Economic consequences of the 1933 Soviet famine

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Introduction

Krugman (1991):

- Fixed land, rural population is located in accordance with marginal productivity of land
- Multiple urbanization equilibria are possible due to mobility of urban capital and increasing returns
- Temporary shock to urban population or capital can have a persistent impact

Empirical question

Do multiple equilibria exist?

Literature 1/2

No persistent effects from temporary population and capital losses:

- Davis and Weinstein (2002), Davis and Weinstein (2008) – Japan, WW2
- Brakman et al. (2004), Bosker et al. (2007) – Germany, WW2
- Redding and Sturm (2008) – partition and reunification of Germany
- Miguel and Roland (2011) – Vietnam

Literature 2/2

Location characteristics affect long-term urban development:

- Nunn and Puga (2012) – terrain ruggedness in Africa
- Bleakley and Lin (2012) – portage sites in the U.S.
- Michaels and Rauch (2018) – Roman cities in contemporary England and France

Russia:

- Acemoglu et al. (2011) – holocaust changed social structure and therefore had a detrimental effect
- Mikhailova (2018) – some persistence due to evacuation, but economically small

This paper

- Studies 1933 famine consequences
- Rural population recovers
- Persistent negative impact on urbanization
- Not explained by differential natural increase
- Timing of the shock to population might be important: lack of labor during rapid construction of new cities

Outline

Background

Data

Empirical strategy

Results

- Province population
- Rural and urban economy
- Urban settlements
- Mechanism: natural population increase v. migration

Chronology

1917 Revolution

1928 Start of the first 5-year plan; Rapid industrialization and urbanization, especially after 1933

1933 Famine; Victims: 6 – 8 million

Before 1928: NEP

New Economic Policy:

- Private rural economy
- Private small-scale urban enterprises
- Large-scale industry under government control
- Unrestricted migration

Starting in 1928: 5-year plans

5-year plans for industrialization of the country:

- All industry and trade are nationalized
- Large-scale capital investment
- Collectivization of agriculture

Collectivization and the 1933 famine 1/2

Until 1933

- Land, livestock, and implements belong to the collectives
- Peasants work together on collective farms
- After the harvest, grain is put in kolkhoz storages
- The government takes its share
- Procurement is unpredictable as officials struggle to fulfill the plan
- The remainder is distributed among kolkhoz members
- Trading of foodstuffs is banned, food is rationed in the cities

As a result:

- Production drops, the government overprocures, famine in 1933

Collectivization and the 1933 famine 2/2

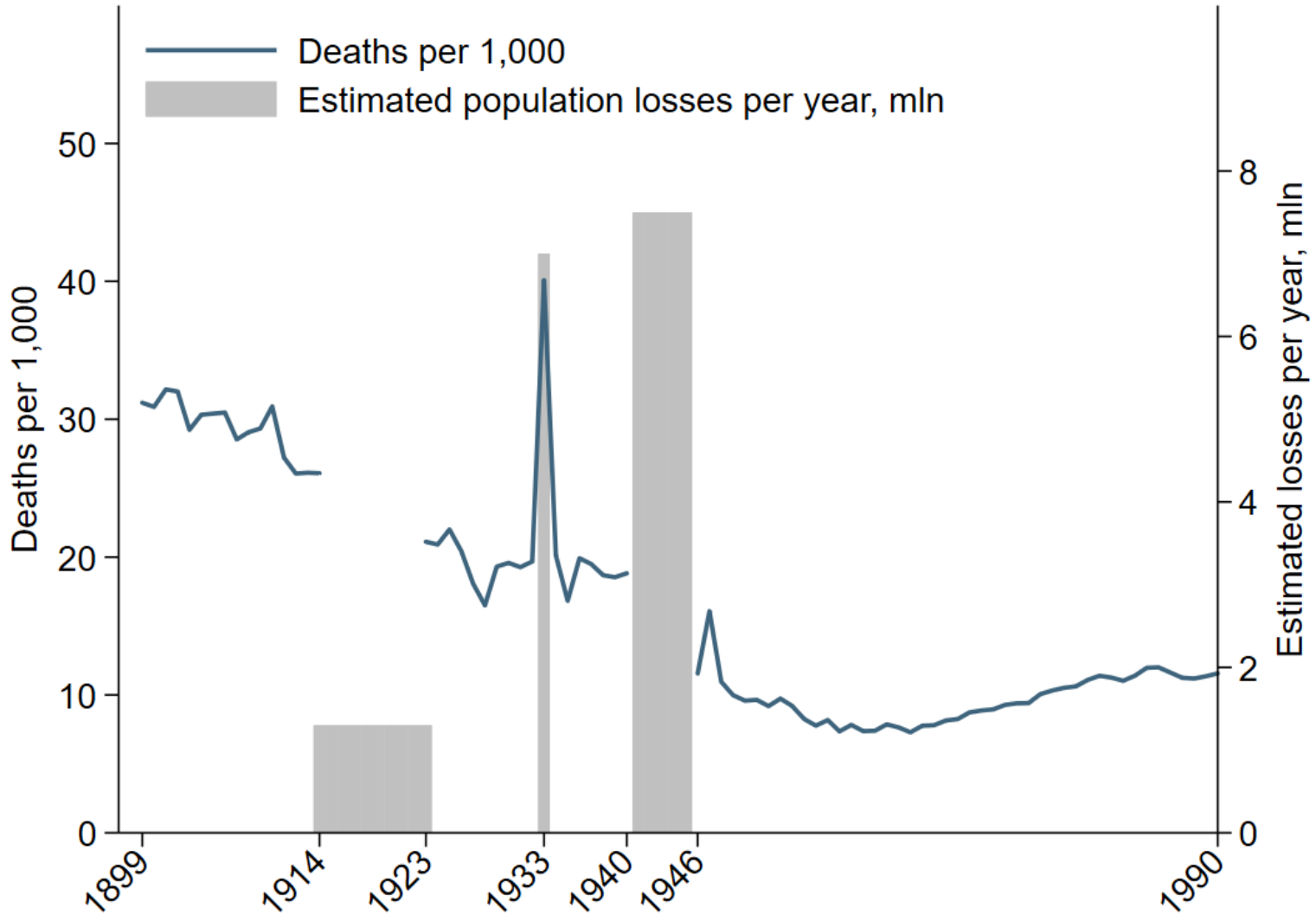
After 1933

- Procurement quotas are fixed in advance
- Kolkhoz members allowed to work small individual plots and to keep some livestock
- Peasants can trade food on kolkhoz markets with free prices

As a result

- Peasants are guaranteed subsistence

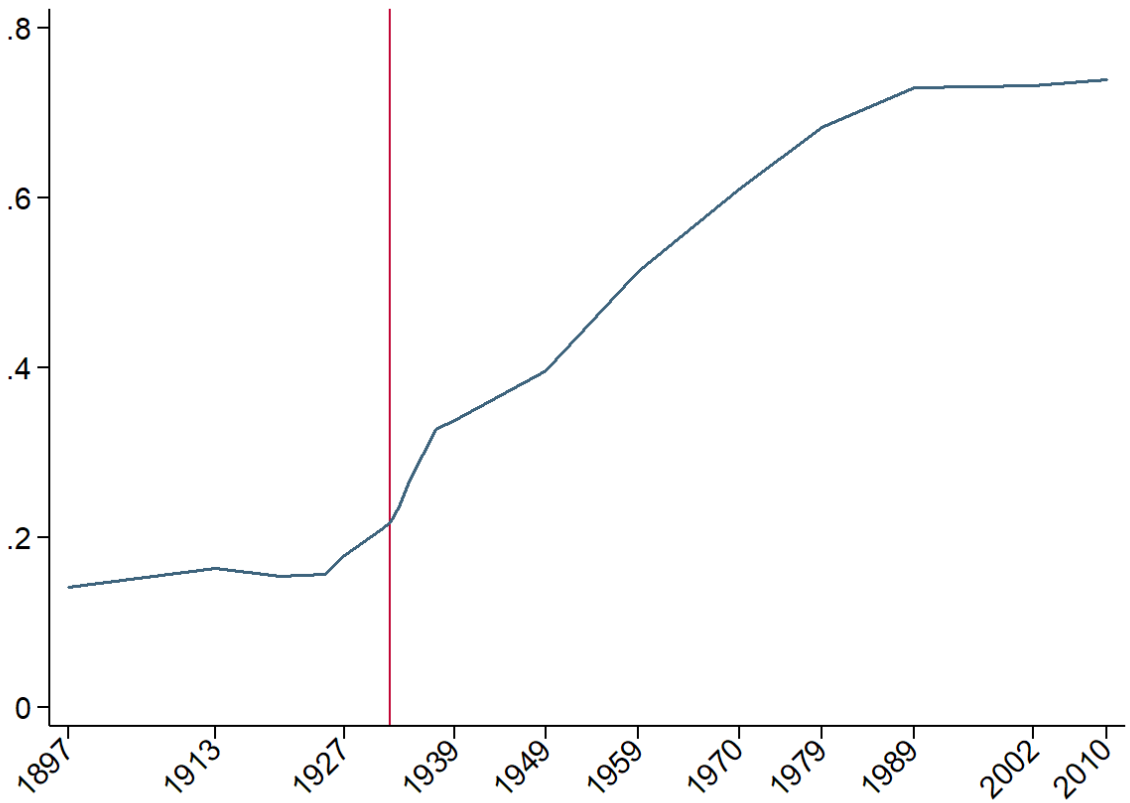
Mortality and population losses



Belarus, Russia, and Ukraine. Constant administrative borders. Territories added in 1939 are not included.

Rapid urbanization

- 1927 – 18%
- 1932 – 22%
- 1939 – 34%



Belarus, Russia, and Ukraine. Constant administrative borders. Territories added in 1939 are not included.

A note on passport system

- Was introduced in 1932
- Designed to remove 'undesirable elements' (criminals, refugees, 'class enemies') from important cities
- Under control of MVD, not NKVD
- MVD keeps decentralized catalogues, no evidence of exchange of information between cities
- Employed urban dwellers are eligible for a passport
- If a person is denied a passport, no mark is made in her documents

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Data 1/2

- Province-level population panel
  - 81 provinces (contemporary Belarus, Russia, Ukraine)
  - All censuses: 1897, 1926, 1939, 1959, 1970, 1979, 1989, 2002, 2010
  - 1913 from statistical yearbook
  - 1939 corrected for centralized additions
  - 1949, 1950 from the Russian State Archive of the Economy
- Urban settlement panel
  - 525 settlements
  - All census years
  - 1946, 1947, 1950 from the archives
  - Selected sample: only settlements that achieved "town" status by 1989
- Yearly mortality and natality data
  - 25 large administrative units

Data 2/2

- Famine severity:
  - Province-level 1933 excess mortality from the archives:

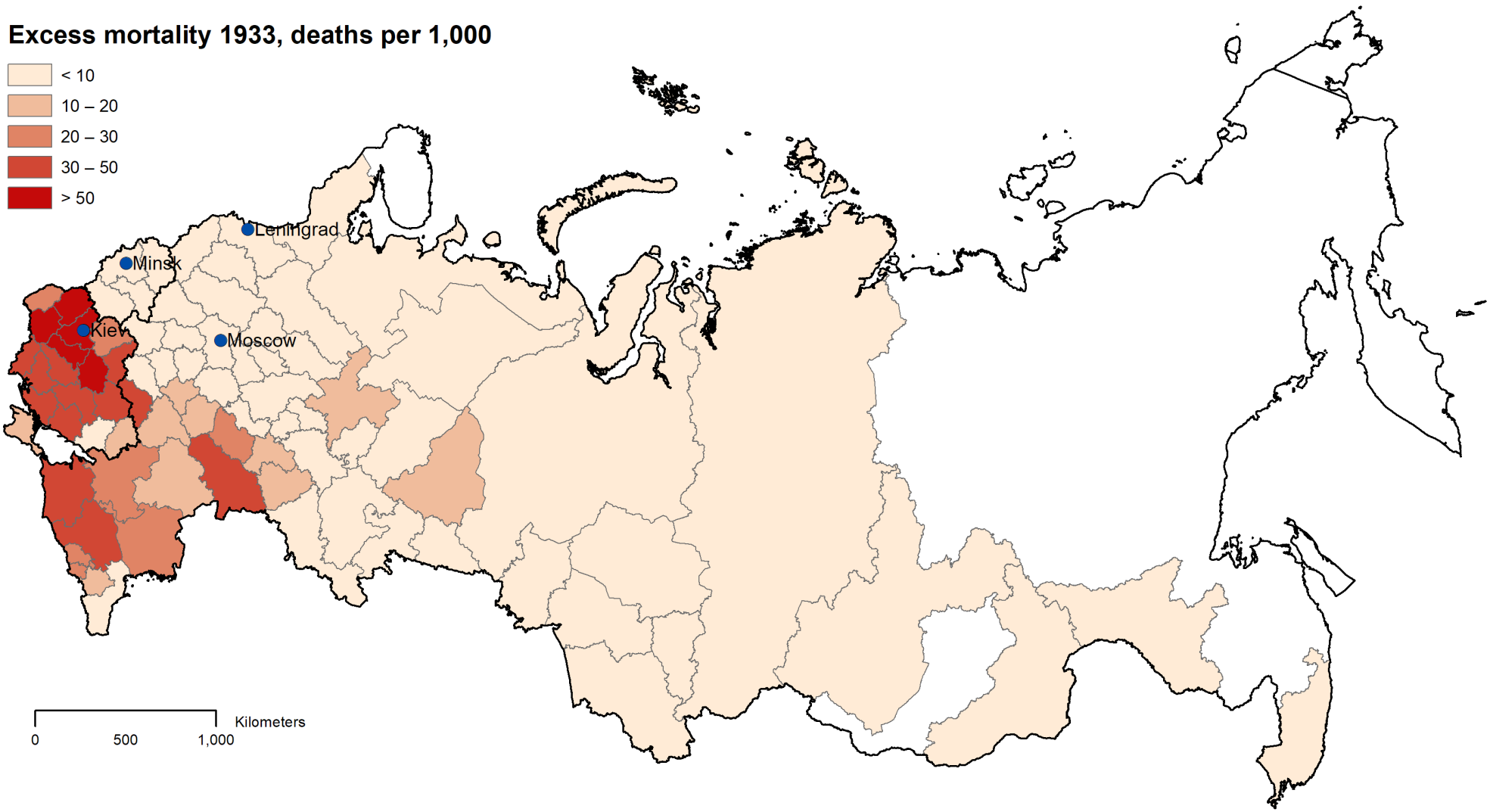
$$\text{1933 excess mortality} = \text{1933 mortaliy} - \frac{1}{4}(\text{1928 mortality} + \text{1937-1939 mortality})$$

  - 1933 mortality in 50 km radius around each urban settlement using district-level 1933 mortality

- WW2 losses:

$$\text{WW2 losses} = 1 - \frac{\text{actual population 1949}}{\text{projected population 1949}}$$

1933 excess mortality



▸ WW2 losses

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Empirical strategy

- OLS
  - Use cross-sectional variation in 1933 famine severity
- IV
  - Idea: weather $\rightarrow$ [harvest] $\rightarrow$ famine
  - Use 1932 weather

Demeaned 1932 weather and 1933 excess mortality

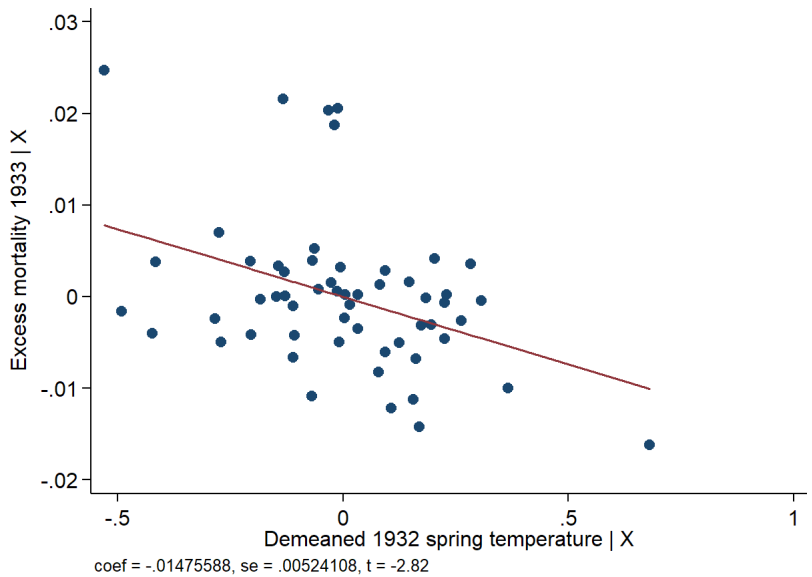
	Dependent variable: Excess mortality 1933													
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Fall														
temp	-0.009		-0.010										-0.001	
	(0.006)		(0.006)										(0.008)	
precip		0.000	0.000										0.001*	
		(0.000)	(0.000)										(0.000)	
Winter														
temp				-0.000		-0.000							0.000	
				(0.000)		(0.000)							(0.001)	
precip					0.000	0.000							0.000	
					(0.000)	(0.000)							(0.000)	
Spring														
temp							-0.015**		-0.017**				-0.018**	-0.016***
							(0.007)		(0.007)				(0.008)	(0.006)
precip								0.000	0.000*				0.000	
								(0.000)	(0.000)				(0.000)	
Summer														
temp										-0.005		-0.001	-0.001	
										(0.005)		(0.004)	(0.006)	
precip											0.001***	0.001***	0.001***	0.001***
											(0.000)	(0.000)	(0.000)	(0.000)
N	77	77	77	77	77	77	77	77	77	77	77	77	77	77
R^2	0.588	0.585	0.603	0.581	0.573	0.582	0.603	0.584	0.621	0.579	0.689	0.690	0.742	0.723

All regressions control for grain suitability, grain volatility, capital province indicator, WW2 losses, Nazi occupation indicator, Ln distance to Moscow, 1932 number of RR stations per km^2, republic FE, and region FE.
* $p < .10$, ** $p < .05$, *** $p < .01$

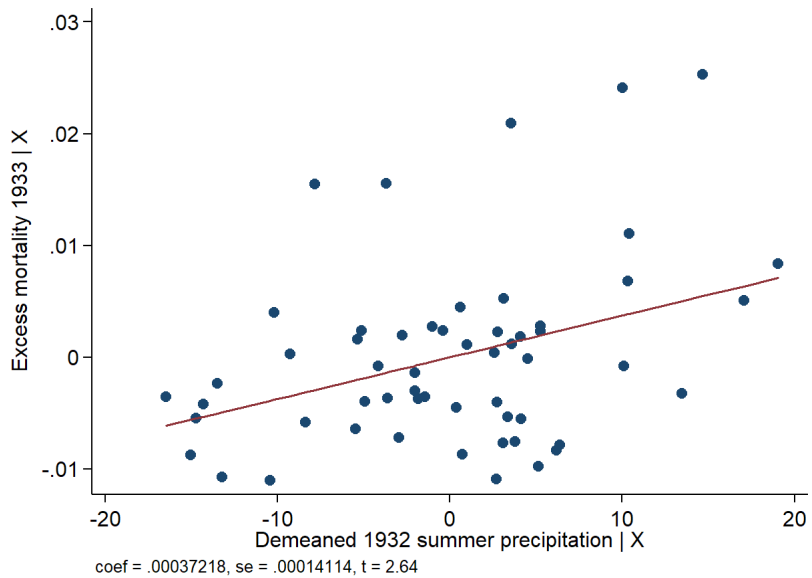
Col 14 scatter plots

[Two conditional scatter plots from the same regression]

(a) Demeaned spring 1932 temperature



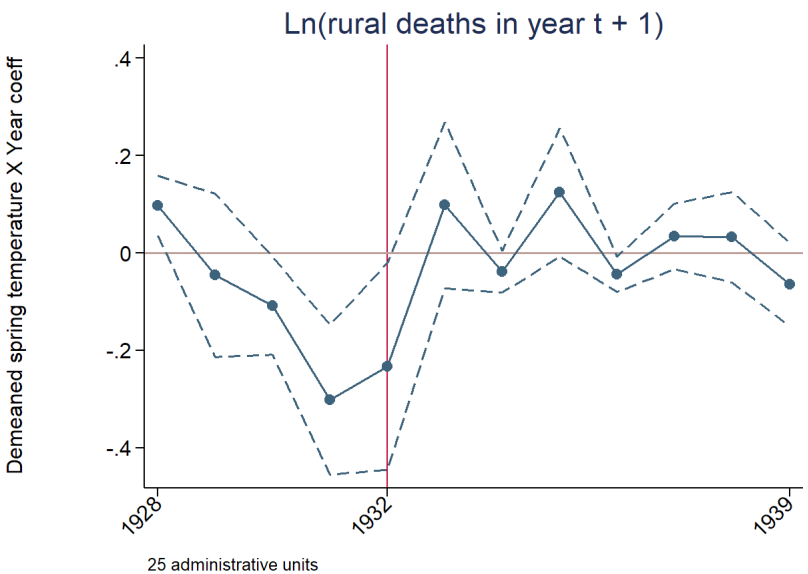
(b) Demeaned summer 1932 precipitation



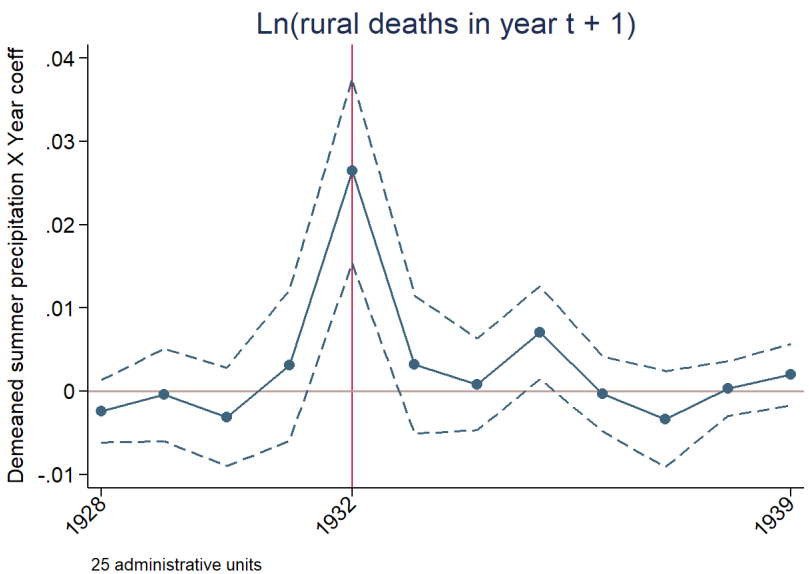
1932 weather did matter

[Two sets of coefficients from one regression]

(a) Demeaned spring temperature



(b) Demeaned summer precipitation



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Empirical specification (1)

$$y_{i,t} = \beta fam_i I_t^{post} + X'_{i,t}\gamma + \alpha_i + \delta_t + \epsilon_{i,t}$$

- i – province, t – year
- y_{it} – outcome of interest (*Ln population* etc)
- fam_i – excess 1933 mortality in province i
- I_t^{post} – post-famine indicator, $I_t^{post} = 1$ if $t > 1933$
- $X_{i,t}$ – province characteristics (grain suitability $\times$ Post-famine, grain volatility $\times$ Post-famine, capital province indicator $\times$ Post-famine, WW2 losses $\times$ Post-war, Nazi occupation indicator $\times$ Post-war, Ln distance to Moscow $\times$ Post-famine, 1932 number of RR stations per km^2 $\times$ Post-famine)
- α_i, δ_t – province and year FE

1933 famine and population

Panel A: Panel data estimation

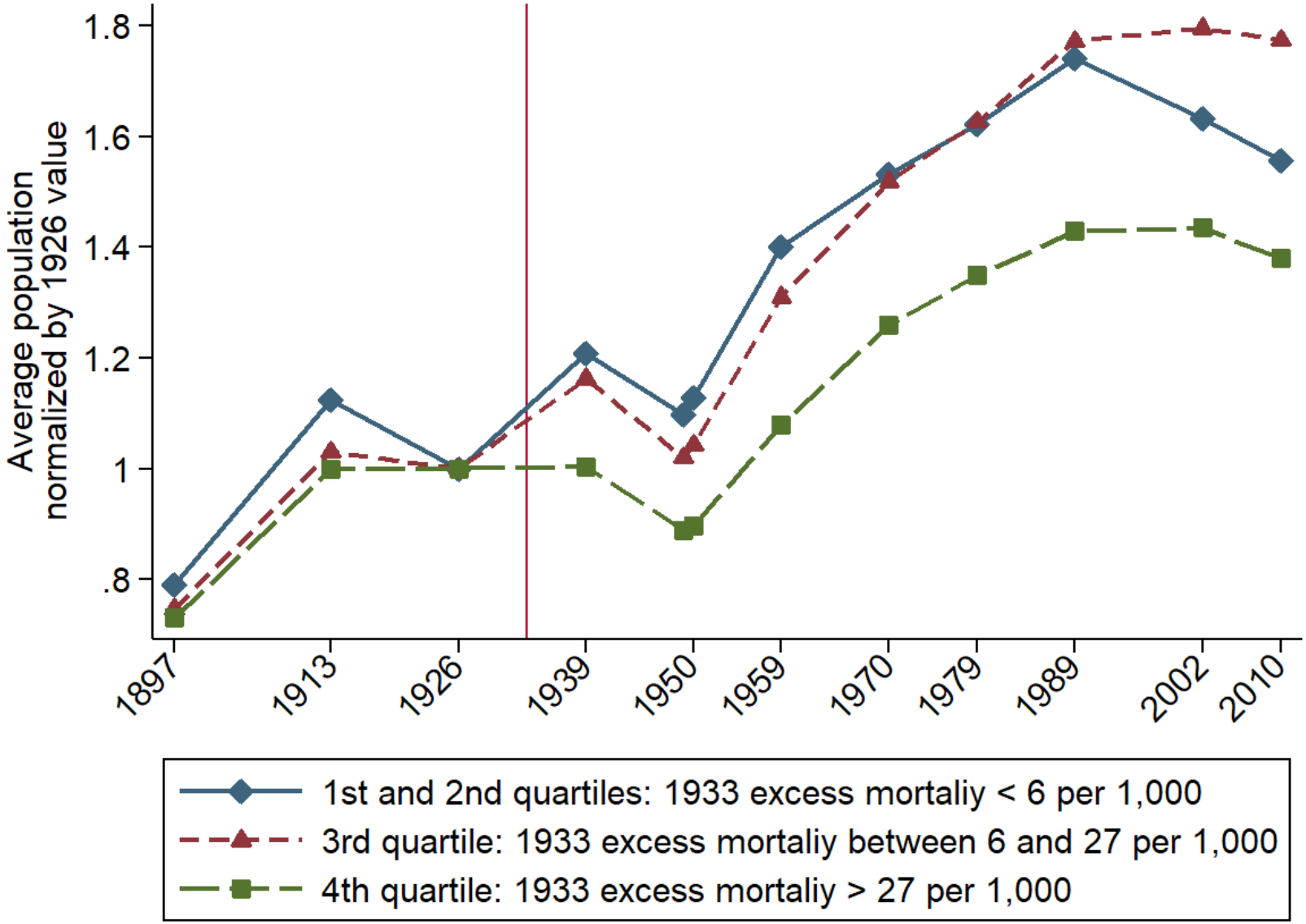
	Dependent variable:								
	Ln population			Ln rural population			Ln urban population		
Model:	OLS (1)	IV (2)	OLS (3)	OLS (4)	IV (5)	OLS (6)	OLS (7)	IV (8)	OLS (9)
Excess mortality 1933 × Post-famine	-8.687*** (1.863)	-8.588*** (3.215)		-1.819 (1.941)	-2.186 (3.371)		-10.069*** (2.770)	-10.206** (4.179)	
Excess mortality 1933 × 1939			-9.615*** (2.375)			-5.443** (2.701)			-10.383*** (3.671)
Excess mortality 1933 × Post-1949			-8.560*** (1.914)			-1.325 (1.983)			-10.027*** (2.762)
Ln rural population							✓	✓	✓
Observations	972	924	972	972	924	972	972	924	972
R^2	0.638	0.868	0.639	0.634	0.837	0.636	0.925	0.947	0.925
Provinces	81	77	81	81	77	81	81	77	81

Panel B: First stages of the corresponding 2SLS panel regressions

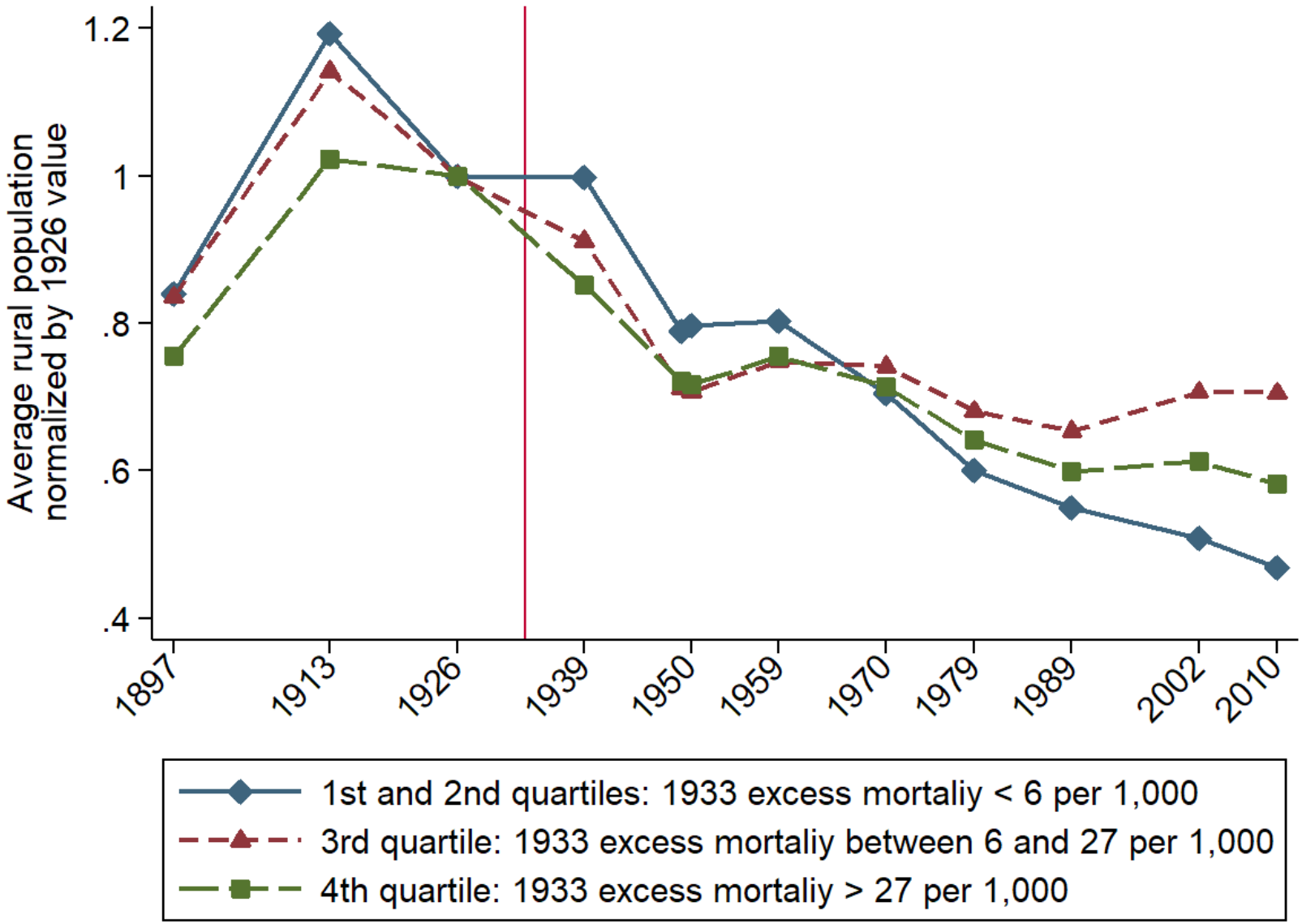
	Dependent variable: Excess mortality 1933 × Post-famine		
Demeaned spring 1932 temp × Post-famine	-0.012*** (0.004)	-0.012*** (0.004)	-0.012*** (0.004)
Demeaned summer 1932 precip × Post-famine	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
F	22.782	22.782	22.711

All regressions control for province and year FE, grain suitability × Post-famine, grain volatility × Post-famine, capital province indicator × Post-famine, WW2 losses × Post-war, Nazi occupation indicator × Post-war, Ln distance to Moscow × Post-famine, 1932 number of RR stations per km^2 × Post-famine, republic-year FE, and region-year FE.
Standard errors clustered at the province level separately before and after the famine.
* $p < .10$, ** $p < .05$, *** $p < .01$

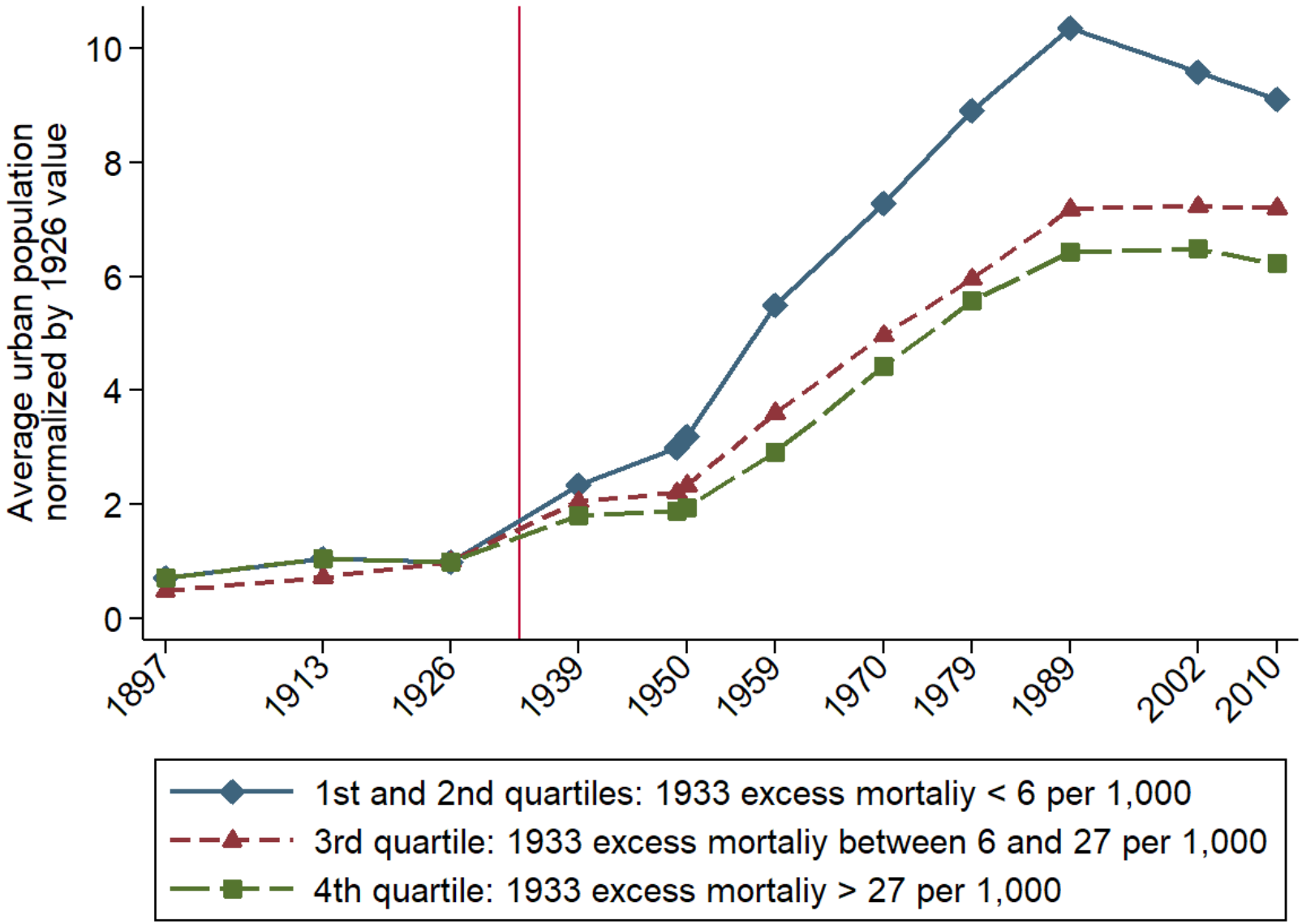
Population by quartiles of 1933 excess mortality



Rural population by quartiles of 1933 excess mortality



Urban population by quartiles of 1933 excess mortality

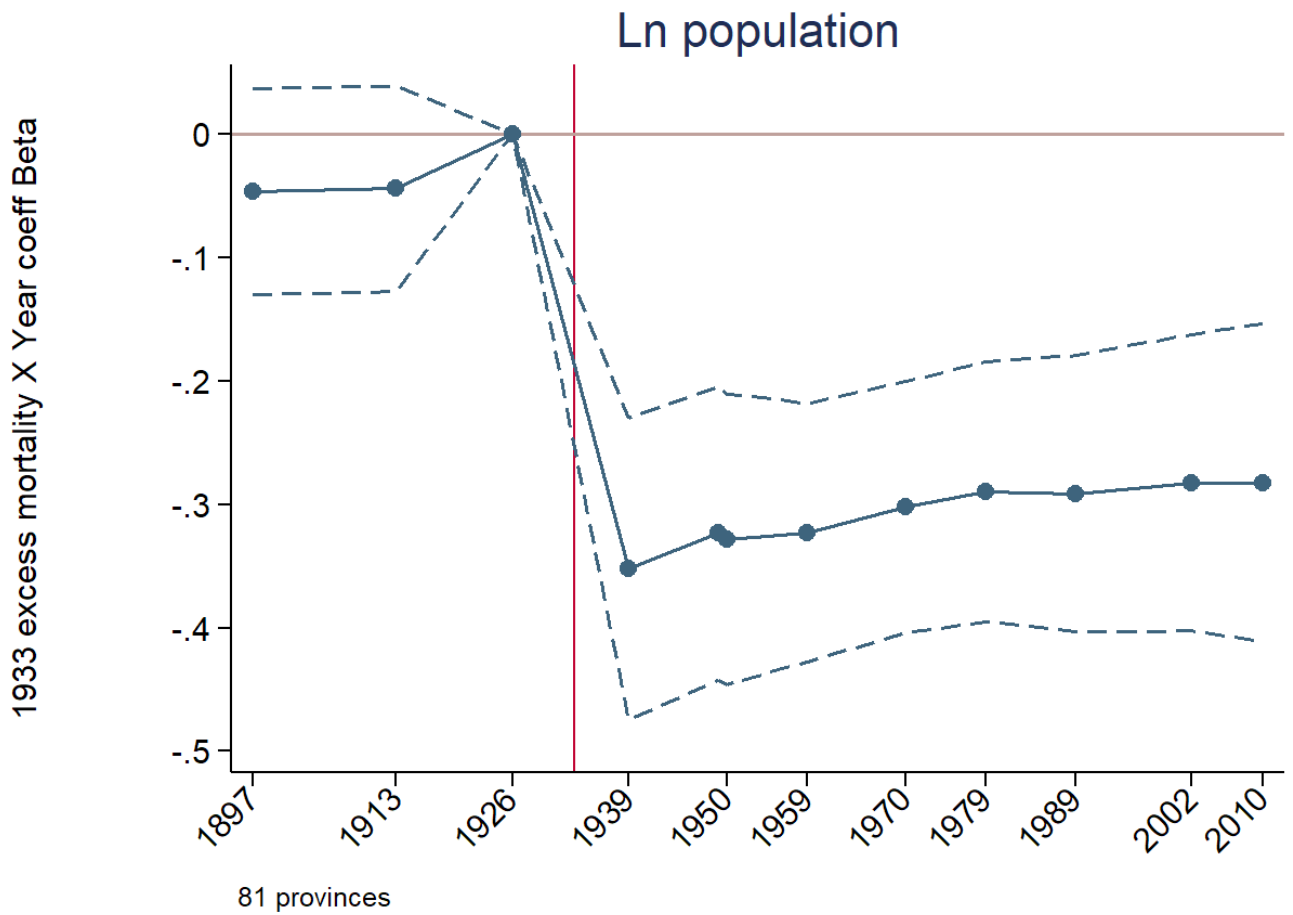


Empirical specification (2)

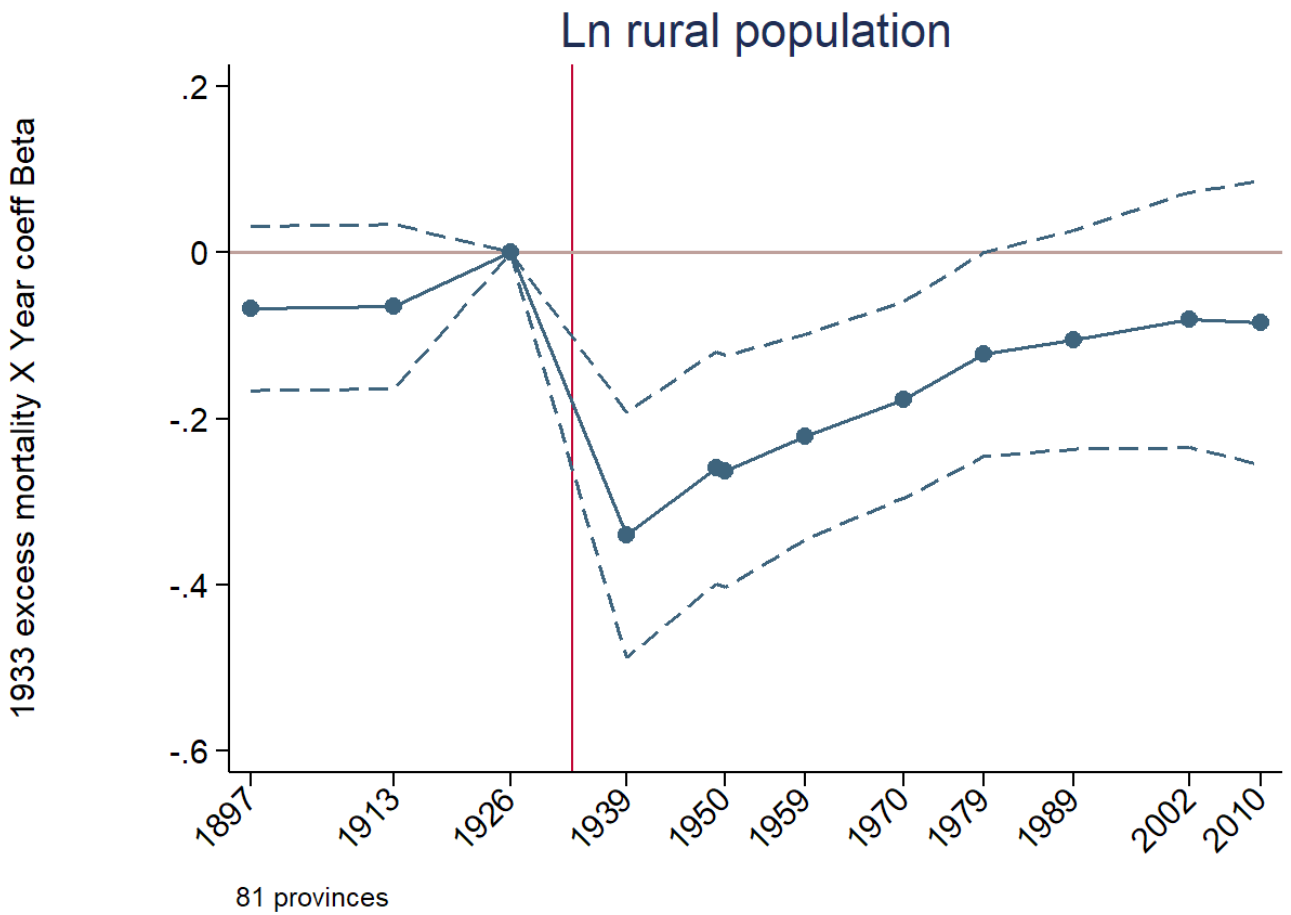
$$y_{i,t} = \sum_{t \neq 1926} \beta_t fam_i \cdot 1[year = t] + X'_{i,t}\gamma_t + \alpha_i + \delta_t + \epsilon_{i,t}$$

- i – province, t – year
- y_{it} – outcome of interest (*Ln population* etc)
- fam_i – excess 1933 mortality in province i
- $X_{i,t}$ – province characteristics (grain suitability $\times$ Post-famine, grain volatility $\times$ Post-famine, WW2 losses $\times$ Post-WW2)
- α_i, δ_t – province and year FE

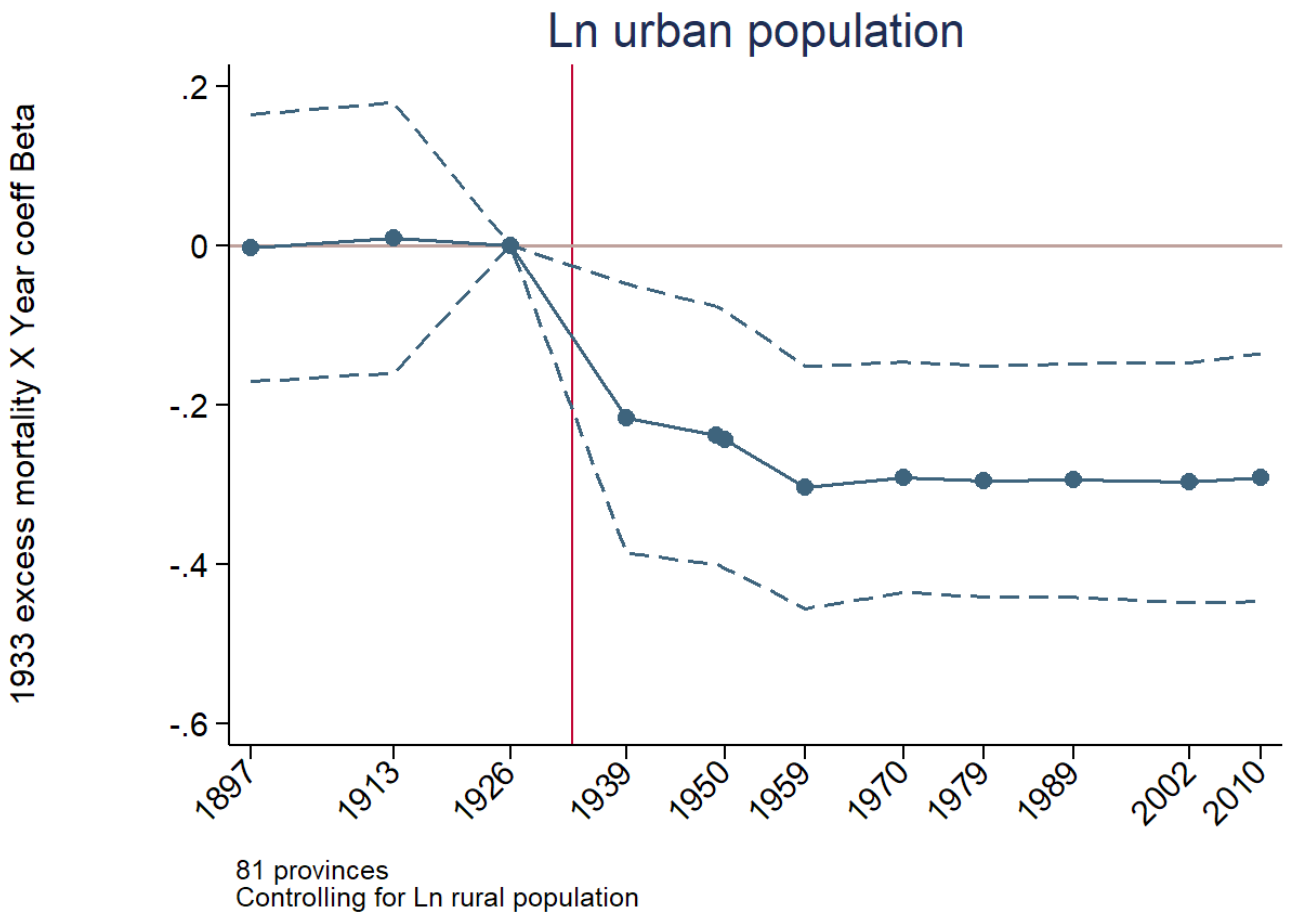
1933 famine and population



1933 famine and rural population



1933 famine and urban population



Robustness checks

- Additional geographic controls: latitude and longitude
- Natural resources: ▸ Check
- Political repressions and Gulag camps: ▸ Check
- Political preferences of the population
- Ethnic deportations
- Holocaust
- Evacuation
- 1947 famine

Outline

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Rural economy

	Dependent variable:					
	Ln grain		Ln sown area		Ln cattle	
	(1)	(2)	(3)	(4)	(5)	(6)
Excess mortality 1933	-1.128		-1.098		-2.897	
× Post-famine	(1.625)		(2.119)		(1.917)	
Excess mortality 1933		-9.031***		-8.230**		-4.720*
× [1934,1940]		(2.620)		(3.235)		(2.836)
Excess mortality 1933		1.736		1.063		-2.760
× Post-1949		(1.881)		(2.315)		(1.950)
Observations	3413	3413	4957	4957	1500	1500
R^2	0.594	0.609	0.563	0.572	0.881	0.881
Provinces	77	77	77	77	60	60

All regressions control for province and year FE, grain suitability × Post-famine, grain volatility × Post-famine, capital province indicator × Post-famine, WW2 losses × Post-war, Nazi occupation indicator × Post-war, Ln distance to Moscow × Post-famine, 1932 number of RR stations per km^2 × Post-famine, republic-year FE, and region-year FE.
Standard errors clustered at the province level separately before and after the famine.
* $p < .10$, ** $p < .05$, *** $p < .01$

Urban economy

	Dependent variable:					
	Ln power plants capacity		Ln electricity produced		Ln industrial output	
	(1)	(2)	(3)	(4)	(5)	(6)
Excess mortality 1933	-2.442		-7.072***		-5.833***	
× Post-famine	(2.314)		(2.592)		(1.790)	
Excess mortality 1933		-3.019		-6.384**		-4.681**
× [1934,1940]		(2.669)		(3.055)		(1.896)
Excess mortality 1933		-2.203		-7.357***		-6.912***
× Post-1946		(2.442)		(2.748)		(2.042)
Observations	1408	1408	1408	1408	898	898
R^2	0.891	0.891	0.894	0.894	0.922	0.922
Provinces	79	79	79	79	78	78

All regressions control for province and year FE, grain suitability × Post-famine, grain volatility × Post-famine, capital province indicator × Post-famine, WW2 losses × Post-war, Nazi occupation indicator × Post-war, Ln distance to Moscow × Post-famine, 1932 number of RR stations per km^2 × Post-famine, republic-year FE, and region-year FE.
Standard errors clustered at the province level separately before and after the famine.
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Urban settlements

1933 mortality and population of urban settlements

Panel A: Panel data estimation

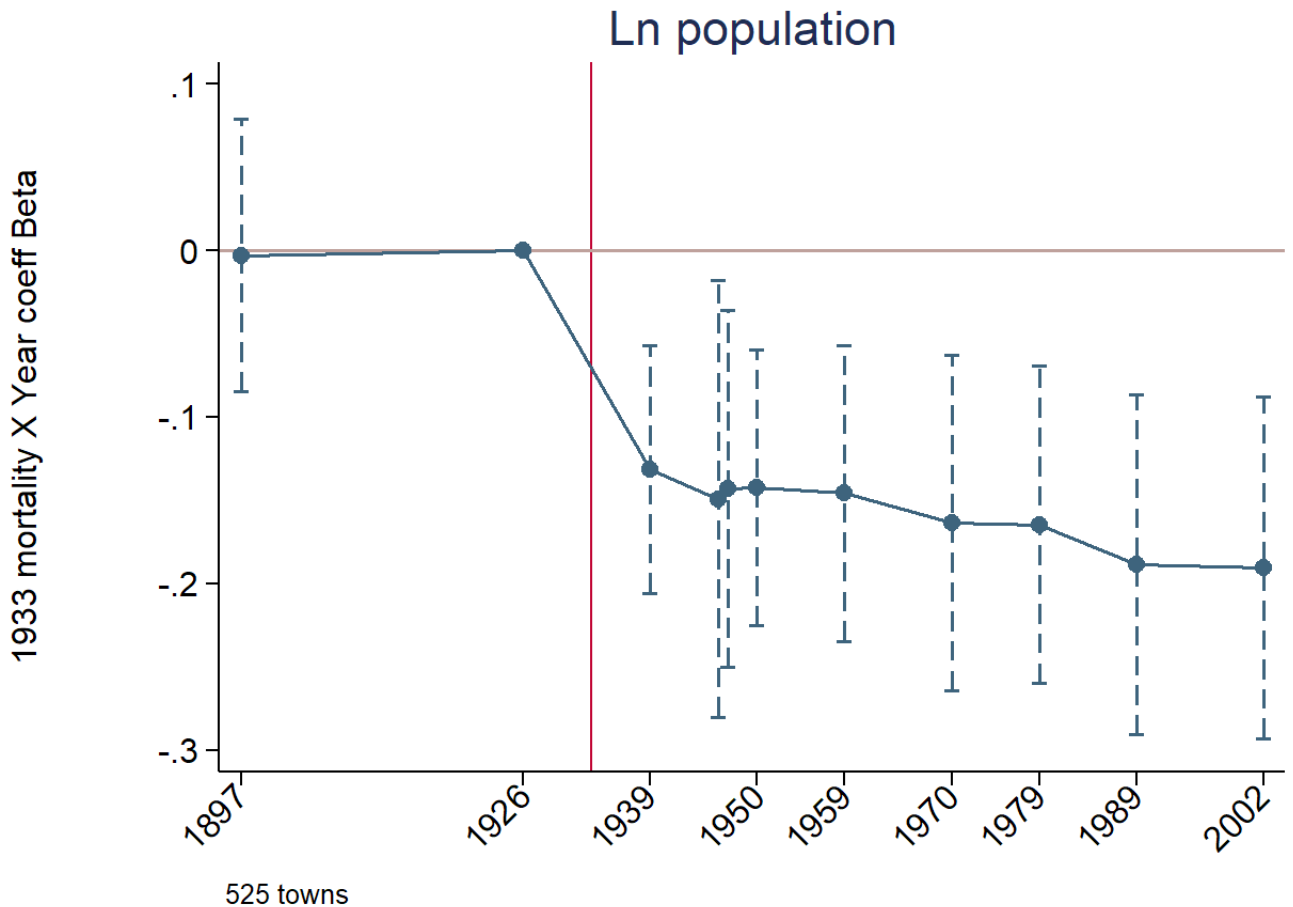
	Dependent variable: Ln population				
Model:	OLS				IV
Sample:	All	Belarus	Russia	Ukraine	All
	(1)	(2)	(3)	(4)	(5)
Mortality 1933 × Post-famine	-7.158***	1.531	-9.380**	-7.648**	-9.245
	(2.681)	(23.235)	(3.693)	(3.306)	(8.142)
Observations	4802	630	2181	1991	4161
R^2	0.809	0.625	0.875	0.764	0.395
Settlements	525	98	205	222	426

Panel B: First stages of the corresponding 2SLS panel regressions

	Dependent variable: Mortality 1933 × Post-famine
Demeaned spring 1932 temp × Post-famine	-0.010***
	(0.002)
Demeaned summer 1932 precip × Post-famine	0.000**
	(0.000)
F	19.751

All regressions control for settlement and year FE, grain suitability × Post-famine, WW2 losses × Post-war, Nazi occupation indicator × Post-war, and province-year FE.
Standard errors clustered at the settlement level.
* $p < .10$, ** $p < .05$, *** $p < .01$

1933 mortality and population of urban settlements



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The correlation between 1933 excess mortality and natural population increase

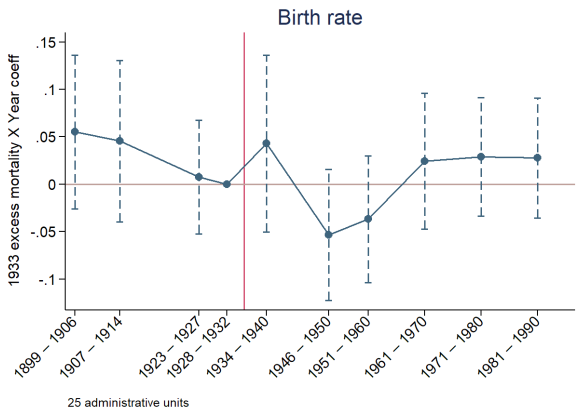
No evidence that rural population recovered due to differential birth and death rates $\Longrightarrow$ recovery must be due to migration

	Dependent variable:					
	Total, 1899 – 1990			Rural, 1928 – 1990		
	Birth rate	Death rate	Natural increase	Birth rate	Death rate	Natural increase
	(1)	(2)	(3)	(4)	(5)	(6)
Excess mortality 1933 × [1934,1940]	0.002	-0.063***	0.061	0.076	0.041	0.032
	(0.043)	(0.019)	(0.036)	(0.060)	(0.031)	(0.068)
Excess mortality 1933 × [1946,1990]	-0.048	-0.022	-0.027	0.027	0.080**	-0.054
	(0.039)	(0.013)	(0.033)	(0.028)	(0.032)	(0.043)
Observations	1470	1491	1470	1130	1151	1130
R^2	0.964	0.969	0.895	0.950	0.904	0.930
Administrative units	25	25	25	25	25	25

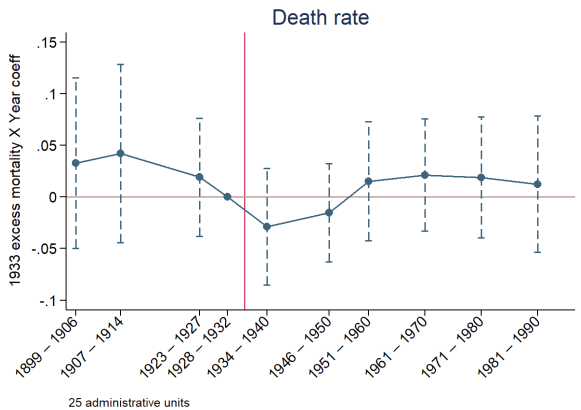
All regressions control for province and year FE, grain suitability × Post-famine, WW2 losses × Post-war, Nazi occupation indicator × Post-war, urbanization rate, and republic-year FE.
Natural increase is birth rate minus death rate.
Robust standard errors.
* $p < .10$, ** $p < .05$, *** $p < .01$

The correlation between 1933 excess mortality and natural population increase, by 5 – 10 year periods

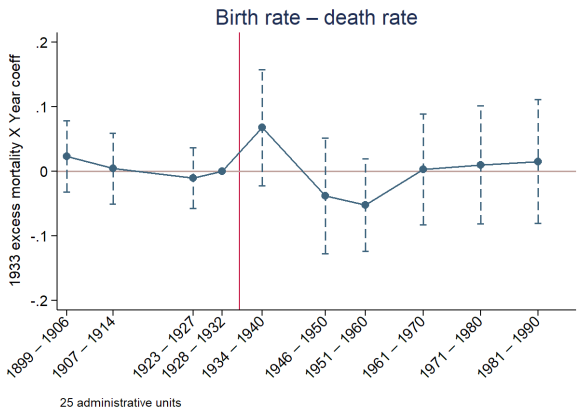
(a) Natality



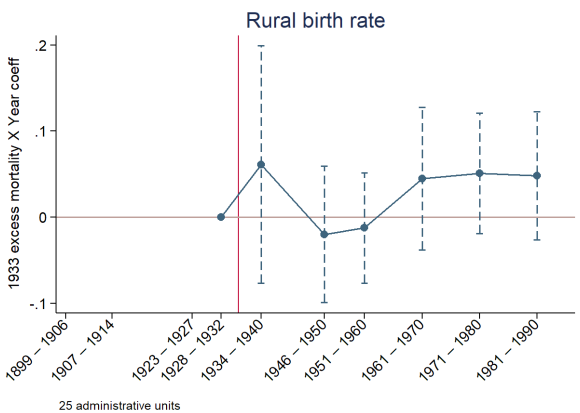
(b) Mortality



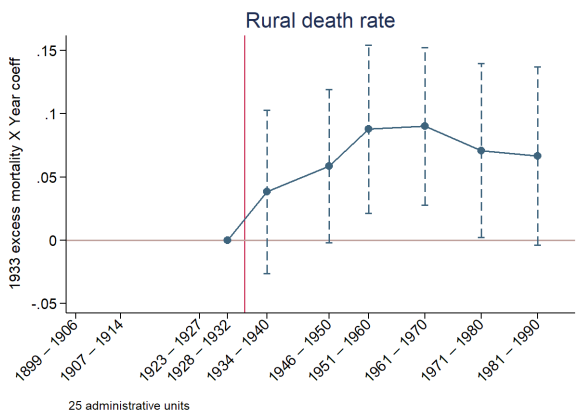
(c) Natural increase



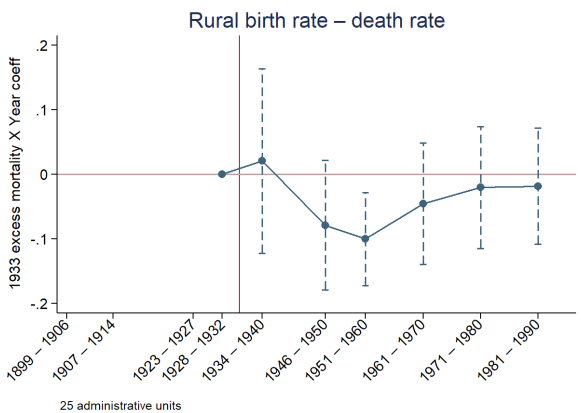
(d) Rural natality



(e) Rural mortality



(f) Rural natural increase



▸ Yearly data

Impact of famine on urban settlements by settlement size

	Dependent variable: Ln population	
Sample:	1926 population $\leq 25K$	1926 population $\geq 25K$
	(1)	(2)
Mortality 1933 $\times$ Post-famine	-9.284***	-2.736
	(3.528)	(5.181)
WW2 losses $\times$ Post-war	✓	✓
Observations	2909	1893
R^2	0.814	0.888
Towns	320	205

All regressions control for town and year FE, grain suitability $\times$ Post-famine, WW2 losses $\times$ Post-war, Nazi occupation indicator $\times$ Post-war, and province-year FE.
Standard errors clustered at the town level.
* $p < .10$, ** $p < .05$, *** $p < .01$

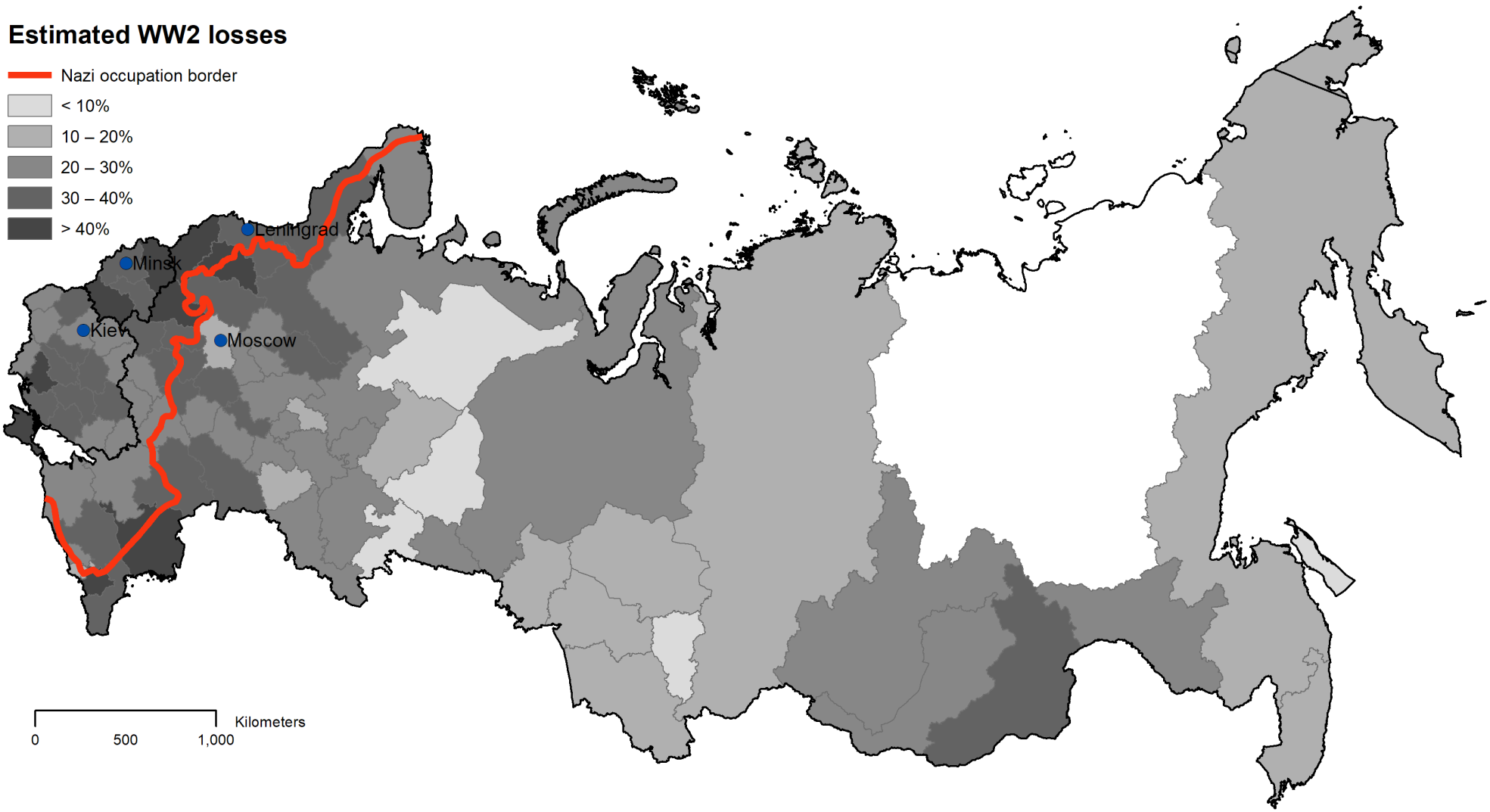
Conclusion

- 1933 famine had a strong persistent negative impact on urban population
- Recovery of rural population must be explained by differential migration
- Smaller urban settlements were more affected

- For the future:
  - Compare plan and the actual urban development
  - Add omitted urban settlements
  - Complete robustness checks
  - Mechanism?

Backup slides

WW2 losses estimates



Back

1933 famine and pop: controlling for natural resources 1/2

Panel A: Panel data estimation

	Dependent variable:								
	Ln population			Ln rural population			Ln urban population		
Model:	OLS (1)	IV (2)	OLS (3)	OLS (4)	IV (5)	OLS (6)	OLS (7)	IV (8)	OLS (9)
Excess mortality 1933 × Post-famine	-7.202*** (1.690)	-8.521*** (3.051)		-1.489 (1.963)	-2.622 (3.226)		-8.201*** (2.358)	-9.290** (3.922)	
Excess mortality 1933 × 1939			-8.381*** (2.265)			-5.129* (2.720)			-8.850*** (3.283)
Excess mortality 1933 × Post-1949			-7.036*** (1.742)			-0.978 (2.009)			-8.111*** (2.352)
Natural resources	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ln rural population							✓	✓	✓
Observations	960	912	960	960	912	960	960	912	960
R^2	0.660	0.876	0.660	0.637	0.839	0.639	0.930	0.951	0.930
Provinces	80	76	80	80	76	80	80	76	80

Panel B: First stages of the corresponding 2SLS panel regressions

	Dependent variable: Excess mortality 1933 × Post-famine		
Demeaned spring 1932 temp × Post-famine	-0.014*** (0.004)	-0.014*** (0.004)	-0.013*** (0.004)
Demeaned summer 1932 precip × Post-famine	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
F	22.662	22.662	22.554

All regressions control for province and year FE, grain suitability × Post-famine, grain volatility × Post-famine, capital province indicator × Post-famine, WW2 losses × Post-war, Nazi occupation indicator × Post-war, Ln distance to Moscow × Post-famine, 1932 number of RR stations per km^2 × Post-famine, republic-year FE, and region-year FE.
Natural resources are oil 2006 production × Post-famine, and coal 2006 production × Post-famine.
Standard errors clustered at the province level separately before and after the famine.
* $p < .10$, ** $p < .05$, *** $p < .01$

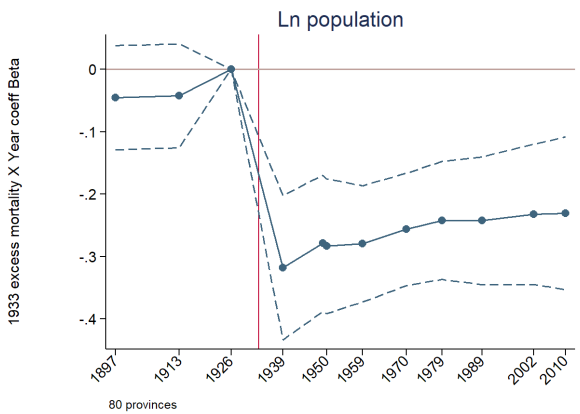
Impact of 1933 famine by the 1926 settlement size

	Dependent variable: Ln population			
Sample:	1926 pop $\leq 20K$	$20K <$ 1926 pop $\leq 30K$	$30K <$ 1926 pop $\leq 40K$	1926 pop $> 40K$
	(1)	(2)	(3)	(4)
Mortality 1933	-8.695**	-3.214	17.937*	1.860
$\times$ Post-famine	(3.615)	(22.864)	(10.514)	(8.017)
Observations	2649	467	302	1384
R^2	0.818	0.969	0.972	0.893
Settlements	295	45	28	157

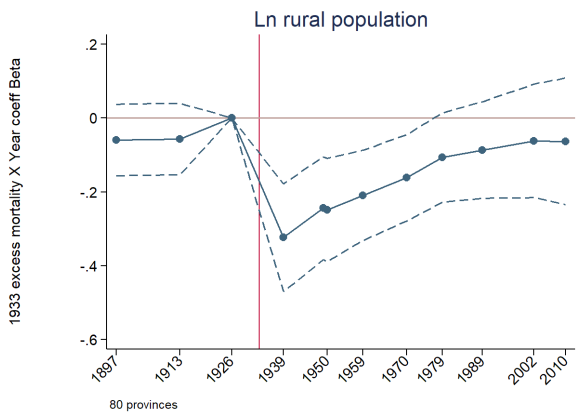
All regressions control for settlement and year FE, grain suitability $\times$ Post-famine, WW2 losses $\times$ Post-war, Nazi occupation indicator $\times$ Post-war, and province-year FE.
Standard errors clustered at the settlement level.
* $p < .10$, ** $p < .05$, *** $p < .01$

1933 famine and pop: controlling for natural resources 2/2

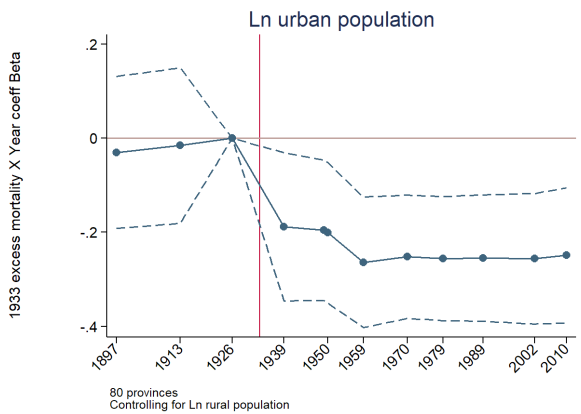
(a) Population



(b) Rural population



(c) Urban population



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Famine and pop: controlling for political repressions 1/2

Panel A: Panel data estimation

	Dependent variable:								
	Ln population			Ln rural population			Ln urban population		
Model:	OLS (1)	IV (2)	OLS (3)	OLS (4)	IV (5)	OLS (6)	OLS (7)	IV (8)	OLS (9)
Excess mortality 1933 × Post-famine	-8.470*** (2.000)	-9.082*** (3.076)		-1.760 (2.071)	-2.493 (3.156)		-9.688*** (2.763)	-10.112** (3.937)	
Excess mortality 1933 × 1939			-9.376*** (2.467)			-5.374* (2.764)			-9.989*** (3.640)
Excess mortality 1933 × Post-1949			-8.347*** (2.051)			-1.270 (2.117)			-9.648*** (2.759)
Political repressions	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ln rural population							✓	✓	✓
Observations	972	924	972	972	924	972	972	924	972
R^2	0.644	0.871	0.644	0.640	0.840	0.642	0.925	0.948	0.925
Provinces	81	77	81	81	77	81	81	77	81

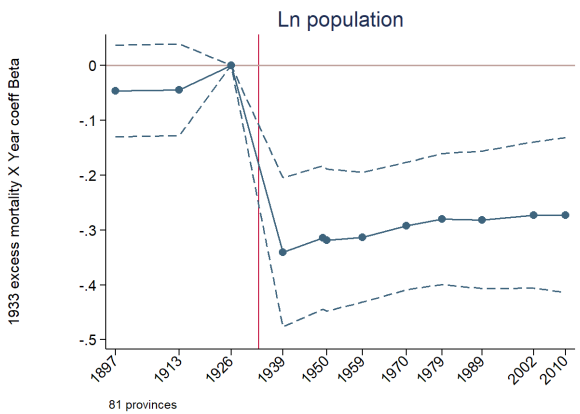
Panel B: First stages of the corresponding 2SLS panel regressions

	Dependent variable: Excess mortality 1933 × Post-famine		
Demeaned spring 1932 temp × Post-famine	-0.010*** (0.004)	-0.010*** (0.004)	-0.010*** (0.004)
Demeaned summer 1932 precip × Post-famine	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
F	26.641	26.641	26.397

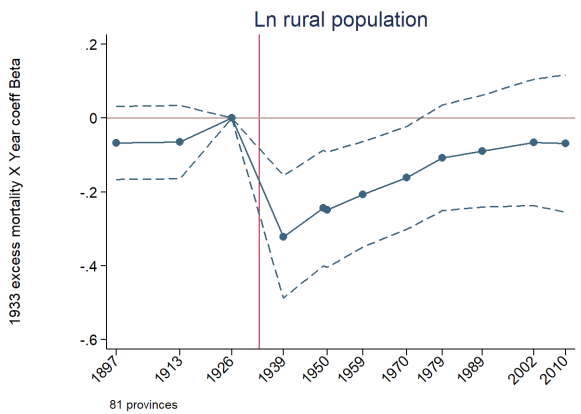
All regressions control for province and year FE, grain suitability × Post-famine, grain volatility × Post-famine, capital province indicator × Post-famine, WW2 losses × Post-war, Nazi occupation indicator × Post-war, Ln distance to Moscow × Post-famine, 1932 number of RR stations per km^2 × Post-famine, republic-year FE, and region-year FE.
Political repressions are Ln number of convicted and Ln number of executed individuals under Article 58 × Post-famine.
Standard errors clustered at the province level separately before and after the famine.
* $p < .10$, ** $p < .05$, *** $p < .01$

Famine and pop: controlling for political repressions 2/2

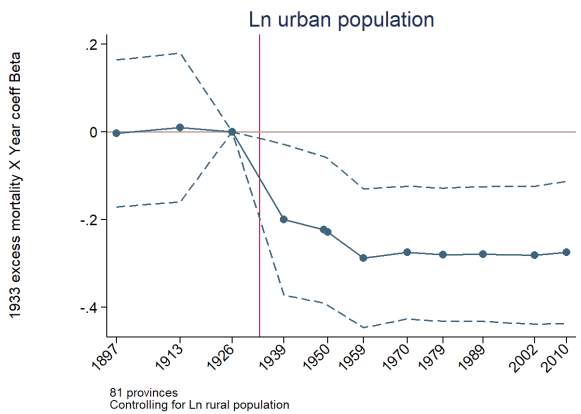
(a) Population



(b) Rural population



(c) Urban population



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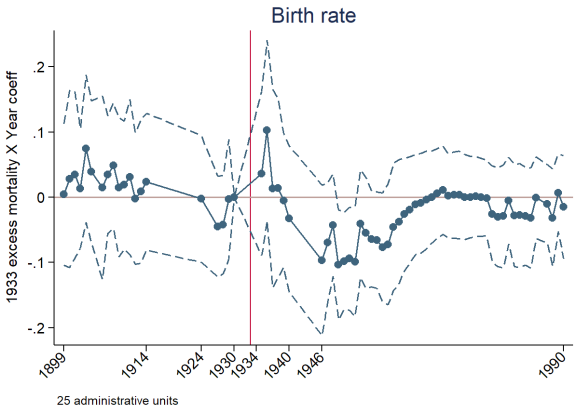
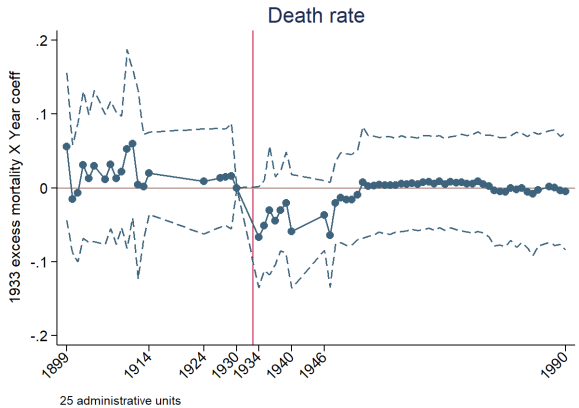
The correlation between 1933 excess mortality and natural population increase, yearly data

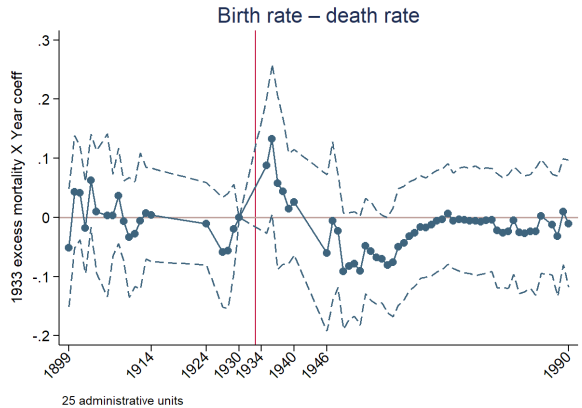
(a) Natality



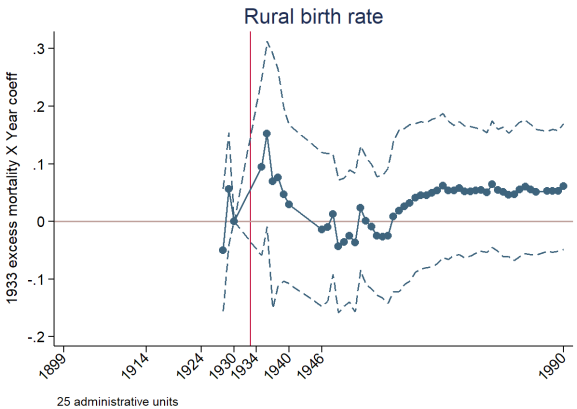
(b) Mortality



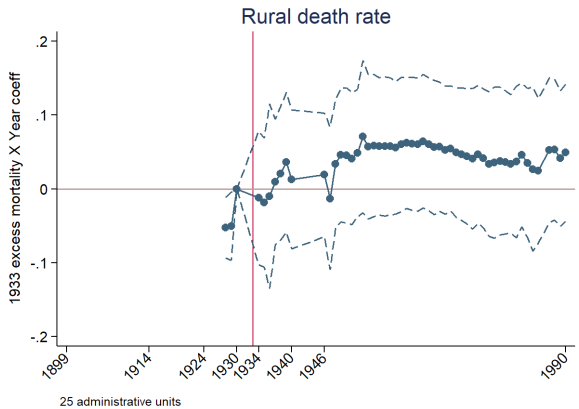
(c) Natural increase



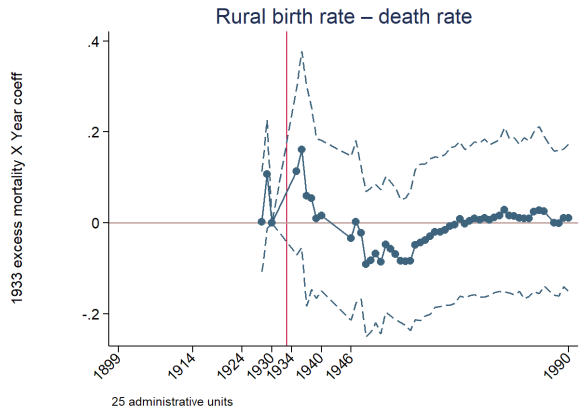
(d) Rural natality



(e) Rural mortality



(f) Rural natural increase



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