

# Replacing a dead child during the Demographic Transition

Mark Gortfelder

Tallinn University

September 9, 2018

# Previous research I

## Classical theoretical view

- Child mortality decline led to the fertility decline (Davis 1945, Notestein 1945)
- Not proved by the Princeton project (Van de Welle 1986)

# Previous research I

## Classical theoretical view

- Child mortality decline led to the fertility decline (Davis 1945, Notestein 1945)
- Not proved by the Princeton project (Van de Welle 1986)

## Recent micro-level studies with event-history methods

- Child deaths do raise the probability for another birth (Bengtsson & Dribe 2006, Kolk 2011, Van Bavel 2003, 2004)
- Only two focusing on this relationship and its change during the transition (Reher et al. 2017, Reher & Sandström 2015)

# Previous research II

## Problems

- Data issues: small datasets from limited areas using family reconstruction

# Previous research II

## Problems

- Data issues: small datasets from limited areas using family reconstruction
- Methodological issues:
  - Standard survival methods unsuited for fertility research (Gray et al. 2010)
  - No distinction between risk (stopping) and duration (spacing) (Alter et al. 2007)

# Research Questions

# Research Questions

- 1 Did child mortality increase the probability of another birth?
- 2 If so, did the relationship change over time?

# Research Questions

- 1 Did child mortality increase the probability of another birth?
- 2 If so, did the relationship change over time?
- 3 Did child mortality decrease the interval to another birth?
- 4 If so, did the relationship change over time?



# Method

Mixture cure model (split-population model)

# Method

Mixture cure model (split-population model)

- Risk (stopping) with the logistic sub-model
- Duration (spacing) with the accelerated-failure time (AFT) sub-model

# Method

Mixture cure model (split-population model)

- Risk (stopping) with the logistic sub-model
- Duration (spacing) with the accelerated-failure time (AFT) sub-model

Rarely used in fertility research (Bremhorst et al. 2016, Alter et al. 2007)

# Study design

## Three cohorts

- 1 Mothers born 1860-1874
- 2 Mothers born 1875-1889
- 3 Mothers born 1890-1901

# Study design

## Three cohorts

- 1 Mothers born 1860-1874
- 2 Mothers born 1875-1889
- 3 Mothers born 1890-1901

## Four parity progressions

- 1  $1 > 2$
- 2  $2 > 3$
- 3  $3 > 4$
- 4  $4 > 5$

In total twelve separate models (+ additional twelve to compare the cure model with the Cox PH model).

# Study variables

- The main variable
  - Number of dead children

# Study variables

- The main variable
  - Number of dead children
- Other variables
  - Sex-composition of the sibset
  - Lactation indicator
  - Time between first and second birth
  - Age of the mother at the start of the interval
  - Birth year of the mother
  - Ethnicity
  - Residence-type of the mother

# Family Registry of the Republic of Estonia

## Main facts

- Kept from 1926 (1920) to 1949
- Also offers retrospective information on pre-1926 events from Church records
- Kept by each municipality on its residents



# Family Registry of the Republic of Estonia

## Main facts

- Kept from 1926 (1920) to 1949
- Also offers retrospective information on pre-1926 events from Church records
- Kept by each municipality on its residents

## Limitations

- Coverage and selectivity issues that grow going back in time
- Not all residents accounted in every municipality
- Losses due to war

## Sample sizes for the separate models

Women with biological, legitimate, singleton live births and no data quality issues

Table 1: Number of mothers by parity progression and birth cohort

Cohort	1>2	2>3	3>4	4>5
b. 1860-1874	26439	23848	19028	14086
b. 1875-1889	49040	41989	30168	20194
b. 1890-1901	46548	35072	20907	11650

# Demographic transition in Estonia I

- Fertility decline lagged mortality decline only a little
- Early transition - 10% fertility decline by 1888

# Demographic transition in Estonia I

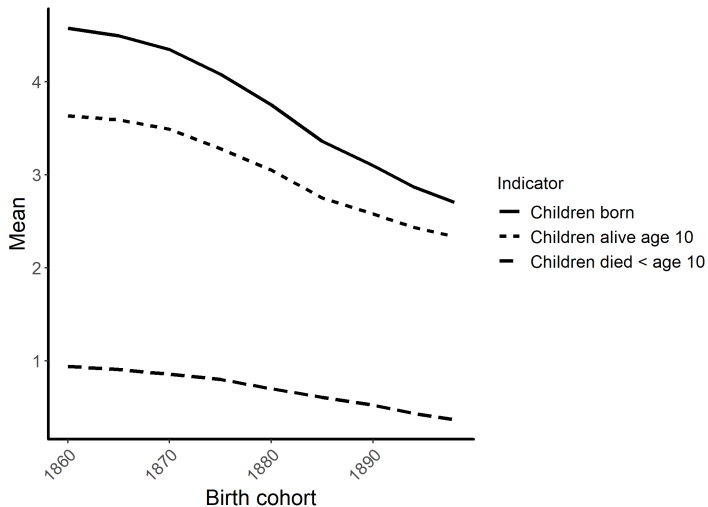
- Fertility decline lagged mortality decline only a little
- Early transition - 10% fertility decline by 1888
- Population in urban areas: 1897 1/5, 1940 1/3
- Mass literacy by 1881

# Demographic transition in Estonia I

- Fertility decline lagged mortality decline only a little
- Early transition - 10% fertility decline by 1888
- Population in urban areas: 1897 1/5, 1940 1/3
- Mass literacy by 1881
- Pioneering areas - towns and South Estonia
- Pioneering group - Baltic-Germans?

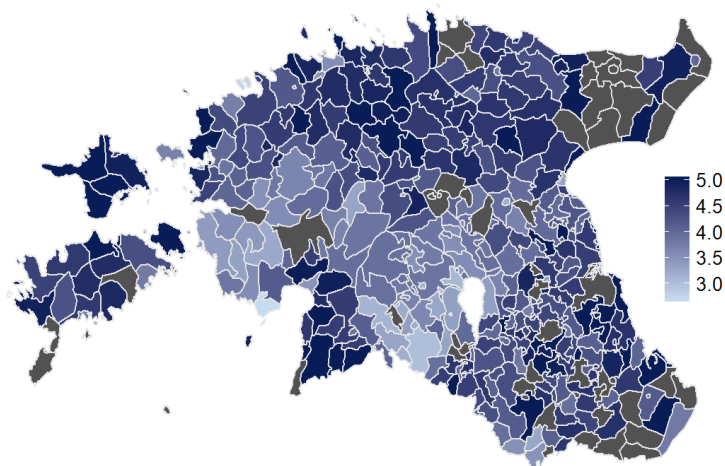
# Demographic transition in Estonia II

- Figure 1. Key indicators based on the study population



## Spatial differences

- Figure 2. Mean number of children for women born 1860-1879



## Risk sub-model of the mixture cure model

Table 2: Results for the risk sub-model (logistic regression) for all cohorts and parity progressions

Cohort	Dead children	1>2	2>3	3>4	4>5
1860-74	1	3.158*	1.896*	1.263*	0.985
	2(+)		5.274*	2.357*	1.503*
1875-89	1	3.691*	2.095*	1.372*	1.146*
	2(+)		7.227*	2.688*	1.560*
1890-01	1	4.372*	2.268*	1.409*	1.027
	2(+)		7.440*	2.637*	1.430*

Note: \* $p < 0.001$



## Duration sub-model of the mixture cure model

Table 3: Results for the duration sub-model (AFT) for all cohorts and parity progressions

Cohort	Dead children	1>2	2>3	3>4	4>5
1860-74	1	0.666*	0.912*	0.957*	0.989
	2(+)		0.701*	0.848*	0.966
1875-89	1	0.746*	0.921*	0.955*	0.965
	2(+)		0.749*	0.845*	0.932*
1890-01	1	0.750*	0.890*	0.939*	0.967
	2(+)		0.659*	0.839*	0.958

Note: \* $p < 0.001$

# Comparison of fit

Table 4: Akaike Information Criterion (AIC) for the respective models

Model	Cohort	1>2	2>3	3>4	4>5
Cure	1860-74	205358	178028	136288	95268
	1875-89	374009	298327	204570	131422
	1890-01	332598	222206	126883	69005
Cox	1860-74	436534	362226	264819	177477
	1875-89	816655	608592	396838	243049
	1890-01	673573	417445	224169	116311

## Answers to the research questions

- ① Child deaths increased probability for another birth
- ② This effect grew stronger during the transition

## Answers to the research questions

- 1 Child deaths increased probability for another birth
- 2 This effect grew stronger during the transition
- 3 Child deaths decreased the interval to another birth
- 4 No clear picture on the change during the transition

Thank you!



**EUROPEAN UNION**  
European Regional Development Fund