The Conquest of the Desert: Land Investment in Egypt

Antoine Castet

AgroParisTech - CIRED

12 December 2025

Context

- Almost the entire Egyptian population (95%) lives along the Nile. Nearly half is concentrated in the Delta, which represents only 3% of the territory.
- This unequal distribution is explained by geography: Egypt is a vast desert crossed only by the Nile.
- Historically, the Egyptian population concentrated in the areas most suitable for agriculture, along the Nile's waters, and remains today confined to a limited geographical space.

Context

- In this context, Egypt faces a major challenge: its demography. Between the 1950s and 2010, the population quintupled, from 20 to 106 million inhabitants.
- This rapid growth raises two essential issues: feeding and housing an ever-growing population on a limited territory.
- Egypt has relied, and continues to rely, on agricultural imports but has for several decades sought to limit its international dependence.
- The desert, representing nearly 95% of the territory, is largely unused and thus considered a potential "miracle solution" capable of stimulating agricultural production, reducing congestion in the Delta heart, and creating new employment opportunities.

Context

- 1958: Nasser launches a development project for desert areas, the Tahrir Province.
- 1967: Failure and end of the project. Consolidation of Delta agriculture instead of desert expansion.
- 1971: Aswan dam commissioned. Increase in agricultural productivity.
- 1981: Law No. 143, appropriation of desert lands by the state. Mubarak comes to power. Land allocated to farmers.
- 1987: Strong intensification of land distribution, especially to graduates.
- 2021: Launch of the "New Nile Delta" project by Sisi.

Context

- Major public investments in irrigation infrastructure (canals and pumping) to support agricultural expansion.
- The government encouraged the installation of large conglomerates, fostering mechanized large-scale farms, especially under pivot irrigation.
- These large mechanized farms coexist with traditional small family farms. This duality is one of the key features of the new agricultural zones.

Research Question

What are the consequences of Egypt's agricultural expansion policy on the economic development of its districts?

- Quantify agricultural expansion in the desert.
- Study the consequences for structural transformation.
- Study the consequences for employment and demographics.

Map of 1950.

Literature Review

- Classical models link economic development to structural transformation (Kuznets, 1957; Lewis, 1954).
  - Rising agricultural productivity is a key driver (Kuznets, 1957; Nurkse, 1953; Rostow, 1960).
  - It raises rural incomes and stimulates demand for manufactured goods and services (Gollin et al., 2002; Vogel, 1994).
  - It reduces agricultural labor demand and frees up workers for other sectors (Gollin et al., 2002; Lewis, 1954; Schultz, 1953).
  - Matsuyama (1992) warns that higher agricultural productivity may lead to specialization in a low–value added sector, slowing economic development.

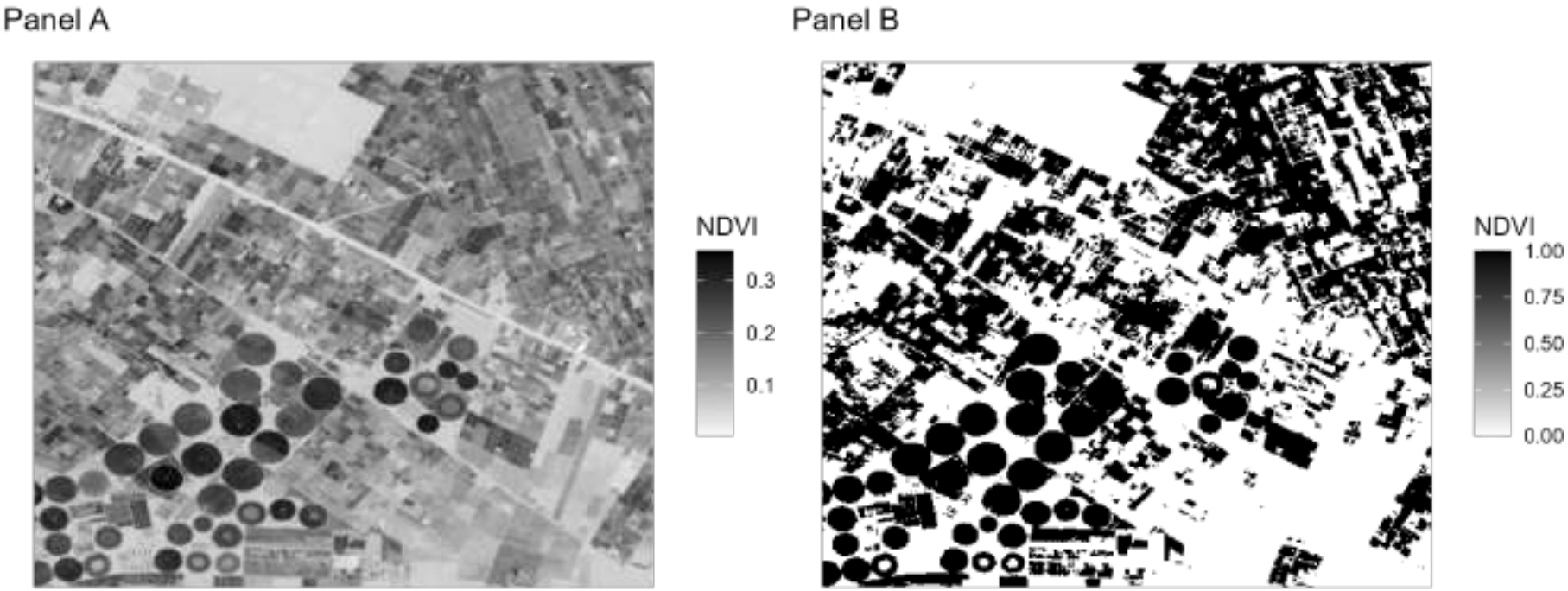
Literature Review

- A more recent literature investigates within-country structural transformation, studying regional disparities at the national scale.
  - Adoption of GM crops increases agricultural productivity, enabling reallocation of agricultural workers and reducing the agricultural employment share (Bustos et al., 2016).
  - The development of irrigation systems in India increases agricultural productivity but does not affect structural transformation (Asher et al., 2022; Blakeslee et al., 2023; Boudot-Reddy and Butler, 2024).
  - Areas highly suitable for coffee cultivation specialized in agriculture, which hindered the development of manufacturing (Uribe-Castro, working paper).

Literature Review

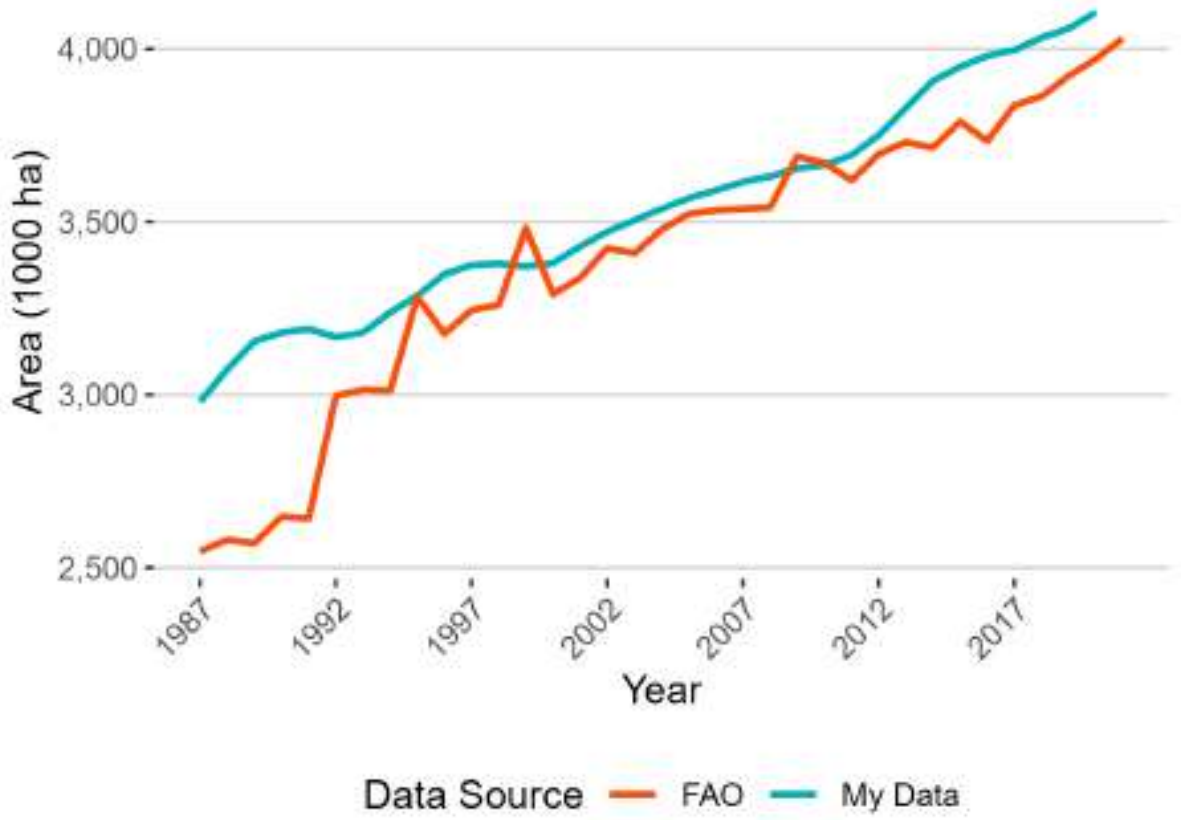
- No consensus on the effect of increased agricultural productivity on structural transformation. Key distinction:
  - Labor-saving productivity: increase achieved through technologies reducing labor needs (e.g., tractors). $\rightarrow$ Frees labor for non-agricultural sectors and accelerates structural transformation.
  - Land-augmenting productivity: increase relying on intensified land use (e.g., irrigation). $\rightarrow$ Raises agricultural labor demand and slows structural transformation.
- Ambiguous effect in Egypt: combination of mechanization (labor-saving) and irrigation (land-augmenting) in the same areas.

Agricultural Remote Sensing Data



Example of NDVI measurement using LandSat satellites (1987–2020)

Agricultural Remote Sensing Data

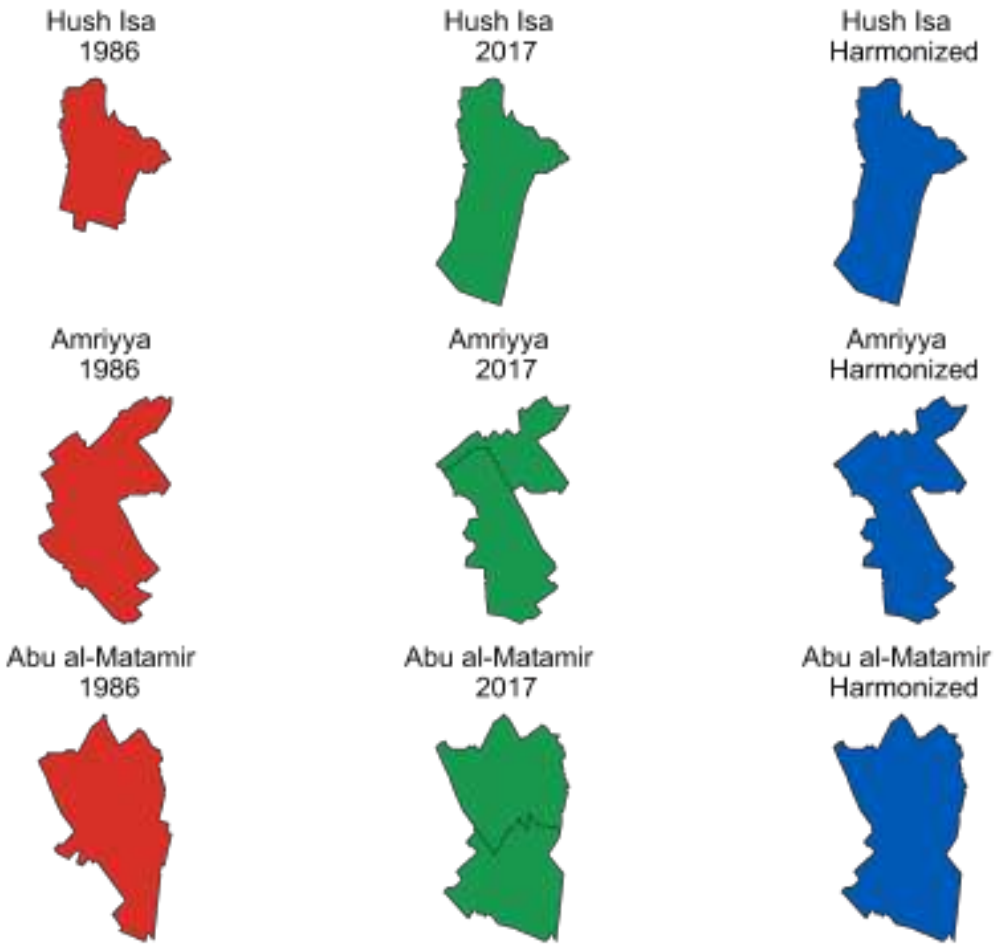


Validation of agricultural remote sensing with FAO data.

Egyptian Census Data

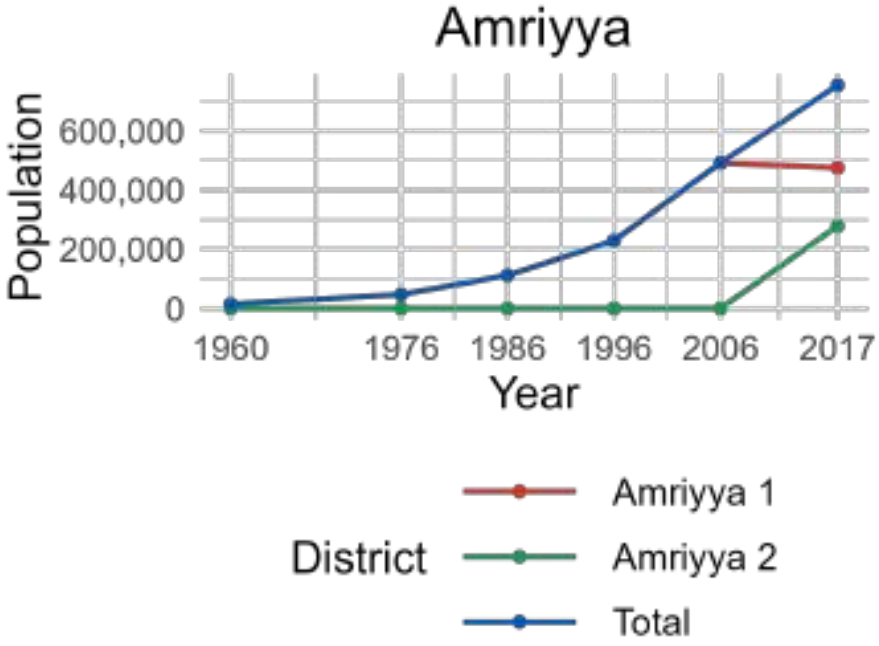
- Censuses conducted every ten years (1960, 1976, 1986, 1996, 2006, 2017). Data available only at the district level. First study to use them.
- Variables: total population, share of men, age structure (0–20, 20–60), illiteracy rate, employment rate, and employment shares in agriculture, industry, and services.
- Nine districts excluded due to data discontinuities.
- Boundary changes and creation of new districts require data harmonization. Desert expansion requires harmonization with 2017 administrative boundaries.

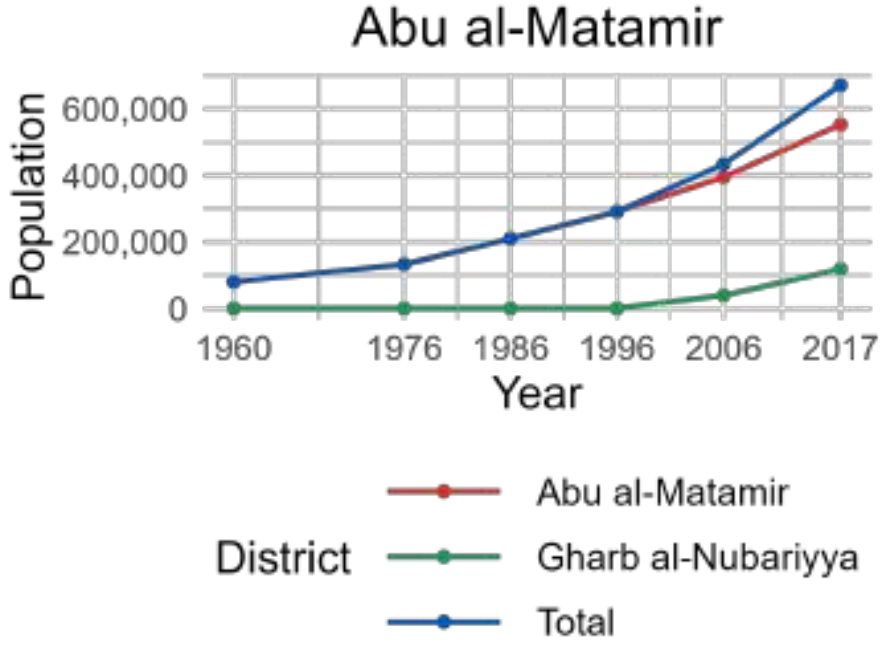
Egyptian Census Data

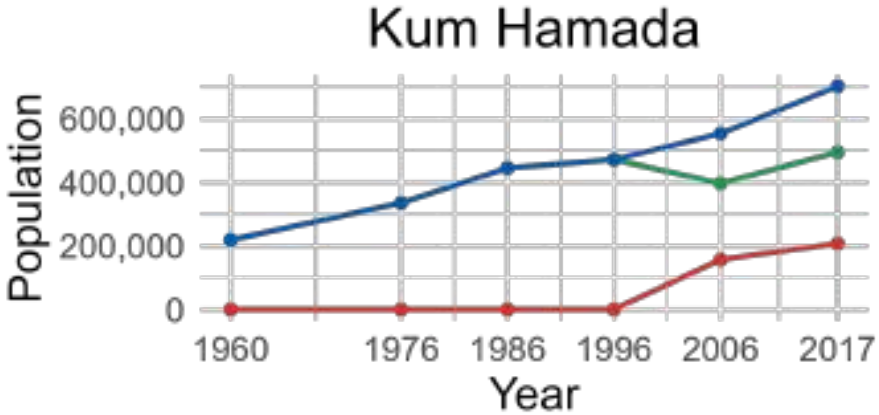


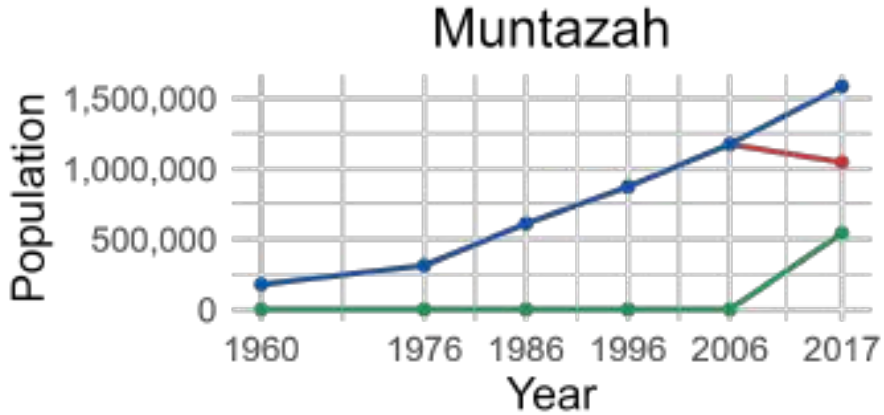
District harmonization process

Egyptian Census Data









Empirical Strategy

- **Objective:** compare the evolution of sectoral employment shares between districts that were able to expand their agricultural land and those that could not, before and after agricultural expansion.
- Before 1981 and Law No. 143, districts bordering the desert had no reason to follow a different trajectory from the Delta heart. The only difference was access to historically unusable lands.
- After 1981, districts bordering the desert had the possibility to expand their territory and increase agricultural production.

Empirical Strategy

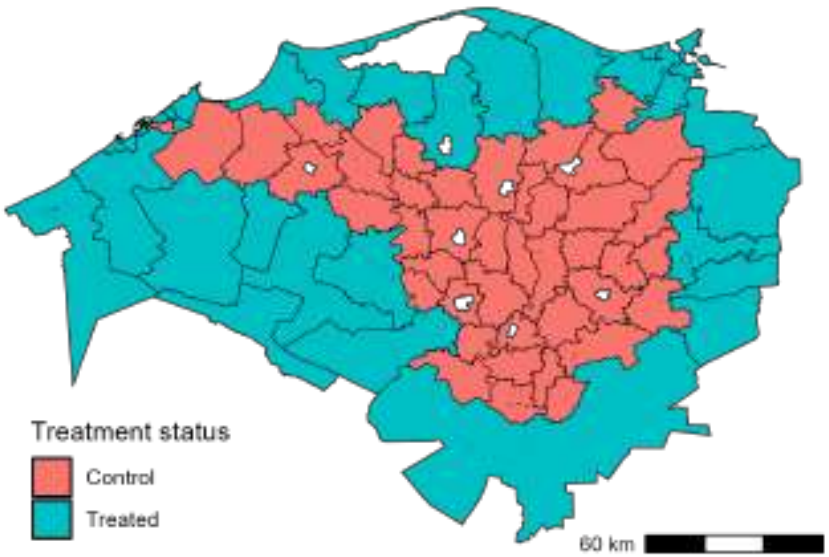
Formally, I estimate a difference-in-differences model:

$$Y_{i,t} = \alpha + \beta\,(\text{Treatment}_i \times \text{Law}_t) + \delta X_{i,t} + \mu_i + \eta_t + \varepsilon_{i,t} \qquad (1)$$

- $Y_{i,t}$: share of employment in agriculture, industry, or services in district i at time t.
- Treatment_i: equals 1 if district i borders the desert, 0 otherwise.
- Law_t: equals 0 before the 1981 law, 1 after.
- $X_{i,t}$: district-level controls at time t: population, share of men, shares aged 0–20 and 20–60, illiteracy rate.
- μ_i: district fixed effects.
- η_t: year fixed effects.

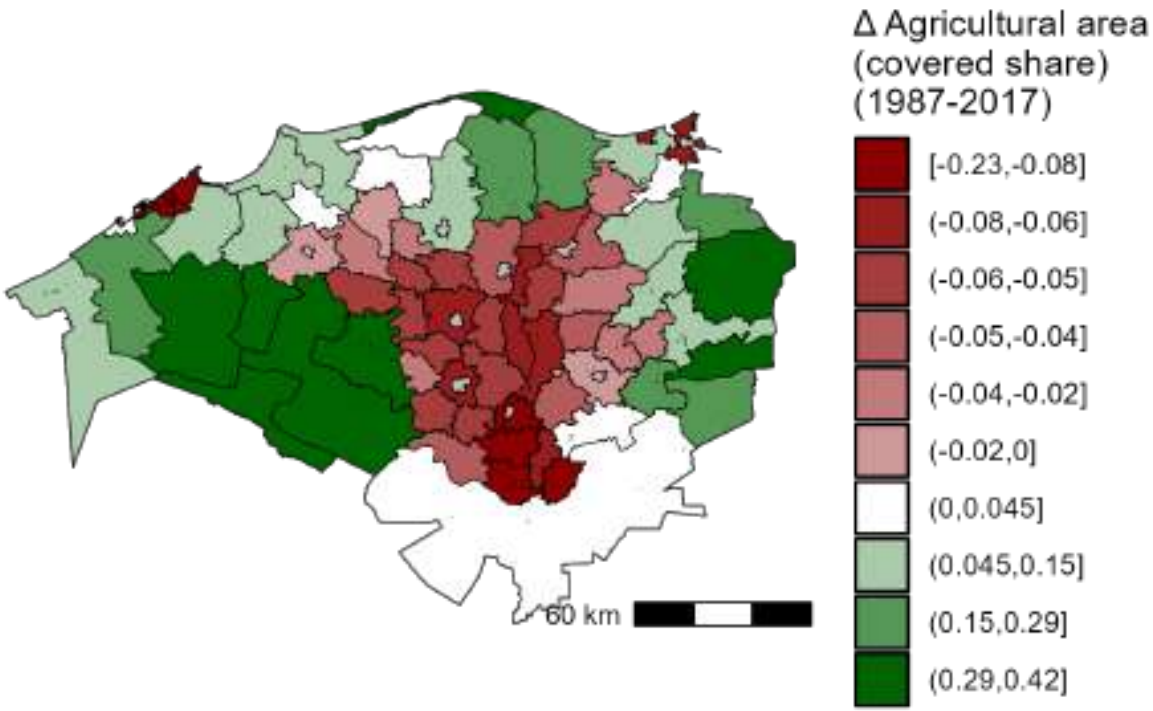
Empirical Strategy

Treated districts are those in contact with the desert and able to increase their agricultural land.

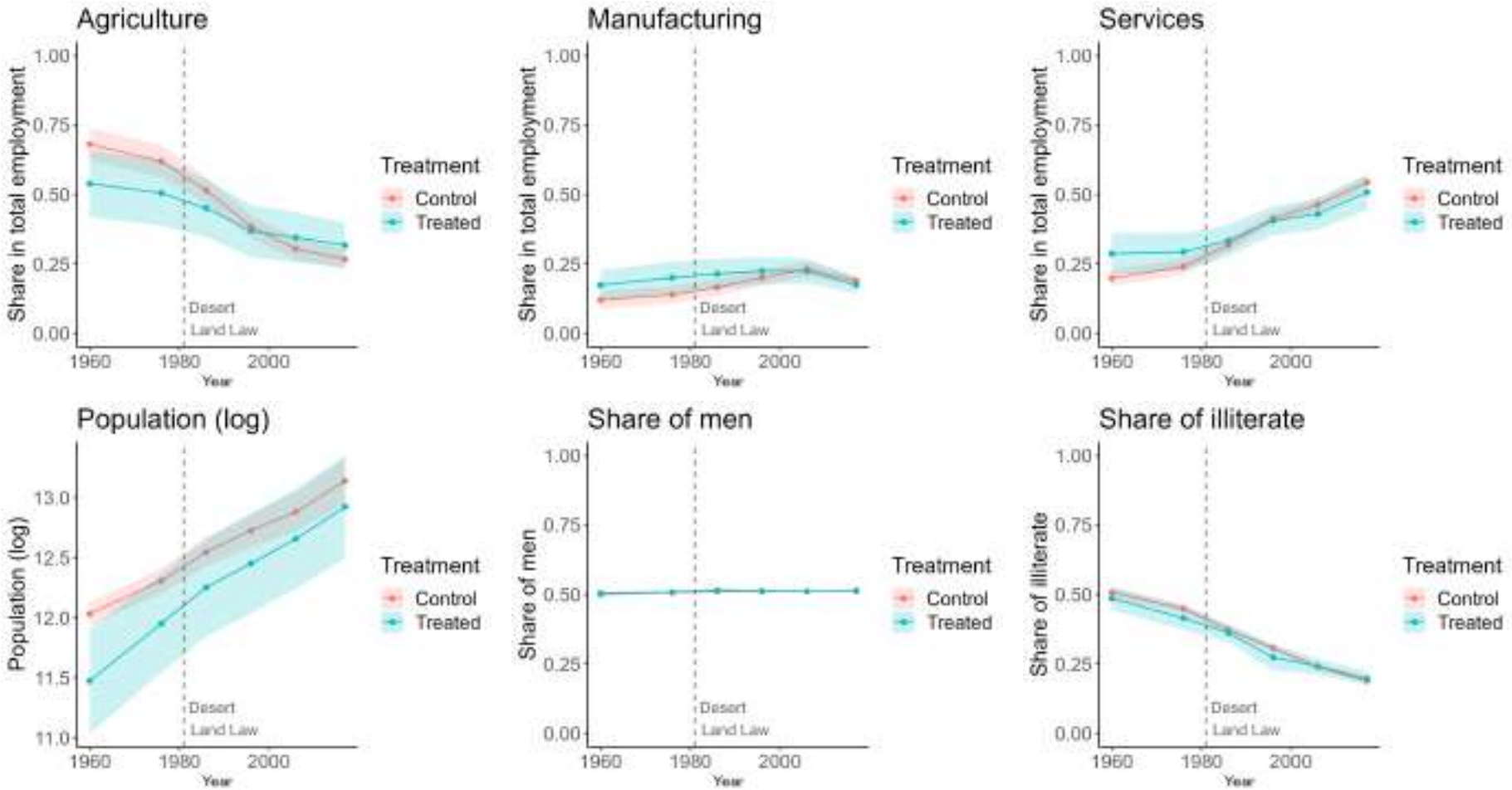


Empirical Strategy

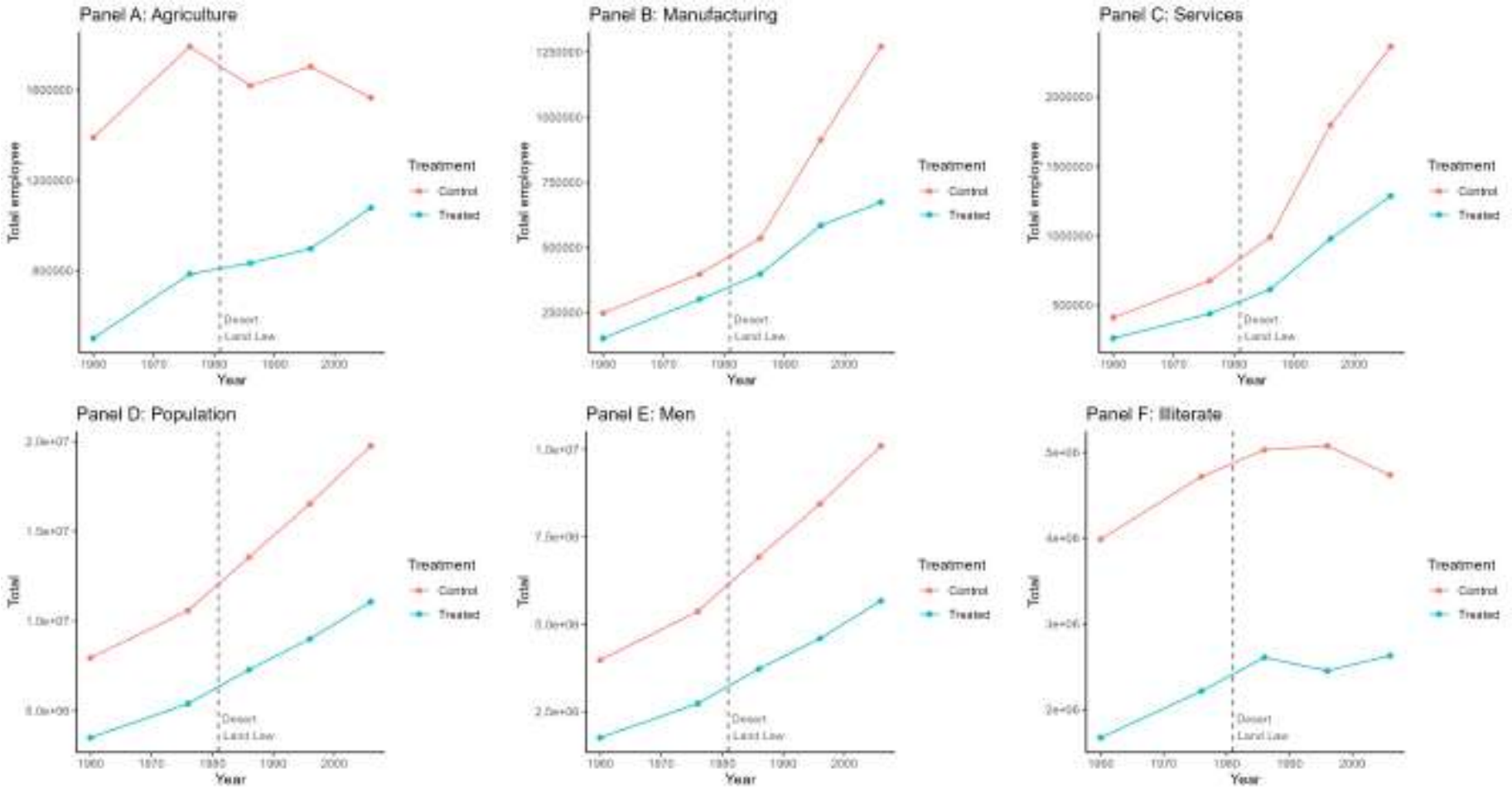
Bordering districts indeed expanded their agricultural area (measured with NDVI), while those in the Delta heart experienced urbanization.



Parallel Trends



Parallel Trends

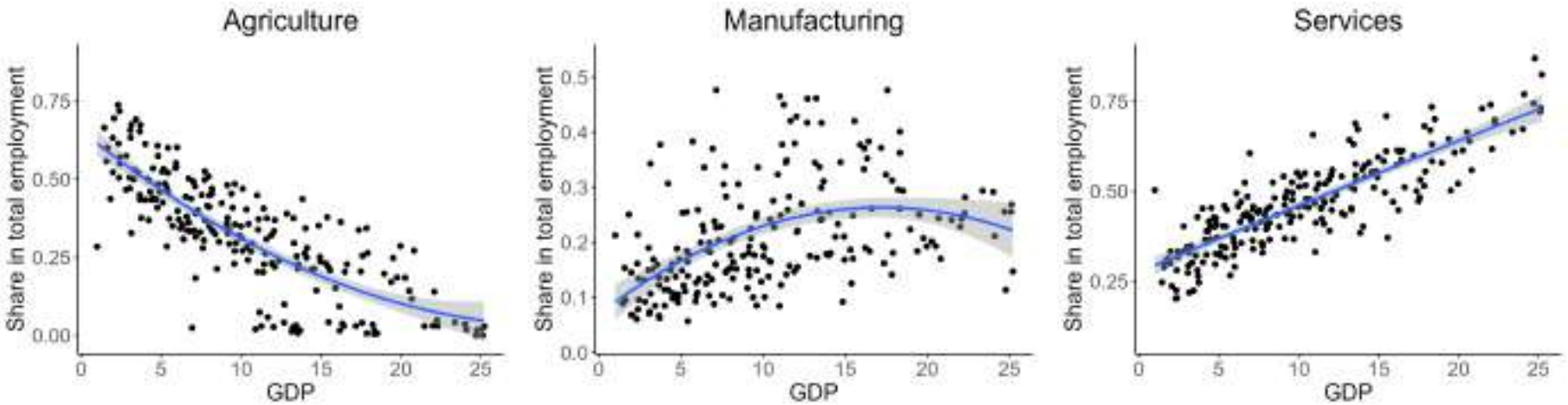


Descriptive Statistics

	Before			After		
Variables	Control	Treated	P-value	Control	Treated	P-value
	(N=90)	(N=62)		(N=180)	(N=124)	
Agriculture						
Mean (SD)	0.650 (0.195)	0.522 (0.322)	0.006	0.368 (0.166)	0.371 (0.252)	0.911
Median (Min, Max)	0.70 (0.01, 0.89)	0.66 (0.00, 0.86)		0.37 (0.00, 0.79)	0.44 (0.00, 0.82)	
Manufacturing						
Mean (SD)	0.130 (0.104)	0.187 (0.152)	0.011	0.197 (0.089)	0.210 (0.124)	0.337
Median (Min, Max)	0.09 (0.03, 0.50)	0.13 (0.02, 0.53)		0.18 (0.06, 0.48)	0.17 (0.03, 0.48)	
Services						
Mean (SD)	0.220 (0.099)	0.290 (0.192)	0.009	0.435 (0.114)	0.420 (0.166)	0.372
Median (Min, Max)	0.20 (0.09, 0.58)	0.23 (0.10, 0.75)		0.44 (0.14, 0.74)	0.37 (0.14, 0.87)	
Population (log)						
Mean (SD)	12.172 (0.361)	11.714 (1.170)	0.004	12.824 (0.551)	12.572 (1.148)	0.024
Median (Min, Max)	12.18 (11.24, 12.96)	11.86 (8.51, 15.72)		12.85 (10.51, 14.46)	12.68 (9.81, 16.68)	
Male						
Mean (SD)	0.504 (0.008)	0.507 (0.010)	0.074	0.511 (0.005)	0.513 (0.012)	0.044
Median (Min, Max)	0.50 (0.49, 0.54)	0.51 (0.49, 0.54)		0.51 (0.50, 0.53)	0.51 (0.49, 0.61)	
0-20 years old						
Mean (SD)	0.521 (0.020)	0.522 (0.049)	0.809	0.463 (0.051)	0.452 (0.072)	0.147
Median (Min, Max)	0.52 (0.46, 0.55)	0.53 (0.26, 0.57)		0.46 (0.30, 0.55)	0.46 (0.27, 0.57)	
20-60 years old						
Mean (SD)	0.417 (0.015)	0.416 (0.040)	0.985	0.471 (0.044)	0.483 (0.051)	0.03
Median (Min, Max)	0.41 (0.39, 0.48)	0.41 (0.22, 0.50)		0.48 (0.34, 0.58)	0.49 (0.39, 0.60)	
Illiterate						
Mean (SD)	0.479 (0.062)	0.451 (0.119)	0.093	0.277 (0.079)	0.269 (0.110)	0.468
Median (Min, Max)	0.48 (0.27, 0.60)	0.47 (0.16, 0.62)		0.26 (0.12, 0.47)	0.26 (0.00, 0.48)	

Descriptive Statistics

Using district-level data, I can highlight, within a single country, the correlation between development level and the share of employment in agriculture.



Main Results

Table 3: The effects of agricultural expansion on sectoral employment

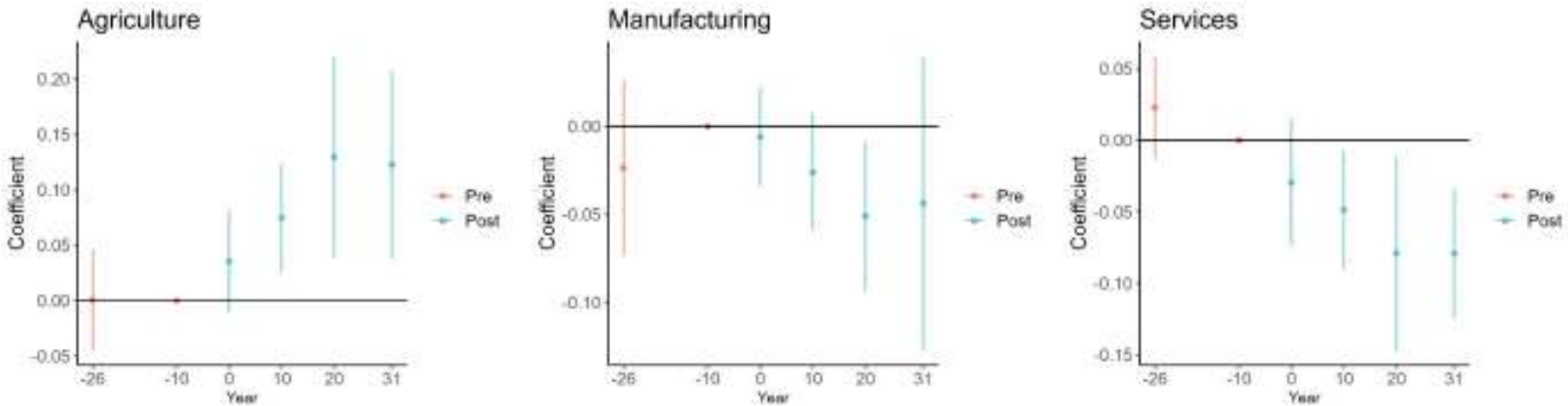
	Agriculture		Manufacturing		Services	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment X Law	0.131***	0.113***	-0.045***	-0.041***	-0.086***	-0.072***
	(0.025)	(0.014)	(0.015)	(0.011)	(0.014)	(0.010)
Num.Obs.	456	456	456	456	456	456
Controls	No	Yes	No	Yes	No	Yes

Note: The dependent variables correspond to the share of individuals in agriculture, manufacturing, and services sectors. All columns include year, and district fixed effects. The inclusion or not of control variables is indicated at the bottom of each estimate. Standard errors clustered at the district level are shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Main Results

The decline in the agricultural employment share is significantly less pronounced in peripheral districts than in the Delta heart.

- TWFE dynamics following Callaway and Sant'Anna (2021):



Main Results

Table 4: The effects of agricultural expansion on the number of employees by sector

	Number of employees (log)					
	Agriculture		Manufacturing		Services	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment X Law	0.410***	0.359***	-0.009	0.071	-0.010	0.068
	(0.077)	(0.093)	(0.151)	(0.117)	(0.129)	(0.084)
Num.Obs.	380	380	380	380	380	380
Controls	No	Yes	No	Yes	No	Yes

Note: The dependent variables correspond to the natural logarithm of the number of employees in Agriculture, Manufacturing, and Services. All columns include year, and district fixed effects. The inclusion or not of control variables is indicated at the bottom of each estimate. Standard errors clustered at the district level are shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Main Results

Table 5: The effects of agricultural expansion on population, and employment

	Population (log)		Employee (log)		Employment share	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment X Law	0.205*	0.285***	0.204*	0.264***	0.002	-0.004
	(0.117)	(0.089)	(0.117)	(0.091)	(0.005)	(0.004)
Num.Obs.	456	456	456	456	456	456
Controls	No	Yes	No	Yes	No	Yes

Note: The dependent variables correspond to the natural logarithm of the population, the natural logarithm of employee, and the share of employment. All columns include year, and district fixed effects. The inclusion or not of control variables is indicated at the bottom of each estimate. Standard errors clustered at the district level are shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Main Results

Table 6: The effects of agricultural expansion on sex ratio and age structure

	Share of men		Population share (0-20)		Population share (20-60)	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment X Law	0.000	0.001	-0.013	-0.011	0.012*	0.011*
	(0.002)	(0.002)	(0.009)	(0.008)	(0.006)	(0.006)
Num.Obs.	456	456	456	456	456	456
Controls	No	Yes	No	Yes	No	Yes

Note: The dependent variables correspond to the share of men in the population, the population share between 0 and 20 years old and the population share between 20 and 60 years old. All columns include year, and district fixed effects. The inclusion or not of control variables is indicated at the bottom of each estimate. Standard errors clustered at the district level are shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Conclusion

- The desert agricultural expansion policy aimed to increase production and create new development poles, expected to benefit bordering districts.
- These districts did expand their agricultural land, but their agricultural employment share declined more slowly than in the Delta heart. Structural transformation is therefore slowed, not accelerated.
- Future policies should aim for economic diversification and better territorial integration of peripheral districts.