African living standards under the French Empire: Evidence from recruits to the Tirailleurs Sénégalais

Denis Cogneau (PSE-IRD-EHESS)

Alexander Moradi (U. Sussex)

Léa Rouanet (PSE-EHESS)

Motivation

How living standards developed in former French West Africa?

- Very little is known
- Wage levels not representative, if only for farmers
- School enrollment, vaccinations: bias towards positive inputs of colonialism

Here: see what military data tell:

- height stature, occupation, migration

Colonialism in question (1)

Counterfactual reasoning is difficult:

Indeed, processes, structures, institutions matter:

"There is no doubt that a large number of negative structural features of the process of economic underdevelopment have historical roots going back to European colonization" (Bairoch 1993)

Destruction of indigenous institutions and polities, economic & political dependence, even after colonization ended (on French Africa: Ageron, Amin, Balandier, Julien, Meillassoux, Suret-Canale, etc.)

Colonialism in question (2)

However, also continuities between precolonial, colonial and postcolonial eras :

(Bayart, Cooper, Herbst)

- Lowly administered colonial Empires
- Neither exploitative nor developmental
- Indirect rule, preserving the lower layers of administration (chieftaincies)
- Long-term “extroversion” of African economies and polities

Colonialism in question (3)

Before-after approaches focus on more specific dimensions, and restrict the range of impacts:

- Early population crises (violence, epidemics)
  (Echenberg, Feierman, Manning)
- Spread of epidemics later on (Dozon, Ford, Lasker)
- Forced labor, taxation (Fall, Manning)
- Low levels and uneven distribution of public investment
  (Huillery, Rouanet)

Colonialism in question (4)

Yet others rather emphasize:

- Pacification, Modernization
- Generous provision of infrastructure : roads, railways, schools, dispensaries, hospitals

(especially in the later period)

- Metropolitan France gained little from colonization, through natural resources extraction, or capital investments

(e.g. Bloch-Lainé & Jeanneney, Marseille, Lefeuvre)

Here

Before-after approach again:

- Soldiers born between 1890 and 1940
- Changes in height stature …
- As reflecting nutrition and/or health?

  "forced labor and forced cultivation interfered with the normal African work patterns, and cut nutritional levels to the point where health was impaired" (Manning 1999)

- Or (misleading) selection into the army?

  (Bodenhorn, Guinanne, Mroz 2013)

Road Map

1. Conscription in French Western Africa (AOF)
2. Height stature developments
3. Selection issues
4. Provisional conclusion

Until WW1

1857-1905: Mercenary forces for conquest (freed slaves)

1905-1914 : Occupation force : « Choice by chiefs » - 1912: partial conscription (Morocco war) – Mangin's « Force Noire »

1914-1918: 160,000 recruits, 40% in 1918 (levée Diagne) (see Michel 1973, 2003)

WW1

Recruitment already spread all over AOF: already much correlated with population

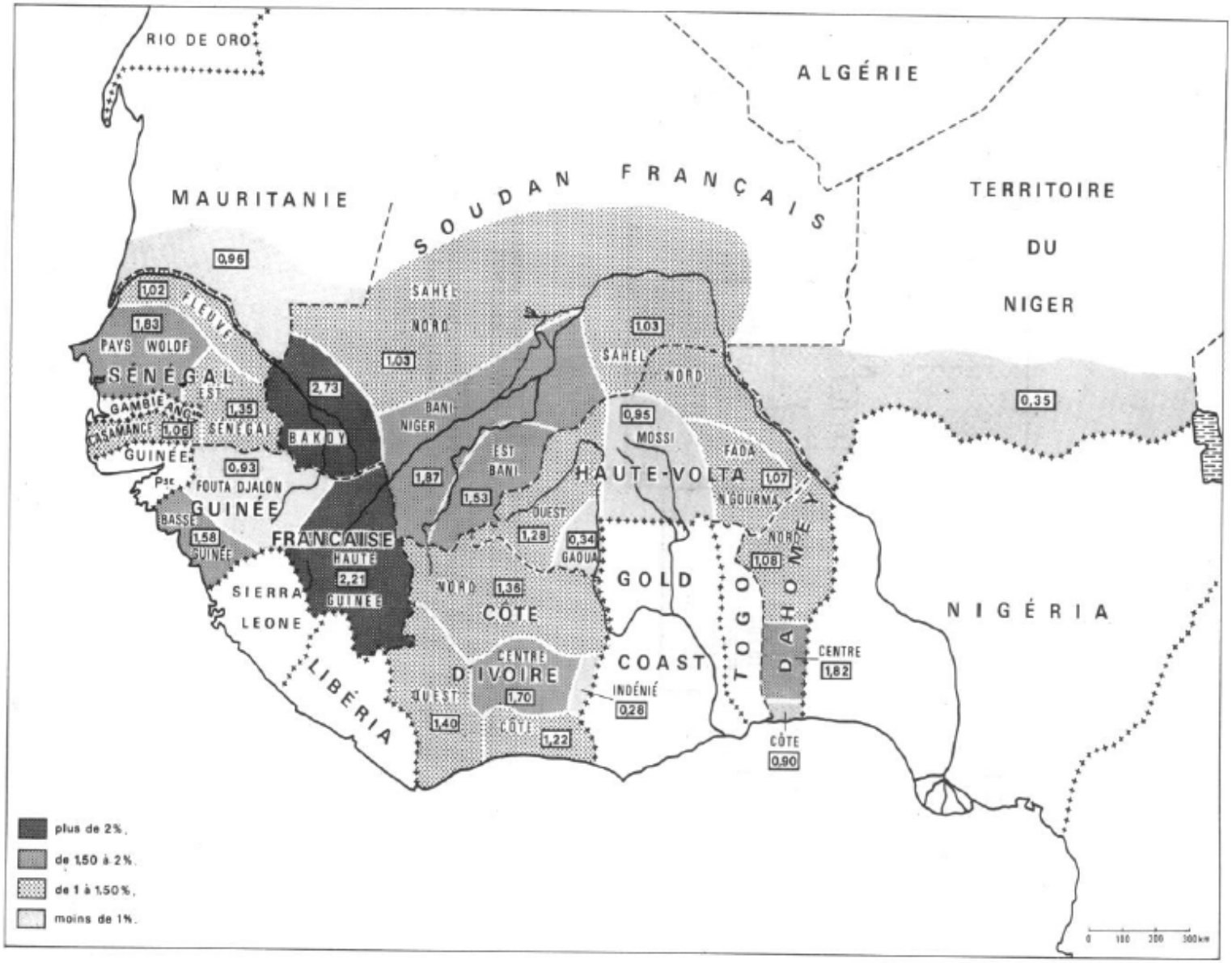
« Martial races » theory : Fouta Djalon, Guinée Forestière, Sud Benin, Sud Mali

Resistance to recruitment (and to tax): Burkina Faso, Benin, Guinée, Senegal (Casamance)

Unexpected success of levée Diagne in 1918

→ Encouraged implementing conscription, against Mangin who wanted a professional army

(Echenberg 1991 / Michel 2003)



Carte nº 2. — Pourcentages du recrutement des tirailleurs pendant la guerre de 1914-1918 par grandes régions des colonies de l'A.O.F., par rapport à la population en 1921.

Michel (1973)

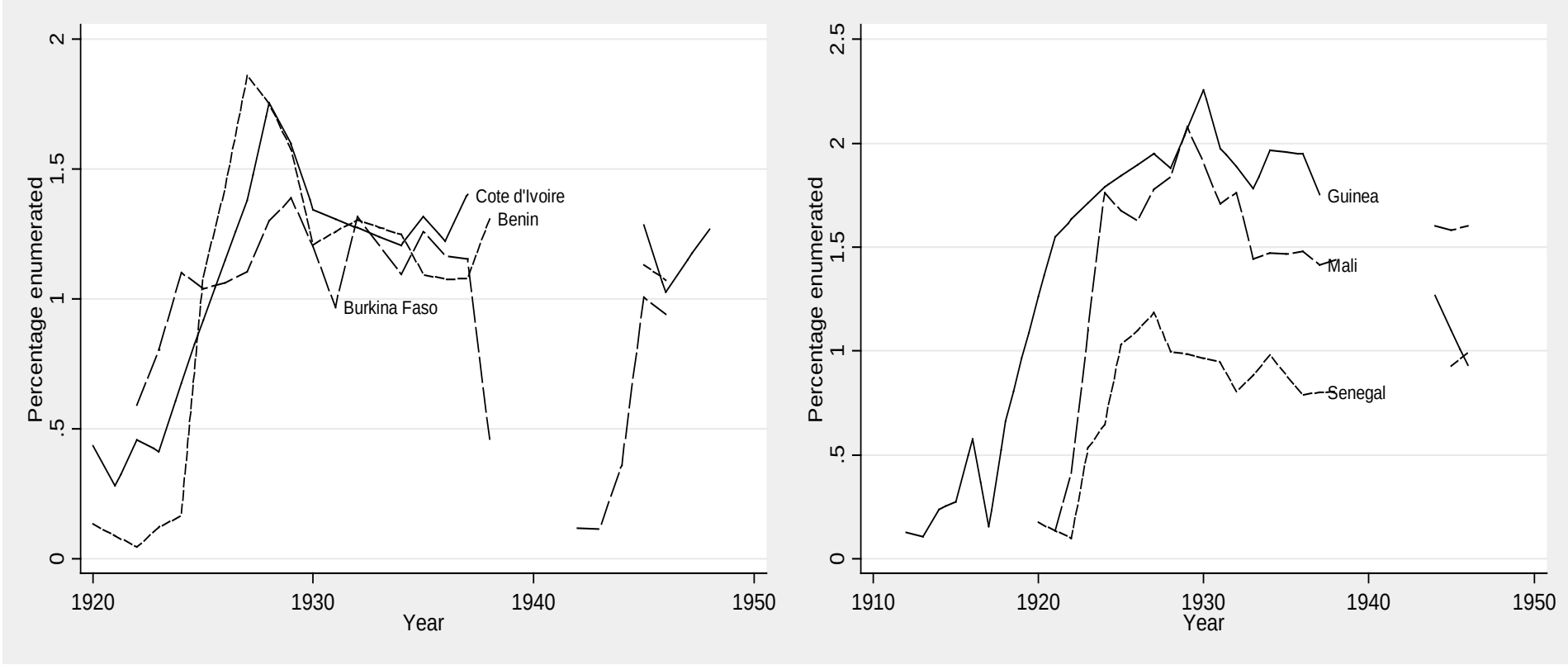
Formal conscription (1925-38)

1) Total number fixed in Paris (Min. of Defense)
2) Distributed by Gal Governor among colonies
3) Distributed by Col Governor among circles
   → **Rather stable allocation rule → little variation over time**

4) Lists of eligibles by circle admin. (enumeration)
5) Fitness exams by draft commissions (fitness)
6) Volunteers declare
7) Lottery number for 1st portion & 2nd portion

2nd portion reservists were used as forced labor (e.g. railway construction) from 1920 to 1946 (Fall 1993)

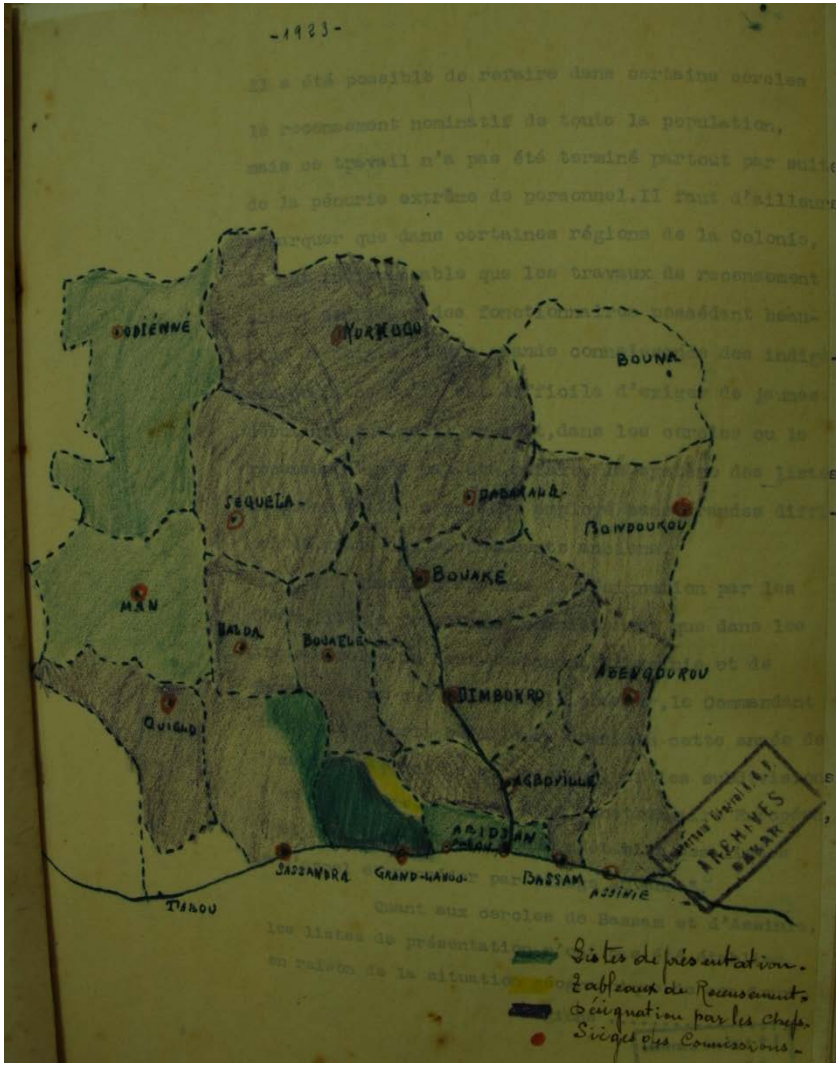
Enumeration



Eligible pop.: 20 year-old, and until 28 y.o.

Here 1% of population estimate (Frankema & Jerven 2013)

Formal conscription 1920-1925



How did it work? (1920-60)

Taxation (=poll tax) and conscription (« blood tax »)

1) Total number fixed in Paris (Min. of Defense)
2) Distributed by Gal Governor among colonies
3) Distributed by Col Governor among circles
   → Rather stable allocation rule (used as instrument)

4) Lists of eligibibles by circle admin. (enumeration)
5) Fitness exams by draft commissions (fitness)
6) Volunteers declare
7) Lottery number for 1st portion & 2nd portion

Some 2nd portions reservists were used as forced labor (e.g. railway construction) during interwar period (until 1946) (Fall 1993)

Data (1)

Colony	Period	N
Quatre Communes	1895-1960	5,261
Senegal-Mauritanie	1923-1960	9,743
Haut-Senegal-Niger (mostly Mali)	1895-1922	4,935
Soudan Français (Mali)	1912-1960	16,119
Haute Volta (Burkina Faso)	1923-1960	8,282
Cote d'Ivoire	1923-1960	10,818
Guinee	1904-1960	15,010
Niger	1900-1960	4,268

Individual soldier files keep at CAPM (Pau) – Unequal prob. sample with 10% rate on average – 1926, 1938, 1940 and 1955 oversampled, as well as earliest years. N = 90,211.

Data (2)

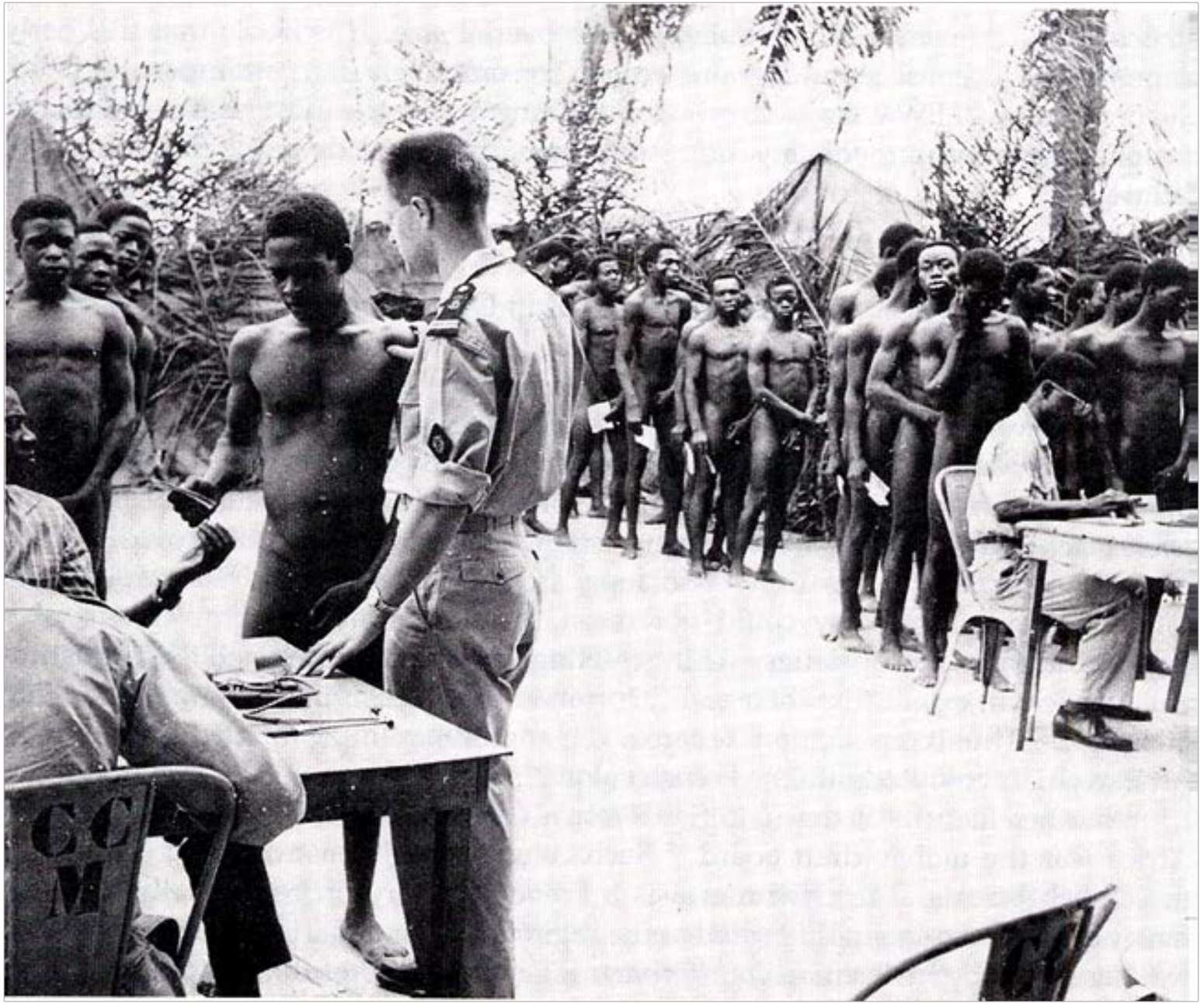
Série 4 D at Archives du Sénégal (Dakar):

Aggregate data on formal conscription 1912-1938 and 1945-1946, at circle-level

- N. of enumerated, absent, fit, 1st & 2nd p., volunteer
- For some years: Target aimed, N. of chiefs' sons, literate in French.

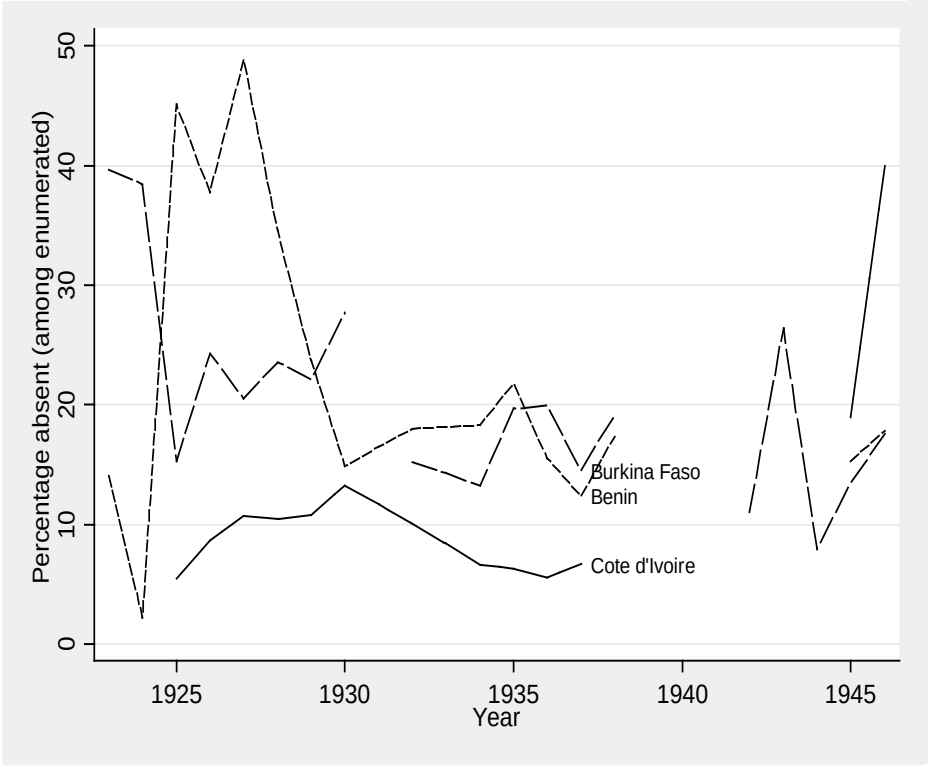
Other data on colonial investments in education, health, infrastructure, etc.

(Colonial budgets of AOF)



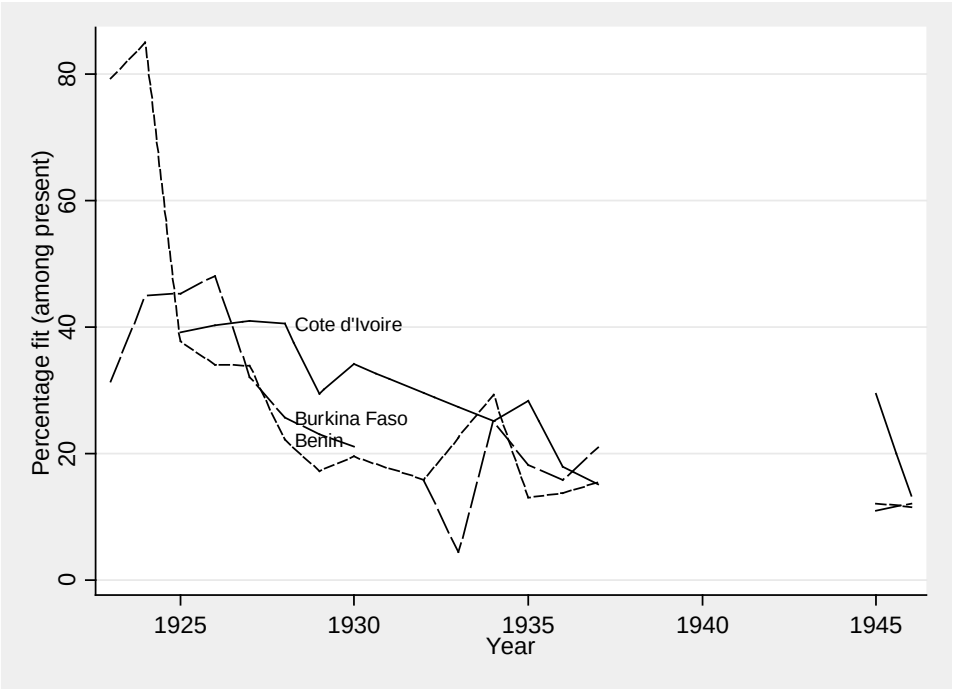
Echenberg (1991)

Absenteeism



Figures very close to Echenberg's at aggregate-level.
Reveal large cross-sectional and intertemporal variations.

Fitness



Draft commissions gradually turned more demanding (except for WW2), in terms of health, height, physical constitution, as soon as they could afford

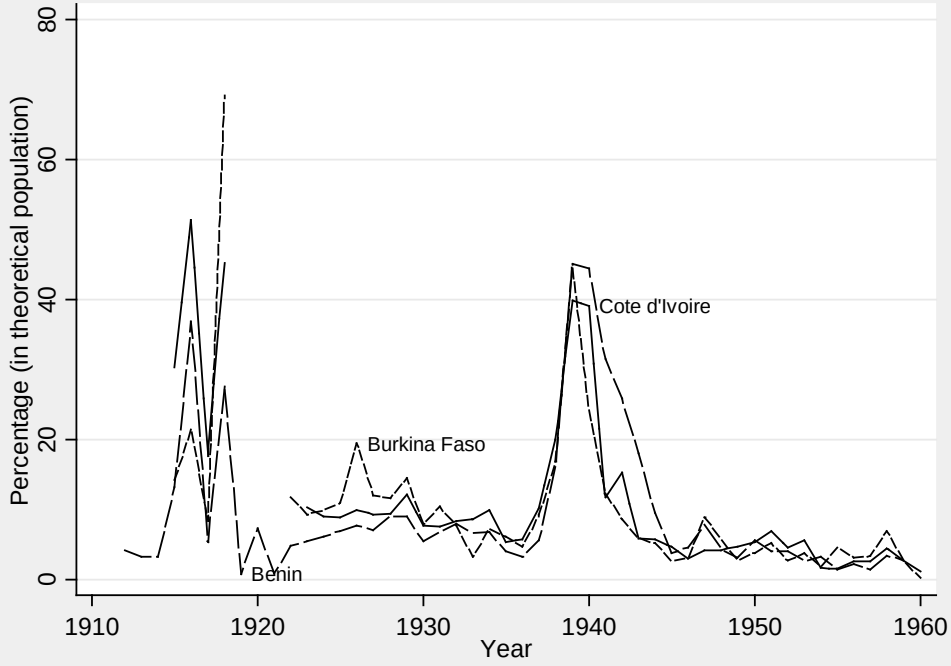
Targets

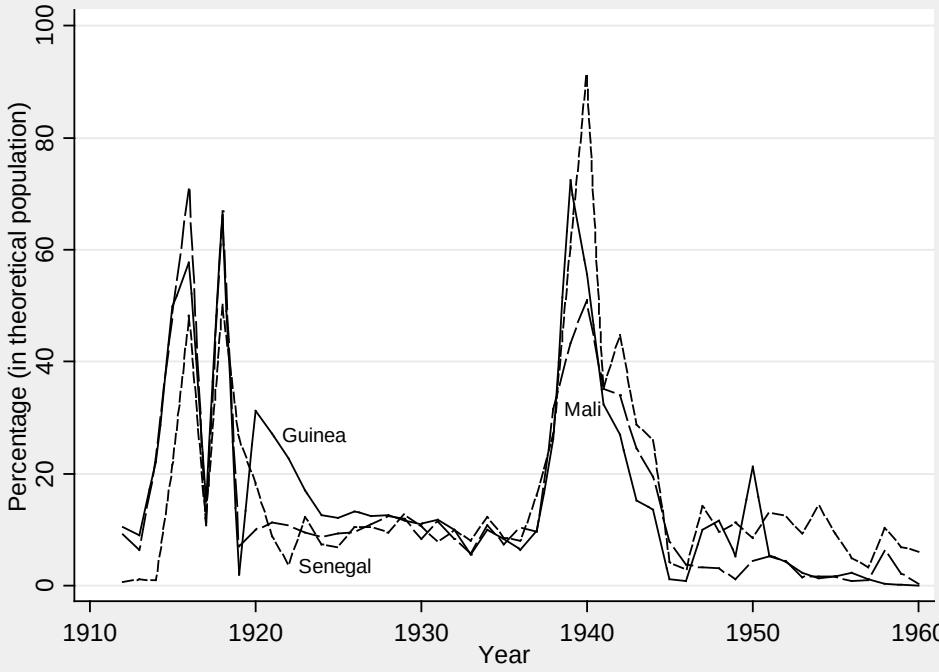
Targets were fixed according to population

Lottery rates and even fitness decisions were adjusted to compensate absenteism

→Targets were always met, despite draft evasion

Recruits in population





WW1: Michel (1973) figures

Eligible population: 1% of population estimates (Frankema & Jerven 2013)

Representativeness

WW1: 160,000 recruits in total (Michel 2003)

Benin (Dahomey), Guinea & Four Communes of Senegal: ok

Half of Haut-Senegal-Niger (Mali & Burkina Faso)

No Cote d'Ivoire, Senegal, Mauritania and Niger

WW2: 70,000 / yr 1939-40 - 38,000 / year 1941-42 (Vichy)

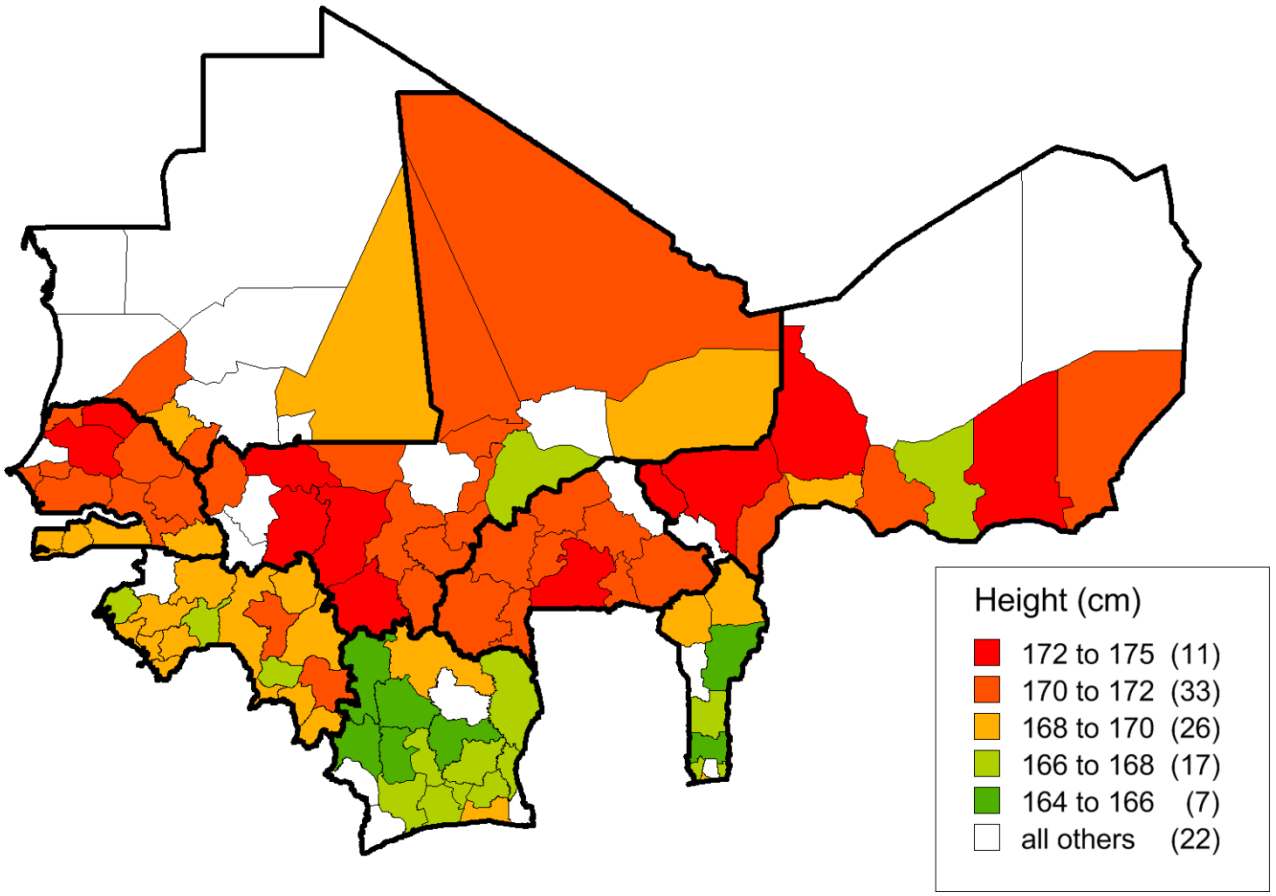
20,000 in 1942-1944

Well represented for each colony (incl. mobilized 2nd p.)

1923-1960 not WW2: Well-represented except 2nd portions in Cote d'Ivoire, Haute Volta and Niger

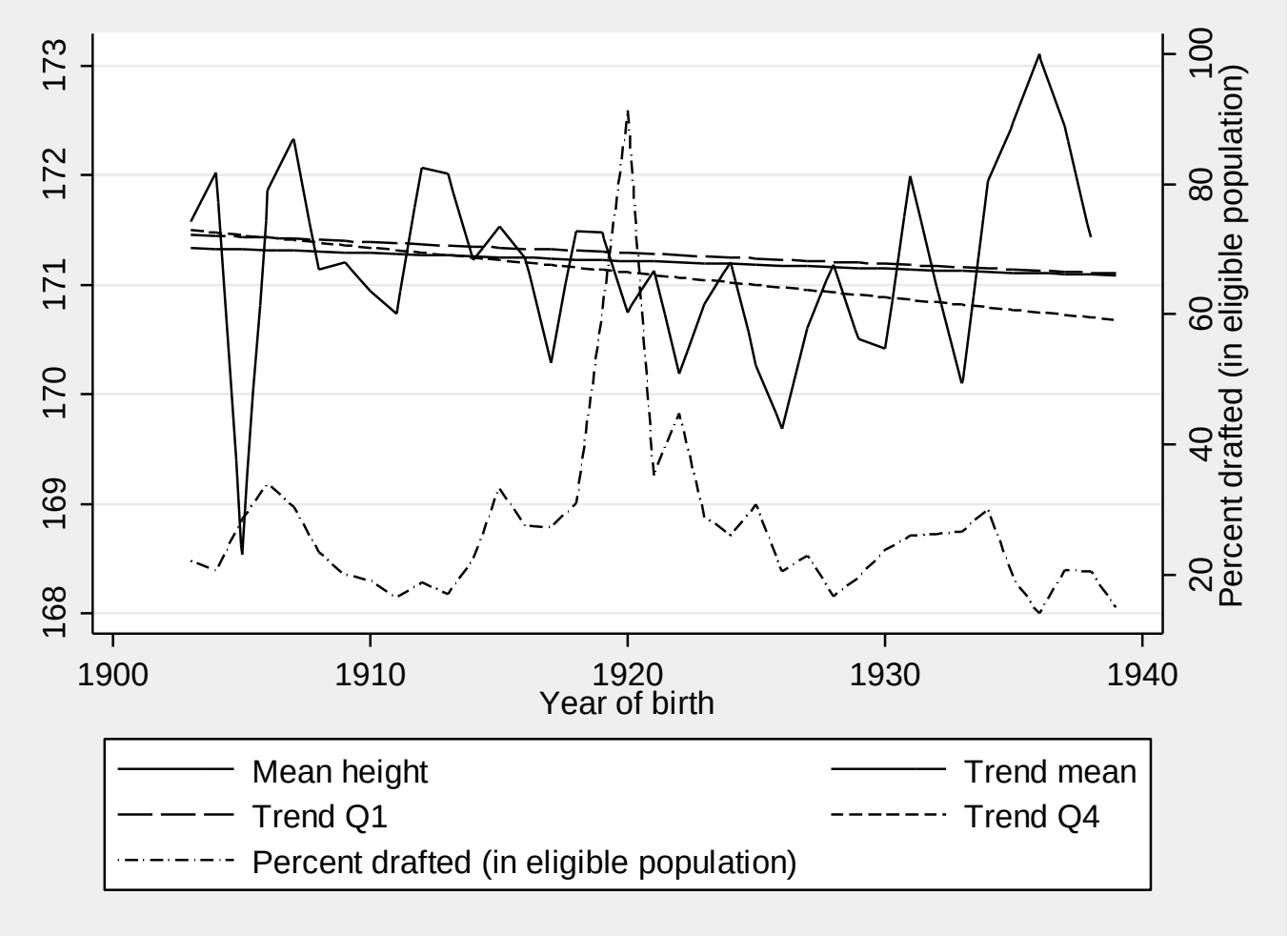
Height

Recruits 1938-40 (mean height in district of birth)

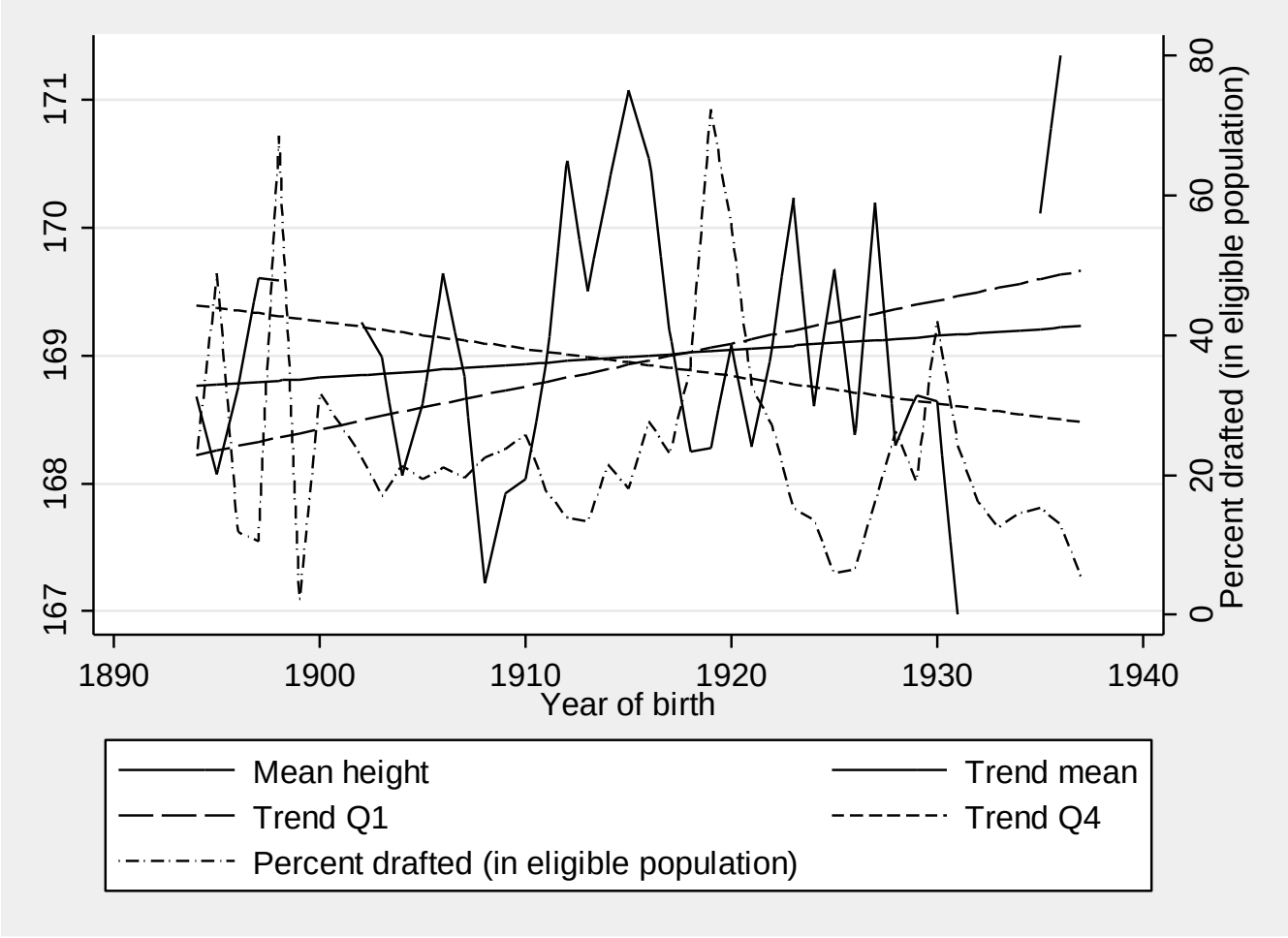


See years 1924-26 and 1954-56 in appendix

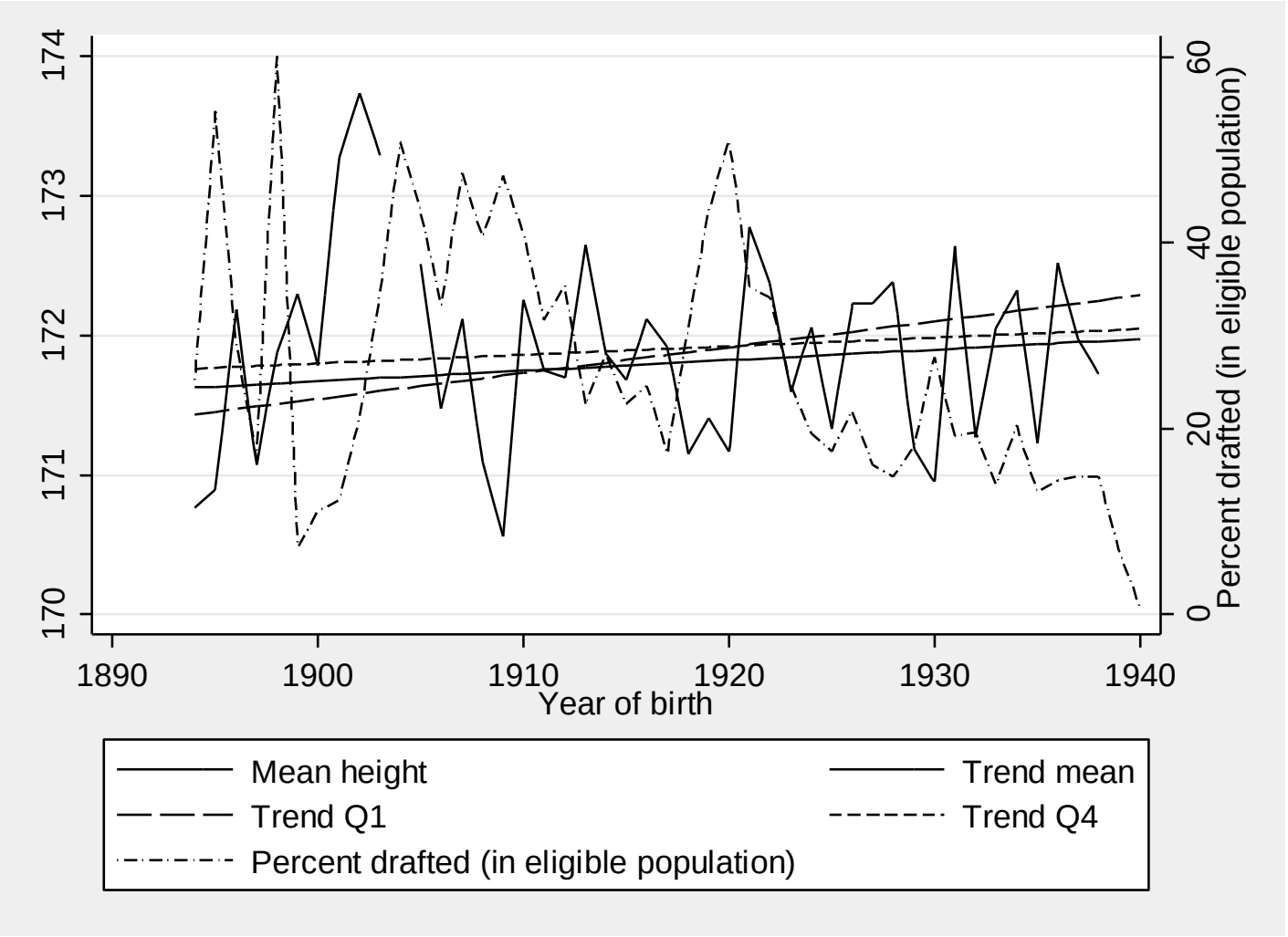
Height trends in Senegal + Mauritania colonies



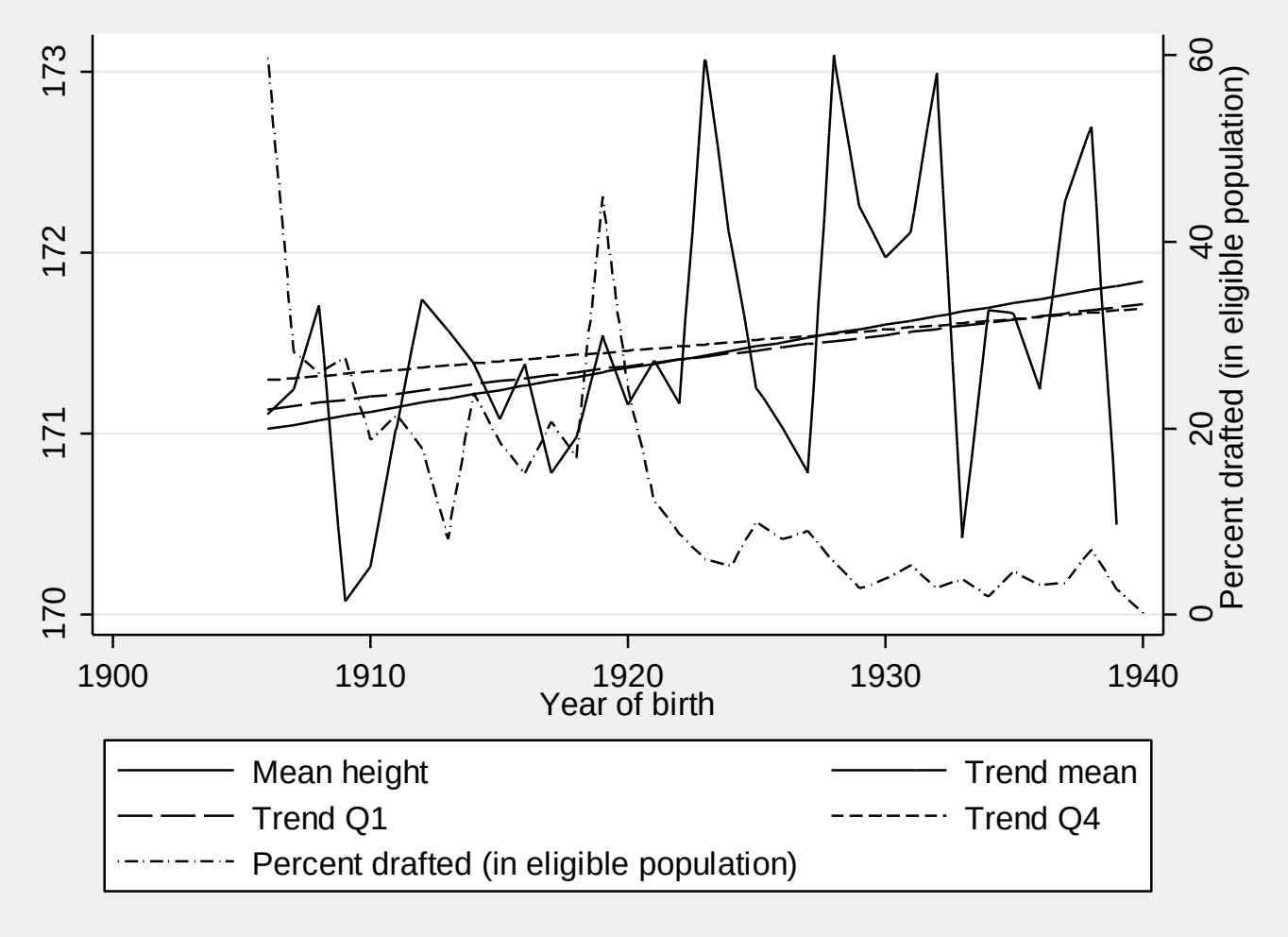
Height trends in the Guinea colony



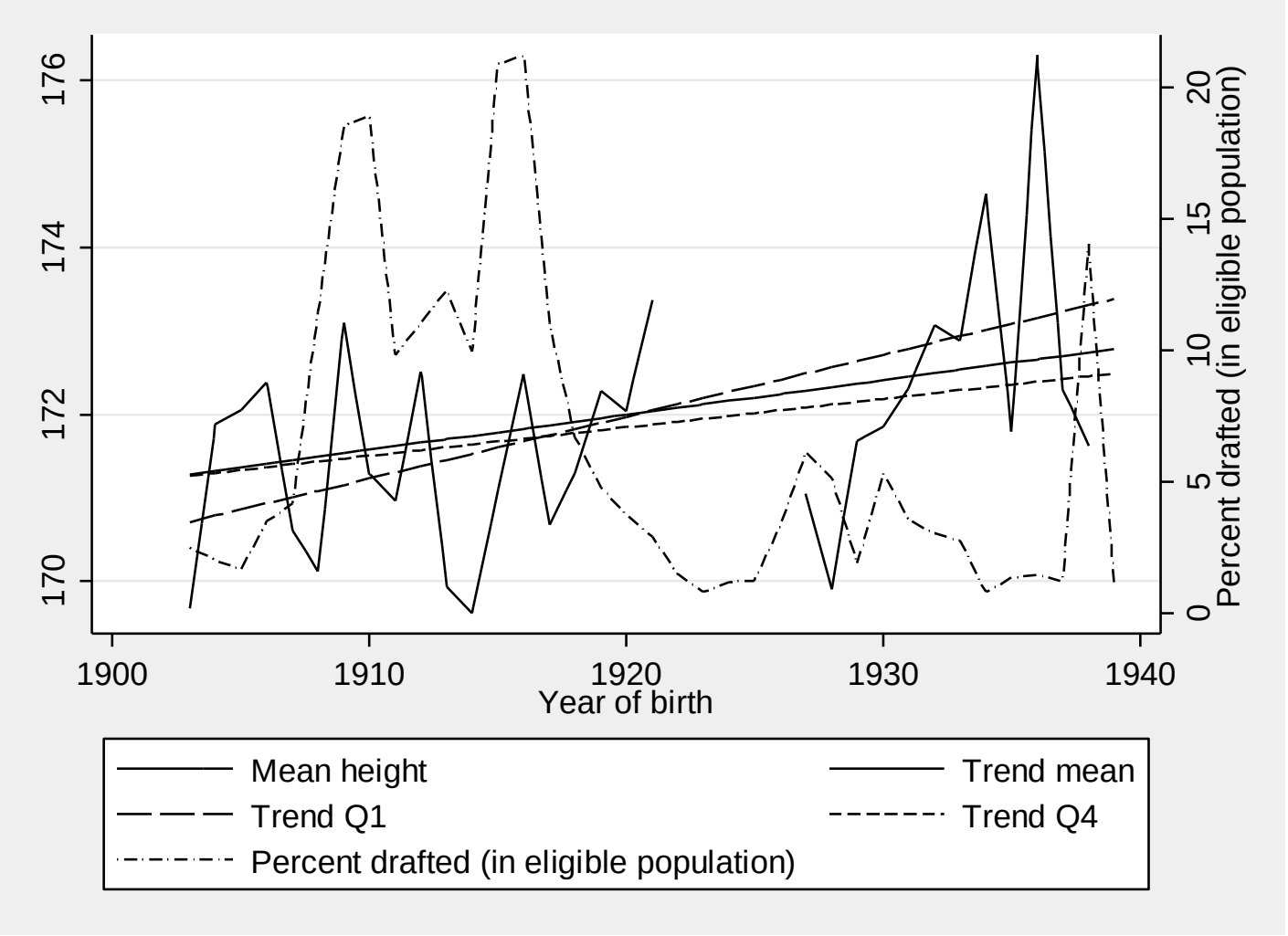
Height trends in the Soudan (Mali) colony



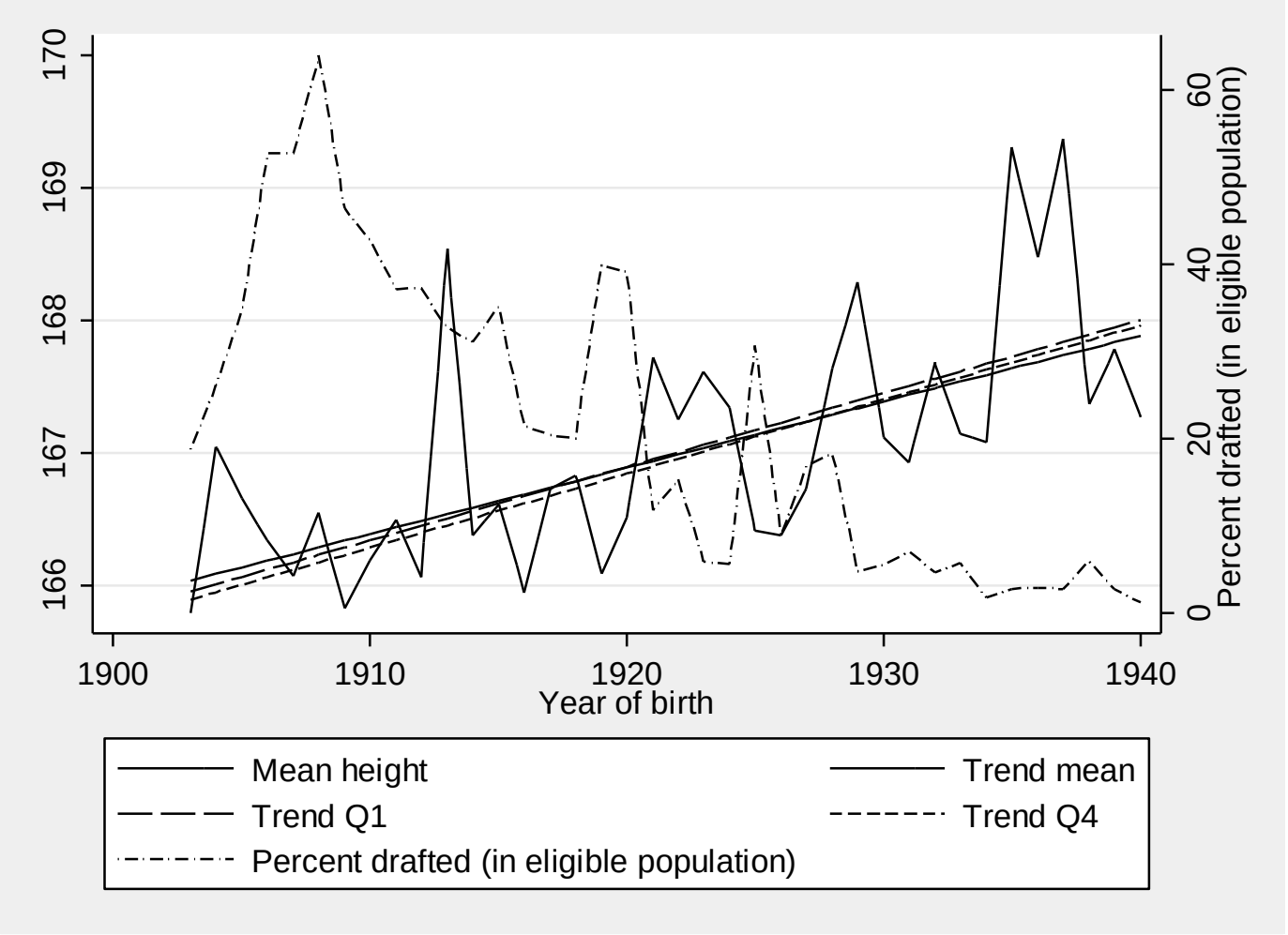
Height trends in the Haute-Volta colony (Burkina Faso)



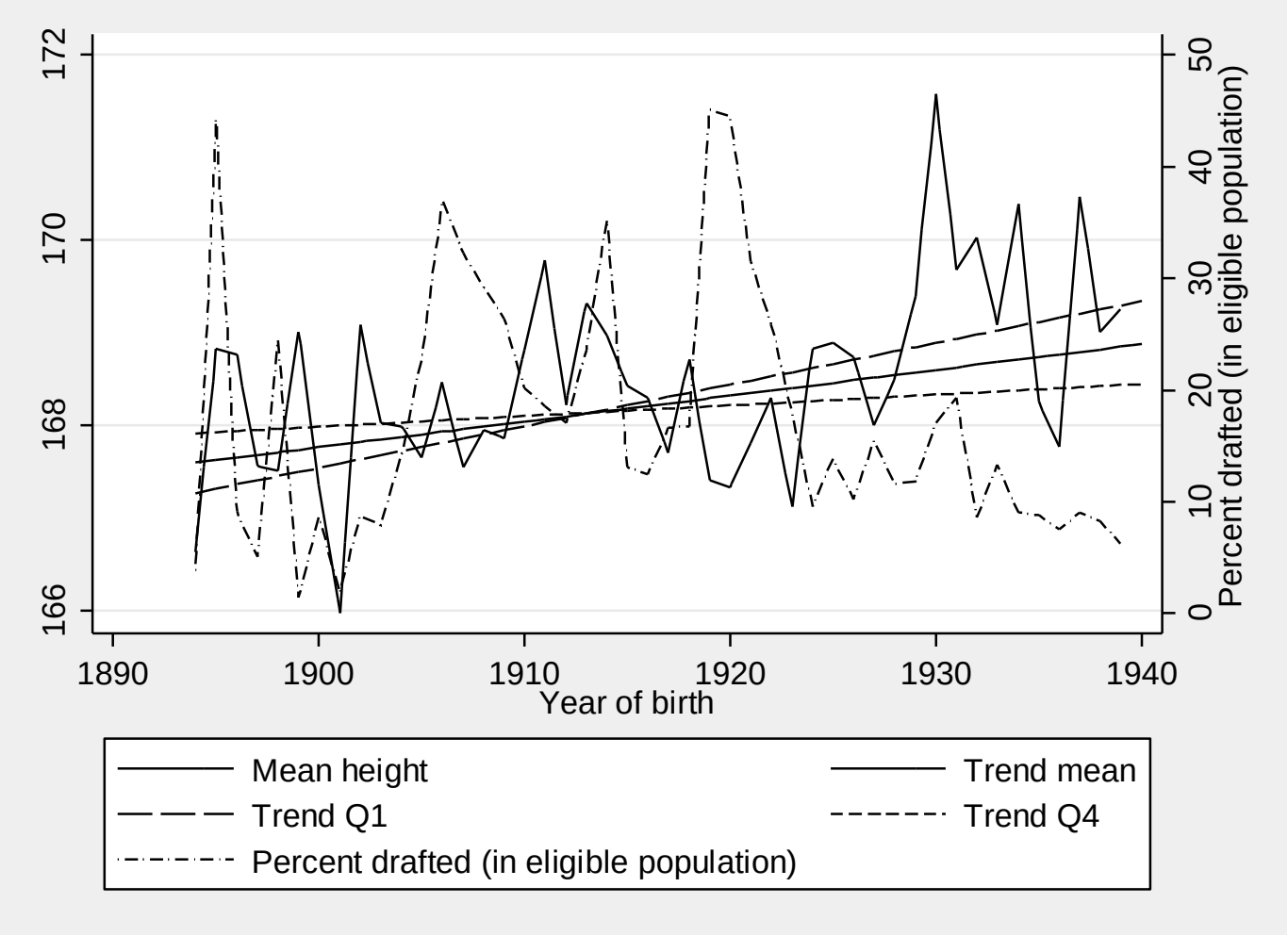
Height trends in the Niger colony



Height trends in the Cote d'Ivoire colony



Height trends in the Dahomey (Benin) colony



Selection

- By mortality before 20
- By enumeration / absenteeism
- By fitness decision
- By professionalisation after 1945 (non-farmers)
- Missing values for height

→ Non parametric: Lee's sharp bounds (2009)

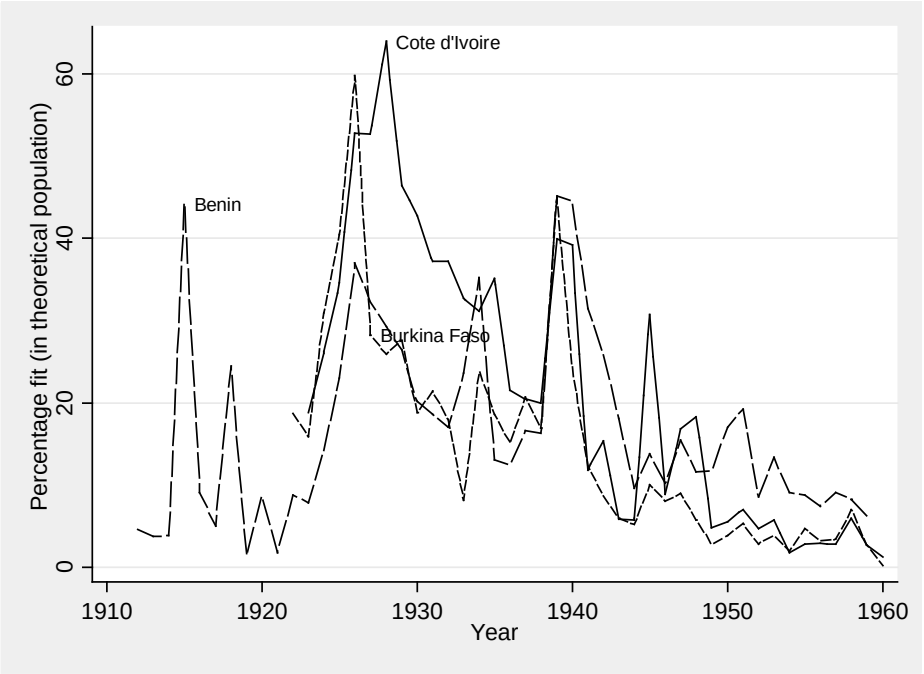
→ Parametric: Inverse Mills ratios (Heckman 1979)

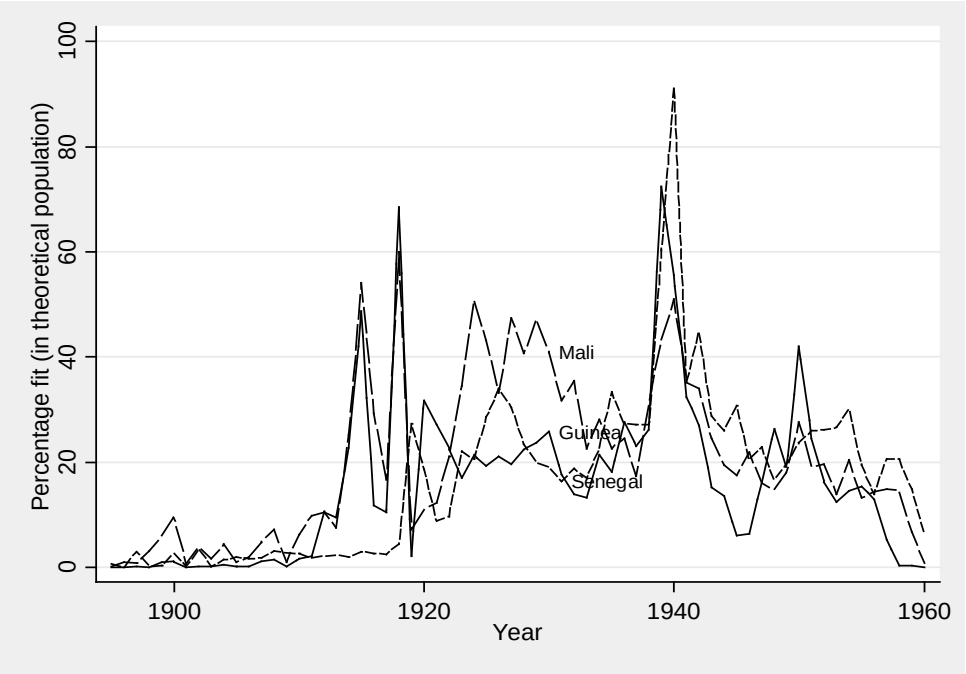
Fitness ratio

Fit for the service = 1st + 2nd portions + volunteers

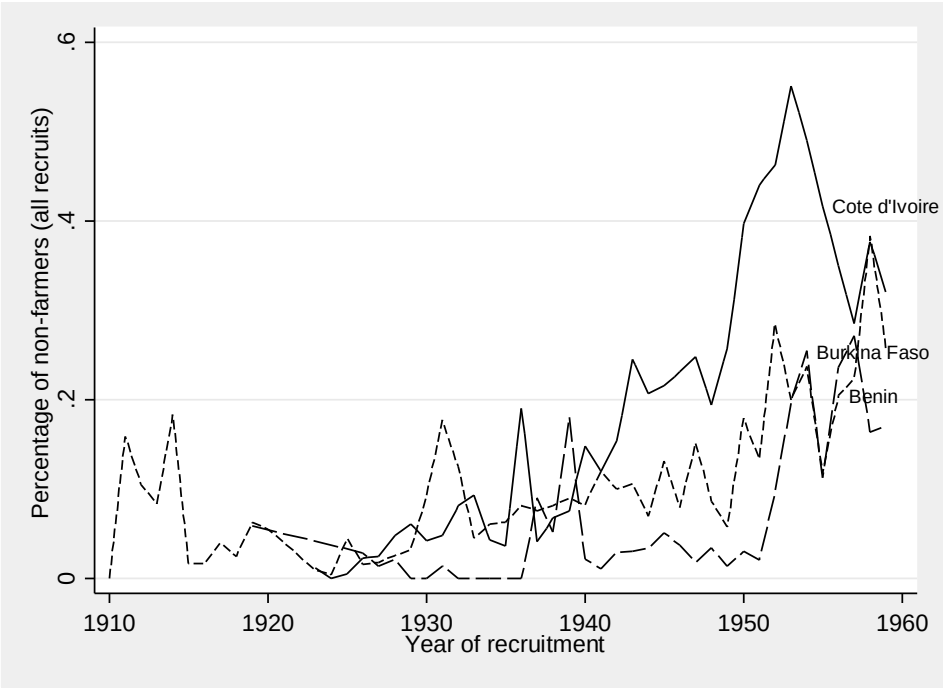
- Before 1922: N soldiers in files
- 1922-1937 & 1945-46: Draft commissions data
- 1938-1944 & 1947-60: N soldiers in files

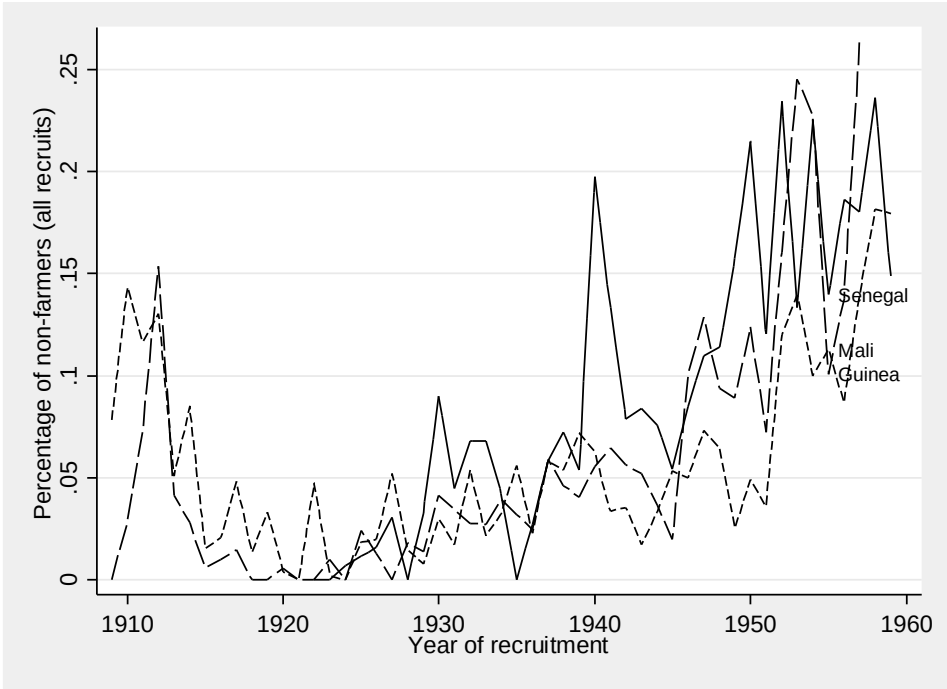
Denominator: Estimate of eligible population as 1% of total population





Share of non-farmers at entry





- After 1945, army gets more professional
- In WW1 more non-farm as well

Bounds for selection (1)

Adapt Lee's (2009) sharp bounds for the impact of a (randomized) treatment with sample selection

Here: Treatment = year of birth of recruits Outcome = height

Objective: Between two birth years t and t+n, purge variation of mean height from the effects of selection into conscription

→ Estimate E(h|t) – E(h|t+n) for « always selected » (e.g. « always fit »)

Assumption 1: Same distribution of potential heights among 20 y-o individuals, or among « present to medical exams », before fitness decision is taken

→ Use draft commissions stats on proportion of fit

Bounds for selection (2)

Assumption 2 (monotonicity of selection):

Conditional on draft commission (district-level), if proportion of fit decreases (by $\tau>0$) between t and t+n, all recruits unfit in t would have been unfit in t+n, and no fit in t+n would have been unfit in t

Bounds are obtained by computing truncated means:

→ Lower Bound: $E(h \mid t+n) – E(h \mid t, h \geq h_{\tau})$

→ Upper Bound: $E(h \mid t+n) – E(h \mid t, h \leq h_{1-\tau})$

Where h_{τ} : τ -th quantile of heights

Compute LB and UB for each district, then (weighted) average over districts.

Lee result: Bounds are as sharp as they can be (given assumptions)

Assumption 3:

$E (\text{height} \mid t, \text{unfit}) \leq E (\text{height} \mid t, \text{fit})$

→ Upper bound = Actual variation (if unfit increase)

Bounds for selection (3)

Given variation in fitness, bounds are wide:

Côte d'Ivoire [1924-30] → [1945-46]
Fit (% of present): 36.3% → 23.4%
Var. in mean height: +0.69 cm
Conf. interval at 95%: [-2.48 cm ; +4.07 cm]

→ Impossible to conclude that height stature improved for « always fit », without more stringent assumptions

Parametric approach (1)

Quasi-gaussian distribution of heights suggests making normality assumptions (Heckman):

$$E(\ h \mid h \text{ observed }) = E(h) + \rho.\ \phi(\Phi^{-1}(1-Z))/Z$$

1) Selection up to fitness decision:

   Z = ratio of 'fit' in draft district to eligible population (fitness ratio)

2) Missing data for height:

   Z = share of non-missing heights among fit in draft district

Parametric approach (2)

However, as eligible population is not known, fitness ratio is not accurately measuring the *probability* of being declared fit

→More flexible approach, not too sensitive to the population level at denominator

= Take a polynomial of degree 4 (quartic) of fitness ratios (assuming population is ok up to a multiplicative constant for each colony), instead of hazard rates

→The same for missing height shares

Height trends models (1)

	All	Senegal + Maurit.	Guinea	Mali	B. Faso	Niger	C. d'Iv.	Benin
Year of birth 1894-1928[(a)]	.0094*	-.0322*	.0072	.0119	.0314	.0277	.0474***	.0061
	(.0052)	(.0177)	(.0138)	(.0092)	(.0188)	(.0356)	(.0117)	(.0121)
Year of birth 1928-1940	.0597***	.1049**	.0899	-.0384	-.0031	.1103	.0743*	.1486***
	(.0215)	(.0468)	(.1025)	(.0386)	(.0474)	(.0926)	(.0440)	(.0441)
District of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth 1894-1928[(a)]	.0046	-.0428**	.0111	.0132	.0220	.0022	.0331**	.0088
	(.0055)	(.0183)	(.0157)	(.0110)	(.0212)	(.0378)	(.0175)	(.0123)
Year of birth 1928-1940	.0372	.1220**	.0492	-.0769*	-.0195	.1120	.0302	.0759**
	(.0210)	(.0460)	(.1065)	(.0406)	(.0563)	(.1103)	(.0471)	(.0323)
Fitness ratio in draft district (quartic)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Missing share in draft distr. (quartic)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N (height non-missing)	37,901	4,467	4,523	7,263	5,291	2,114	7,597	6,646

OLS estimates. Errors are clustered by year of birth. Colony-year specific sample weights are applied.

In bottom panel: 'Fitness ratio' is the ratio of the number of fit (1st and 2nd portions and volunteers) to total population, in the district where the soldier was drafted. 'Missing share' is the ratio of number of fit soldiers whose height was not measured to the total number of fit. A polynomial of degree four of both control variables is introduced in the OLS estimates of the year of birth trends, in order to have a flexible correction for selection into fitness and into missing values for height.

(a): For Benin, Guinea, Mali, where WW1 recruits are well-represented: 1894-1928. For other colonies: 1903-1928.

Height trend models (2)

Global picture of stagnation in height

Significant exceptions seem to be:

- Senegal with a decline; however selection due to child mortality variation should be considered (Rouanet 2015)
- Cote d'Ivoire with a raise, consistent with gains that followed (1930-60, Cogneau & Rouanet 2011); however this figure could still be confounded with increasing height thresholds at fitness exams

→ Further work needed on those two cases

Conclusion

Neither catastrophic decline, nor large improvement for the first half of the 20th century

Does not exclude initial shock

Nor gains in the latest period

Uncertainties linked to selection by mortality and process of recruitment remain

Next steps

Colony-level analysis of trends is not necesarily optimal to obtain relevant variations of height: Forest vs Sahel, Coastal vs landlocked, etc.

Match height evolutions with district-level public investment in health (vaccination rates, dispensaries, medical staff), urbanization and N of europeans, trade…

- Epidemics brought by europeans?
- First decreases in infant mortality → height decreases through selection ?
- Trade (e.g. groundnuts in Senegal) → height increasing income shocks?

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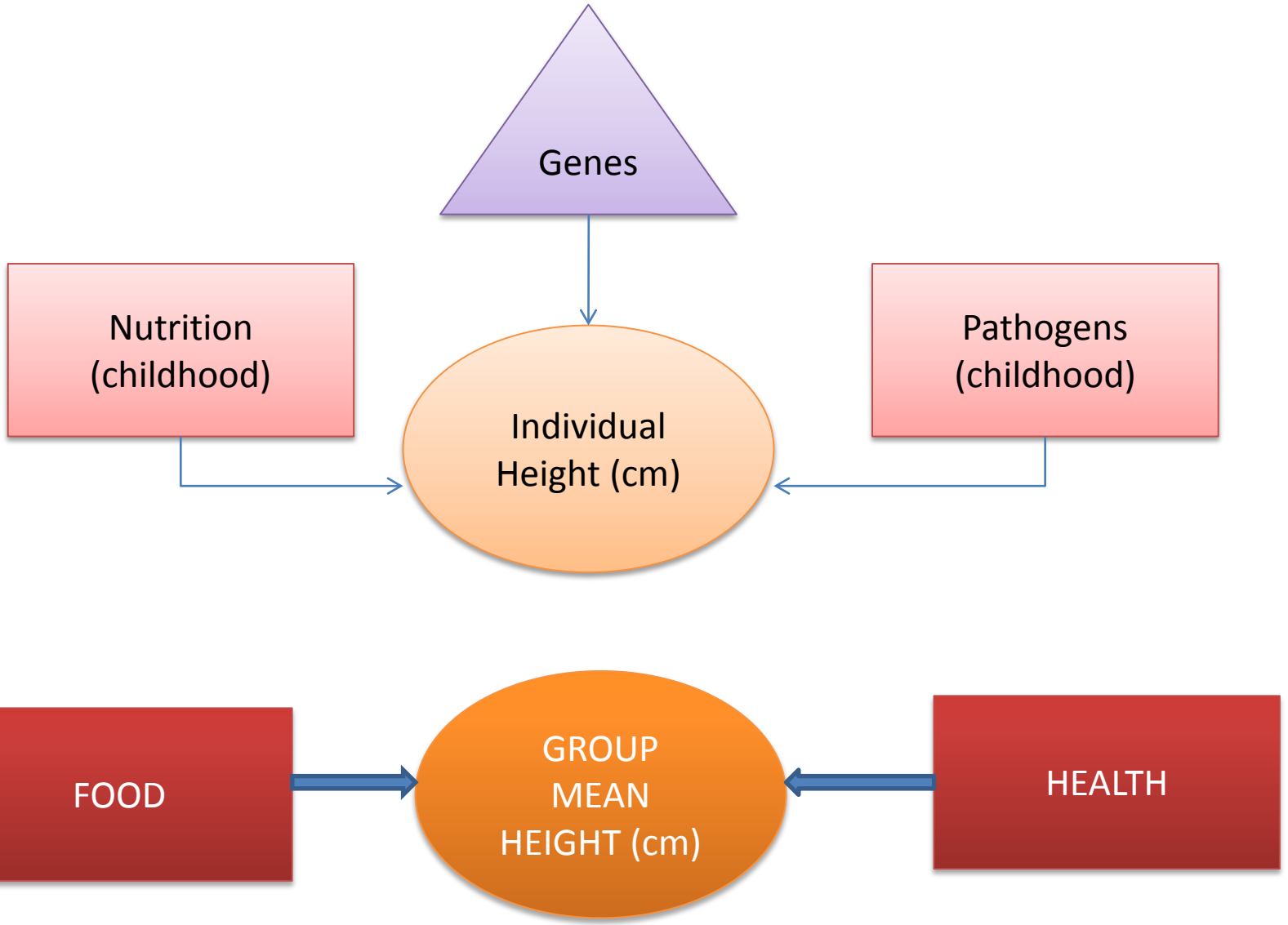
Appendix

Biological living standards: Height



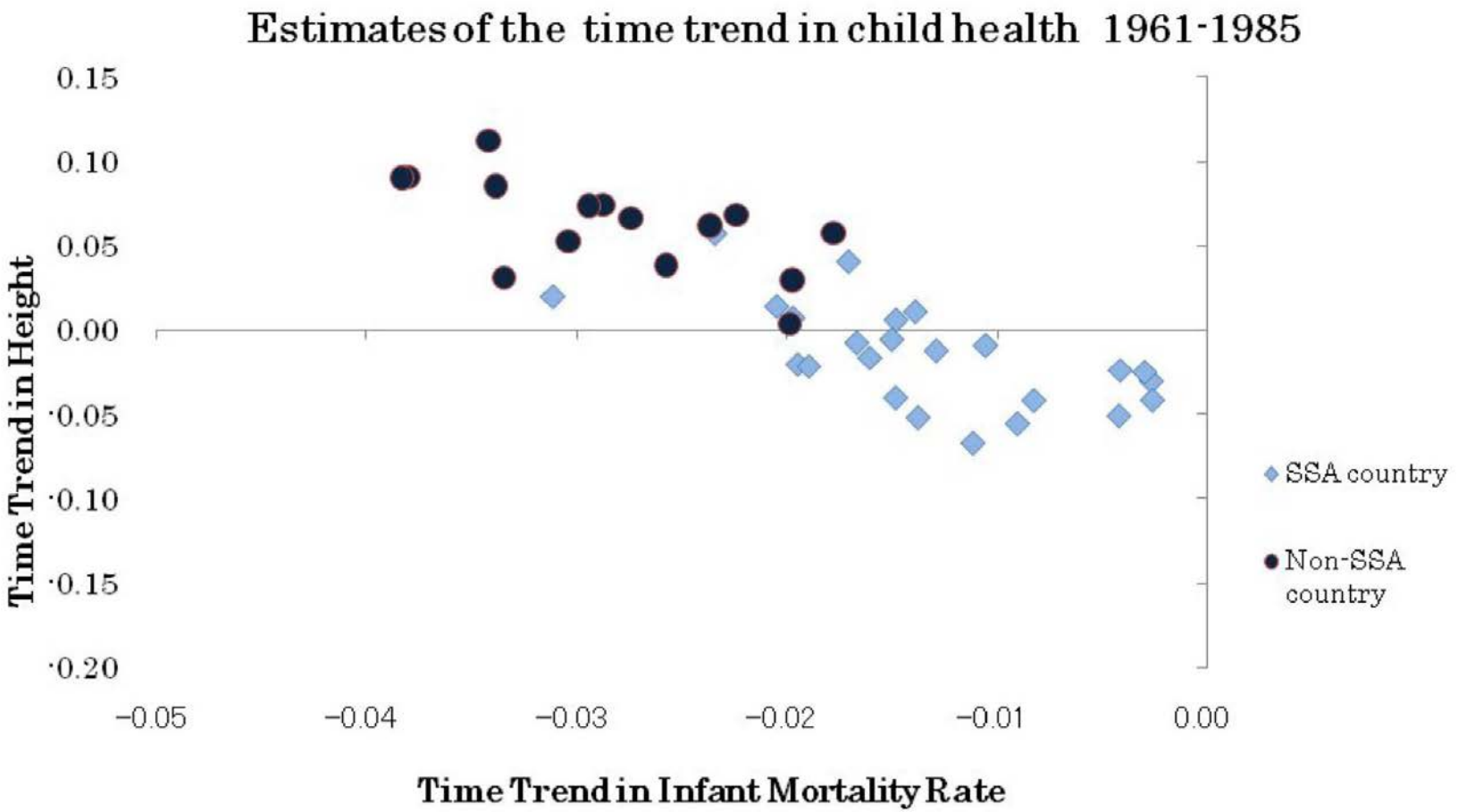
Height in Africa since 1960

A few indications of growth before 1960, then decline (with few exceptions)

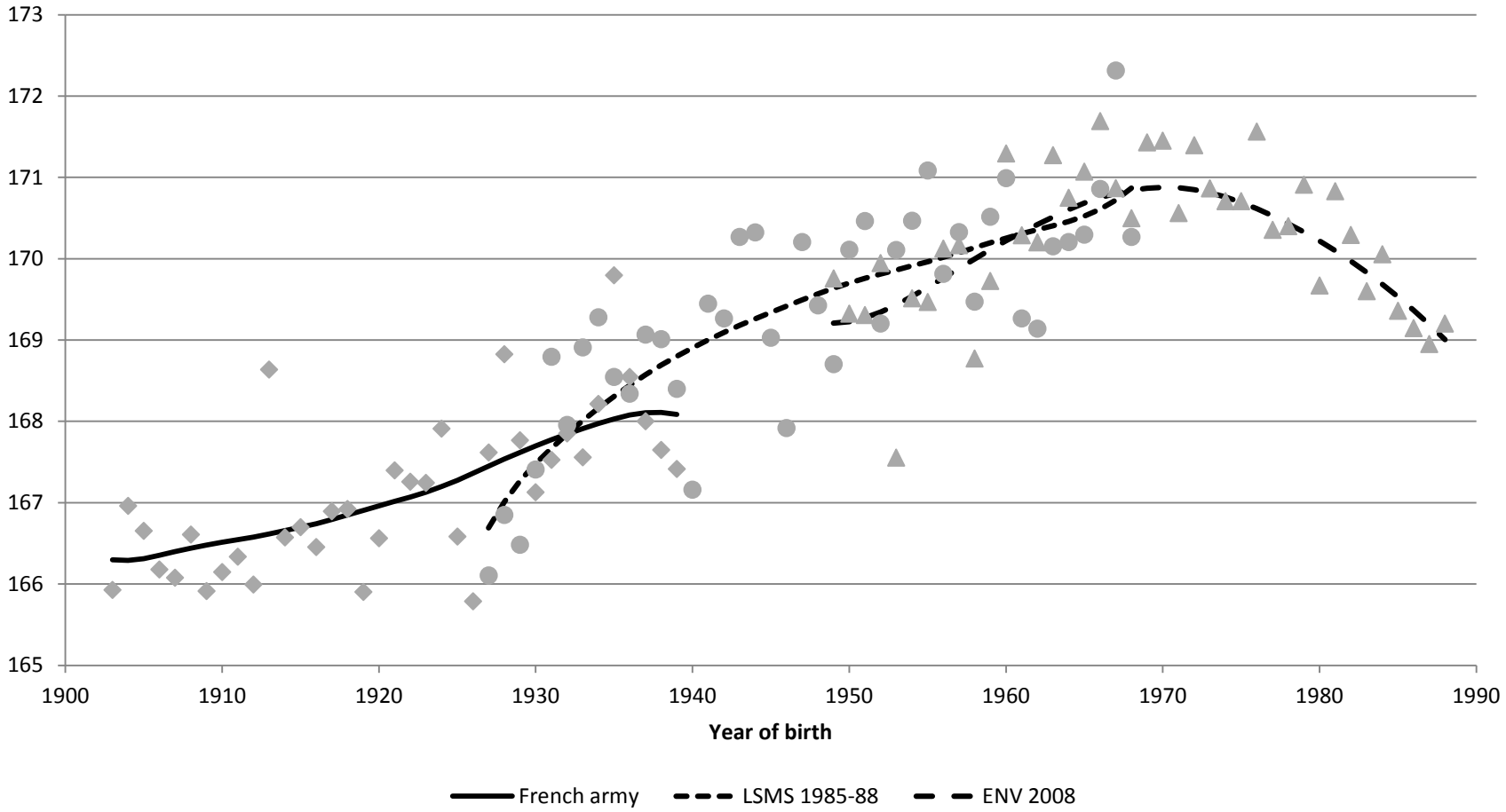
Decreases in infant mortality do not seem to translate the same (not height improving), while protein intakes play the same role as elsewhere (Akachi & Canning 2010)

However, indications of a potentially strong selection effect of decreases in mortality, when starting from high levels (Rouanet 2015)

Akachi & Canning 2010



Cote d'Ivoire in the long run

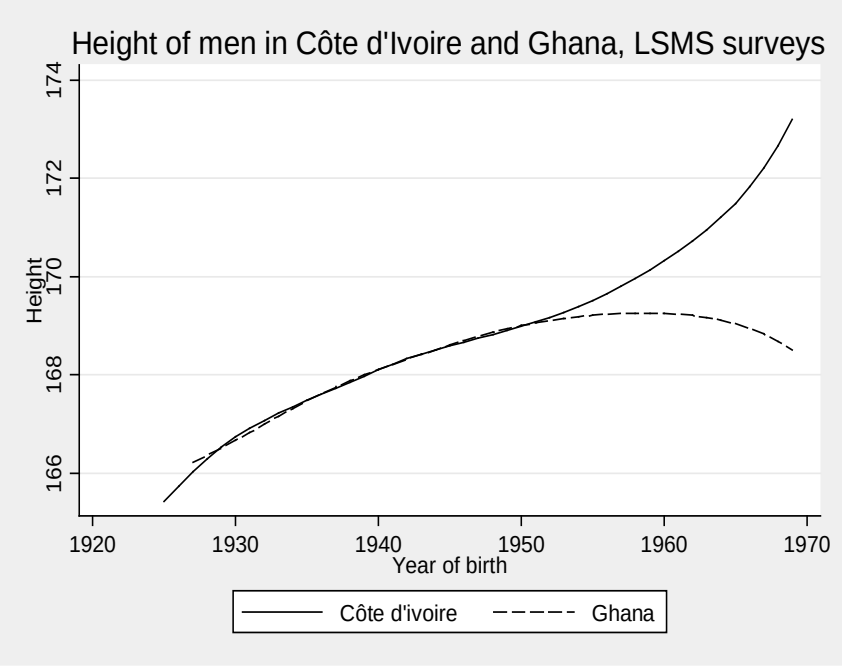


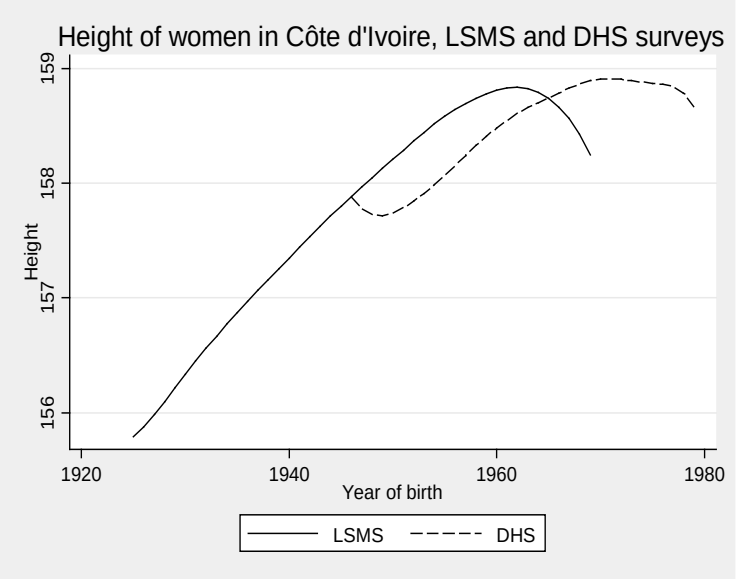
1925-1970: Large height gains

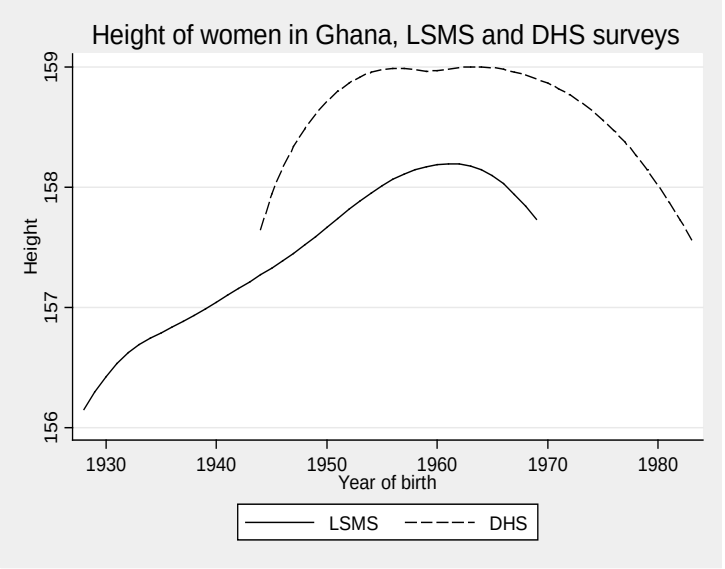
←Cocoa + Urbanization

(Cogneau & Rouanet 2011)

+ Postcolonial divergence







1925-1970: Urbanization & Height

Dependent variable: Height	Côte d'Ivoire		
	I	**II**	**III**
Mother attended school	0.208	0.255	0.301
	(0.614)	(0.606)	(0.600)
Father attended school	0.489	0.298	0.243
	(0.335)	(0.341)	(0.342)
Father Farmer	-1.825	-1.805	-1.714
	(0.262)***	(0.271)***	(0.270)***
Urban density in district of birth at year of birth[a]	0.287	0.380	0.221
	(0.033)***	(0.041)***	(0.055)***
Urban density squared	-.0064	-.0083	-.0047
	(.0010)***	(.0011)***	(.0013)***
Cocoa production density in d. of birth at y. of birth[b]	0.502	1.361	0.837
	(0.275)***	(0.485)***	(0.513)*
Cocoa production squared	-0.176	-0.330	-0.236
	(0.066)***	(0.098)***	(0.105)**
Controls			
Gender	Yes	Yes	Yes
District of birth		Yes	Yes
Year of birth			Yes
Observations		8,266	
R-squared	0.47	0.49	0.49

Errors clustered by district of birth

(Cogneau & Rouanet 2011)

Urbanization: higher private income but also public utilities

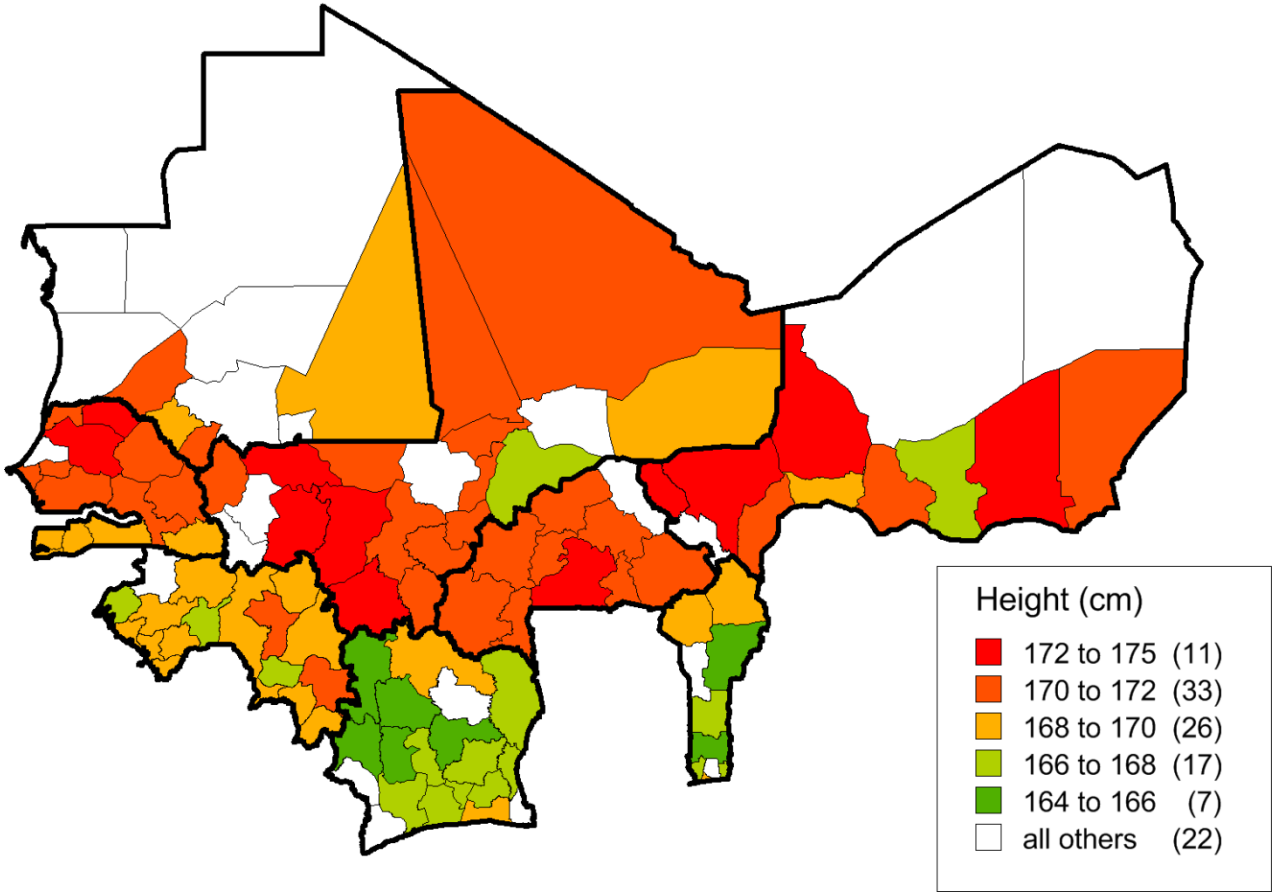
Table 6 – Colonial investments and structural change in 1925-1954 Cote d'Ivoire

	Doctors & nurses[c] per 1,000 km²	Teachers[d] per 1,000 km²
Urban pop. density in area of birth at year of birth[a]	3.102	3.901
	(0.146)***	(0.166)***
Cocoa production density in d. of birth at y. of birth[b]	0.334	0.367
	(0.253)	(0.165)
Controls		
District of birth dummies	Yes	Yes
Year of birth dummies	Yes	Yes
Observations	4,425	
R-squared	0.90	0.90

(Cogneau & Rouanet 2011)

Mean height

Recruits 1924-26 (district of birth)



Mean height

Recruits 1954-56 (district of birth)