 if the municipality's capital had access to the highway network within 10 kilometers, and 0 otherwise from 1925 to 1950.
- *Post_t*: Dummy variable equal to 1 for the years between 1960 and 1980, and 0 otherwise.

Results (OLS)

Table 1: Effect of the First Wave. OLS Estimates

Variables	Employment	Population	Population growth rate
	(1)	(2)	(3)
ConnectFW*Post50	0.269*** (0.064)	0.224*** (0.030)	0.006** (0.002)
Observations	10,200	10,200	10,200
R-squared	0.339	0.602	0.027
Number of mun	1,700	1,700	1,700
Initial conditions	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Notes: Standard errors are clustered at the municipality level and presented in parentheses. Significance levels *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The results include a constant and year interactions with the log version of the following variables: inverse distance to coast, the northern border, and Mexico City, and a dummy variable that shows access to railroads within 10 kilometers. ConnectFW is a dummy that takes the value of 1 when the municipalities are connected in the first wave, 1925-1950. The sample includes the years 1930-1980.

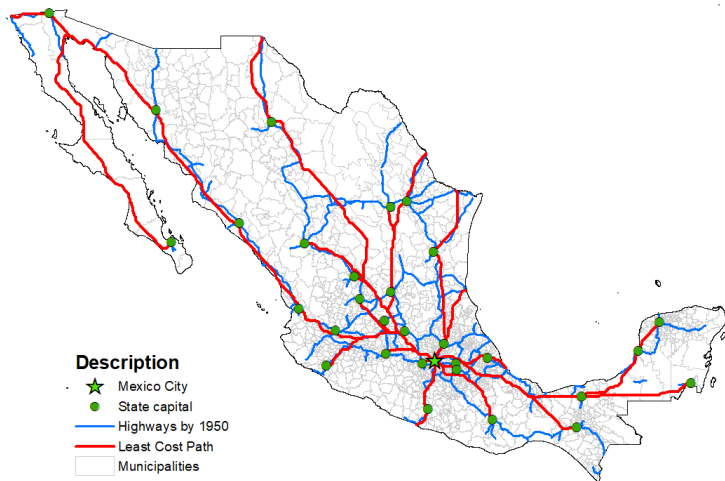
Differences

Table 2: Differences Between Municipalities with Access to Highways in 1930

Variables	With (1)	Without (2)	Diff (1)-(2) (3)	P-score (4)
Panel A. Pre-highways era, 1921-1925				
Total population 1921	14.46	7.71	6.75	0.000
Population density 1921	28.10	21.43	6.67	0.000
Population growth rate 1921-1930	0.92	0.68	0.24	0.172
Market access 1921	1.15	0.73	0.42	0.000
Panel B. Municipalities with highways & railroads, 1930				
Total population	16.5	12.3	4.21	0.399
Population density	69.3	35.2	34.13	0.001
Share of employment				
Agriculture	82.2	87.2	-4.98	0.000
Manufacturing	13.1	8.1	4.99	0.000
Market access	16.5	1.4	15.11	0.034
Panel C. Municipalities with highways & without railroads				
Total population	9.8	6.1	3.67	0.000
Population density	28.9	20.9	8.07	0.000
<i>Share of employment</i>				
Agriculture	90.78	91.82	-1.04	0.169
Manufacturing	7.06	5.75	1.31	0.032
Market access	1.1	1.0	0.11	0.013

It is considered that a municipality has highways whenever the capital of the municipality has access to a highway within 10 kilometers or less, similarly, for railroads. Market access is an index calculated with the following formula: $MA = \frac{\text{Urban Population}}{\text{Distance}}$.

Figure 1: Highway Network by 1950 and Cost-Minimizing Route



Results (IV)

Table 3: Effect of the First Wave. IV Estimates

Variables	Employment (1)	Population (2)	Population growth rate (3)
Panel A. First Stage			
<i>Least Cost Path</i>	0.080*** (0.013)	0.080*** (0.013)	0.106*** (0.018)
Panel B. Second Stage			
ConnectFW*Post50	2.665*** (0.923)	1.981*** (0.512)	0.026 (0.035)
Observations	10,200	10,200	10,200
R-squared	0.2298	0.3923	0.021
F-statistic FS	6792.42	6520.78	4623.25
Number of mun	1,700	1,700	1,700
Initial conditions	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Notes: Standard errors are clustered at the municipality level and presented in parentheses. Significance levels *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Displacement effect

Table 4: Displacement Effect (IV Estimates)

Variables	Baseline (1)	10-20 km (2)	20-30 km (3)	30-40 km (4)	40-50 km (5)	More than 50 km (6)
Panel A. Employment						
ConnectFW*Post50	2.681*** (0.928)	0.039 (0.048)	-0.103* (0.059)	-0.218*** (0.069)	-0.202** (0.086)	0.046 (0.061)
Panel B. Population						
ConnectFW*Post50	2.003*** (0.515)	0.000 (0.022)	-0.049* (0.026)	-0.079*** (0.029)	-0.047 (0.042)	0.021 (0.031)
Panel C. Population growth rate						
ConnectFW*Post50	0.025 (0.035)	0.001 (0.002)	-0.004 (0.003)	-0.002 (0.003)	-0.008 (0.005)	0.006** (0.003)
Initial conditions	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors are clustered at the municipality level and presented in parentheses. Significance levels *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Conclusions

Impact on Industry and Population

- Early highway connections boosted industry and population growth, especially after 1950
- Road access spurred economic activity, migration, and urbanization, benefiting connected regions.

Long-Term Consequences

- Highways strengthened national integration but also widened regional inequalities.
- Early connectivity shaped economic and demographic patterns for decades.