Social mobility and mortality in southern Sweden (1813-1910): a Cox model application

EPC Conference 2016 – Mainz, Germany

Paolo Emilio Cardone - *Sapienza University of Rome - ISFOL*
Joan Pau Jordà - *Centre d'Estudis Demogràfics (CED), Barcelona*

1 September 2016

Aims

Aim of this research project is to seek the influence of how **inter generational social mobility affected mortality** patterns in southern Sweden, covering the transition from preindustrial to a breakthrough industrial society.

Social Economical Status (**SES**) **does not affect substantially life expectancy** of Swedish population in the XIXth century, instead of this, other variables, such as public health measures or education, were key factors (Bengtsson: 2010; Bengtsson and Van Poppel: 2011; Bengtsson and Dribe:2011; Dribe, Helgertz, Van de Putte: 2013).

Could it be possible that other socio-economic factors, such as the **intergenerational mobility**, may affect positively life expectancy?

Data and Methods

A dataset comprised by 80.966 observations of 3.385 individuals between 1813 and 1910 from the Scanian Economic-Demographic Database (**SEDD**) is going to be used.

The database is based on local population registers for five rural Scanian coast **parishes** (Hög, Kävlinge, Halmstad, Sireköpinge, and Kågeröd).

Historical periods:

1. **preindustrial period**: 1813-1869;
2. **early industrial period**: 1870-1894;
3. **the first part of the breakthrough of industrialization**: 1895-1910

Key Variable

Key variable: **SOCIAL MOBILITY**

Is defined as **the chances of an individual, at age 35, to have or not the same SES of his father**, according to SOCPO codification.

GEN UP/DOWN/NO MOBILITY VARIABLE

```
gen mobility = birthsocpo-socpoThirtyFive
replace mobility = -1 if mobility<-1
replace mobility = 1 if mobility>1 & mobility~=.

label define moblbl -1 "upward" 0 "no mobility" 1 "downward"
label values mobility moblbl
```

Data and Methods: Variables (1)

Analyzed Variables:

Social mobility (*mobility*). Categorical. Three possible status: upward (positive change from SOCPO at birth to SOCPO at age 35 c.), no mobility (equal position in both moments) and downward (a negative change).

Social status (*birthsocpo*). Categorical. Five Social Power Levels. These levels are labelled 'elite' (SOCPO 5), 'middle class' (SOCPO 4), 'skilled workers' (SOCPO 3), 'semiskilled workers' (SOCPO 2) and 'unskilled workers' (SOCPO 1).

Historical periods (*period*). Categorical. From 1813 to 1869 (1), between 1870 and 1894 (2), above this period (3).

Data and Methods: Variables (2)

- **Individual household size** (*HouseholdSizeCat*). Categorical. For possible status according to a quartile distribution: household composed by less than 5 members (1), between 6 and 10 (2), from 11 to 30 (3) and more than 31 (4).

- **Migration** (*migration*). Categorical. Dummy variable: 0 no migrant, 1 migrant from abroad.

- **Marital status** (*married*). Categorical. Dummy variable: 0 not married, 1 married.

- **Gender** (*Sex*). Categorical. Dummy variable: 'Female' and 'Male'.

Descriptives analysis (1)

```
. tab mobility birthsocpo
```

mobility	birthsocpo Unskilled	Semi-skil	Skilled	Middle cl	Elite	Total
upward	7,243	8,971	1,513	1,619	0	19,346
no mobility	6,202	6,766	1,449	14,532	899	29,848
downward	0	9,244	2,638	18,129	1,761	31,772
Total	13,445	24,981	5,600	34,280	2,660	80,966

```
. tab mobility period
```

mobility	period 1813-1869	1870-1894	1895-1910	Total
upward	6,141	8,443	4,762	19,346
no mobility	11,443	12,588	5,817	29,848
downward	9,726	16,291	5,755	31,772
Total	27,310	37,322	16,334	80,966

Descriptives analysis (2)

```
. tab mobility married
```

mobility	married: Not Marri	Married	Total
upward	6,821	12,525	19,346
no mobility	9,632	20,216	29,848
downward	10,658	21,114	31,772
Total	27,111	53,855	80,966

```
. tab mobility HouseholdSizeCat
```

mobility	HouseholdSizeCat: <6	6 to 10	11 to 30	>30	Total
upward	5,661	6,962	3,526	3,197	19,346
no mobility	8,057	10,280	6,222	5,289	29,848
downward	7,082	8,218	5,599	10,873	31,772
Total	20,800	25,460	15,347	19,359	80,966

Descriptives analysis (3)

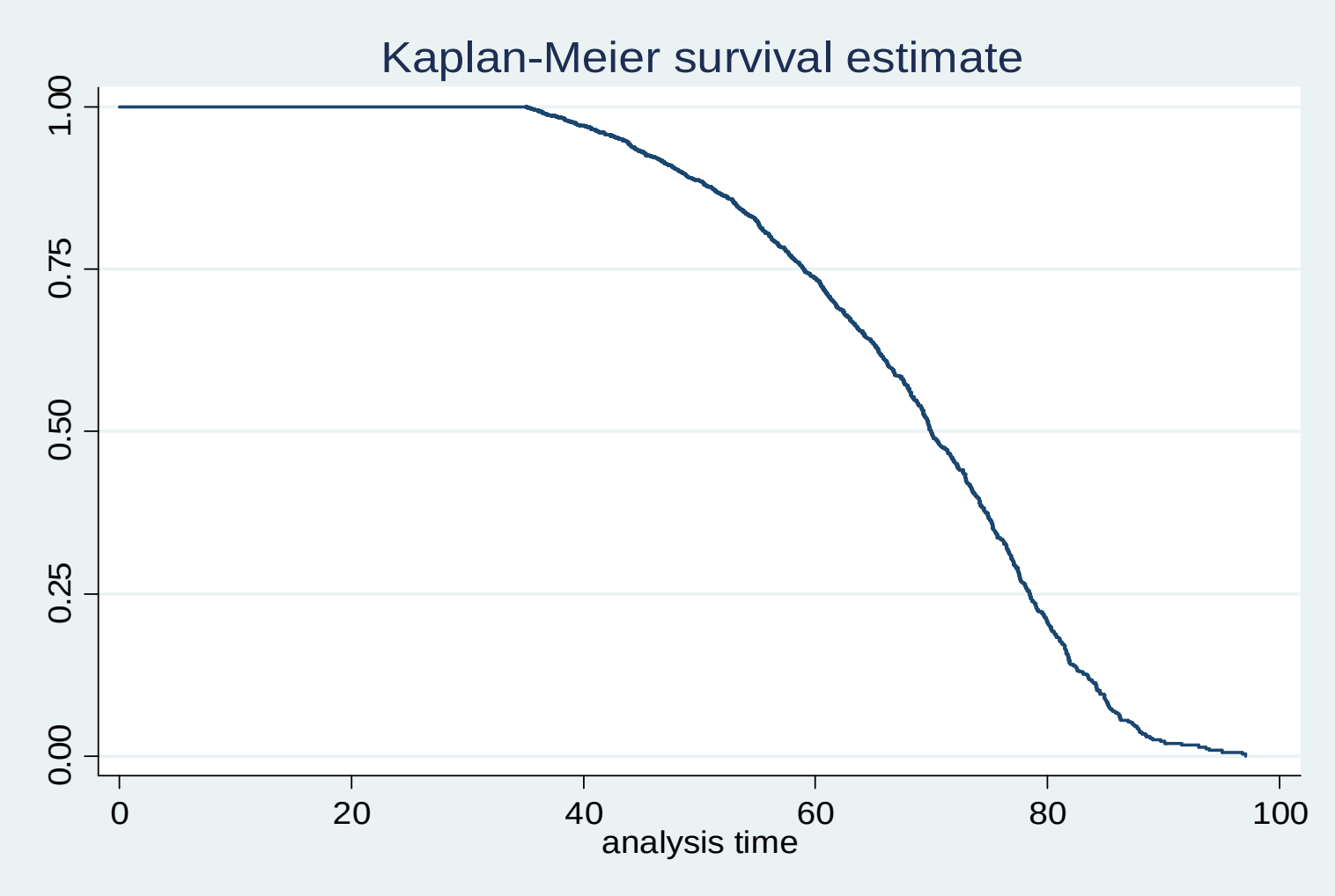
```
. tab mobility migration
```

mobility	migration: Not Migra	Migration	Total
upward	18,085	40	18,125
no mobility	25,605	11	25,616
downward	29,886	30	29,916
Total	73,576	81	73,657

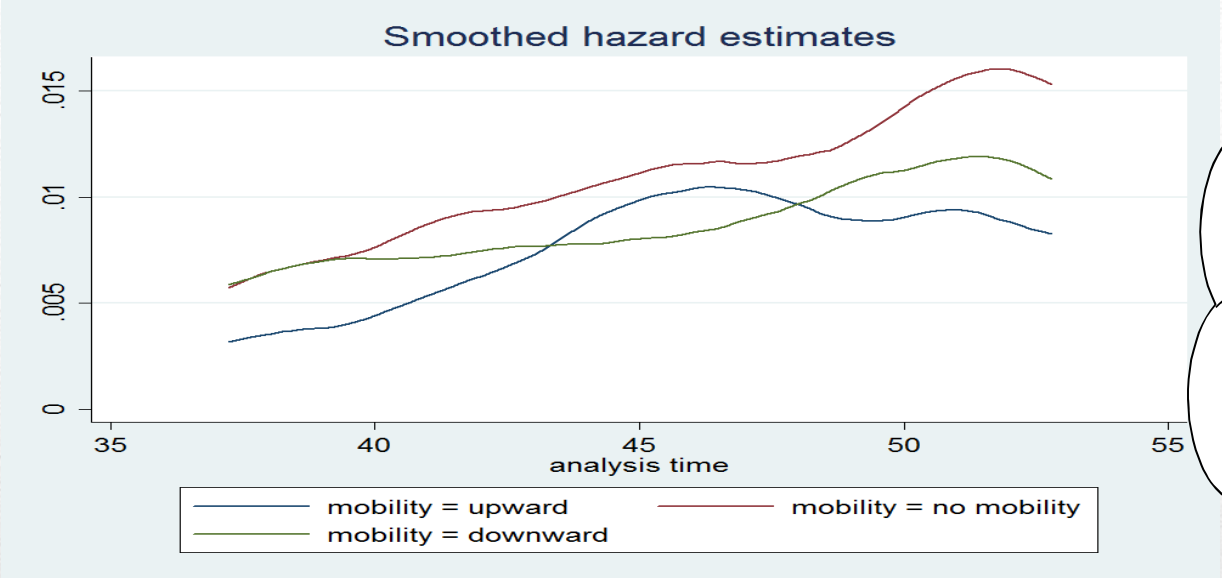
```
. tab mobility Sex
```

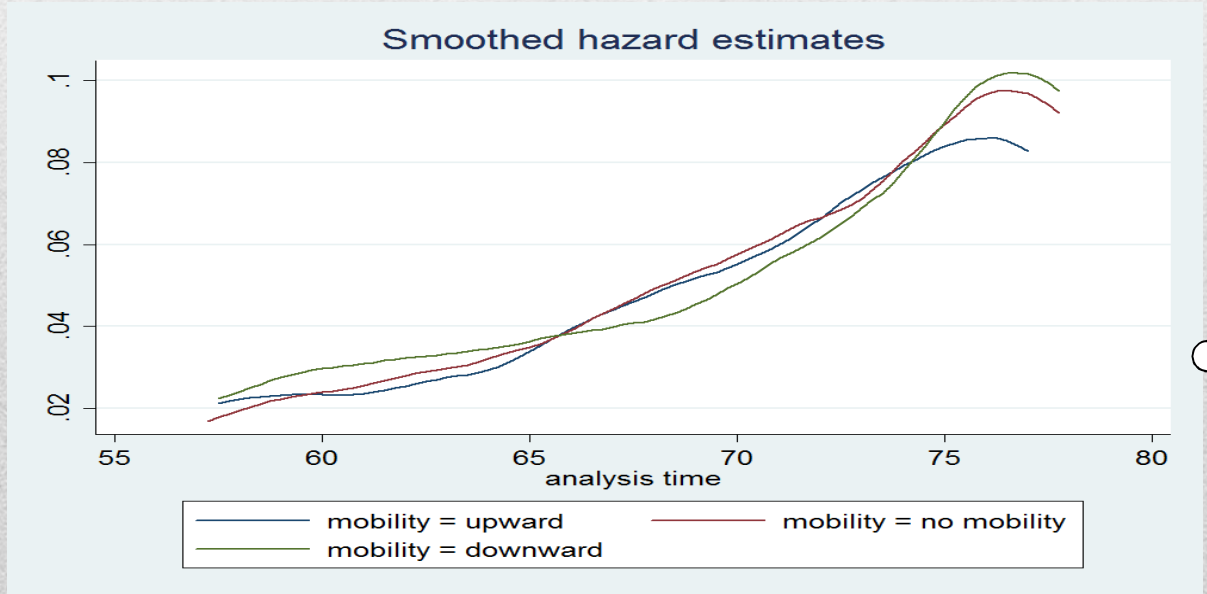
mobility	Sex: Female	Male	Total
upward	9,227	10,119	19,346
no mobility	14,931	14,917	29,848
downward	15,789	15,983	31,772
Total	39,947	41,019	80,966

Kaplan – Meier (Survival Analysis at 35)



Results: hazard proportional assumption





Despite scale graphs are not equal, it could be observed that after age 55 social mobility **does not respect hazard proportionality assumption**

Cox Proportional Hazard model (1)

- A **Cox Proportional Hazard** model is going to be applied in order to estimate the influence of social mobility and other possible mortality determinants.

$$\ln h_i(a) = \ln h_0(a) + \beta x_i$$

- Where *hi(a)* is the hazard of death for an individual *i* at duration (age) *a*, *h0(a)* is the baseline hazard, i.e. the hazard function for an individual having the value zero on all covariates, and β is the vector of parameters for the individual covariates (*xi*).

Cox Proportional Hazard model (2)

- Concretely, we start by estimating a full model which, in addition to social mobility status, includes all the others above mentioned variables (MODEL 1):

$$\ln h_i(a) = \ln h_0(a) + \beta mobility_i + \beta gender_i + \beta marital\ status_i + \beta period_i + \beta inmigrant_i + \beta SOCPO\ at\ birth_i + \beta household\ size_i$$

- Where hi(a) is the hazard of death for an individual i at duration (age) a, h0(a) is the baseline hazard, i.e. the hazard function for an individual having the value zero on all covariates, and β is the vector of parameters for the individual covariates (x*i*).

Estimating Cox Model

xi: stcox i.mobility i.Sex i.married i.period i.migration i.birthsocpo i.HouseholdSizeCat if _t0>=35 & _t0<55

i.mobility	mobility_1-3	(mobility_2 for mobility==0 omitted)
i.Sex	Sex_1-2	(Sex_1 for Sex==Female omitted)
i.married	married_0-1	(married_0 omitted)
i.period	period_1-3	(period_1 for 1813-1869 omitted)
i.migration	migration_0-1	(migration_0 omitted)
i.birthsocpo	birthsocp_1-5	(birthsocp_1 omitted)
i.HouseholdSize	Household_1-4	(Household_1 omitted)

Full Model

xi: stcox i.mobility i.Sex i.married i.period i.migration i.birthsocpo i.HouseholdSizeCat if _t0>=35 & _t0<55

_t	Haz. Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_Imobility_1	.6634897	.1066946	-2.55	0.011	.484121	.9093151
_Imobility_3	.8684816	.1211006	-1.01	0.312	.6607993	1.141436
_ISex_2	.9606922	.111195	-0.35	0.729	.7657063	1.205331
_Imarried_1	.7800335	.0936278	-2.07	0.038	.6165141	.9869234
_Iperiod_2	.8289981	.1096794	-1.42	0.156	.6396413	1.074411
_Iperiod_3	.752649	.1197829	-1.79	0.074	.5509664	1.028158
_Imigration_1	1.493084	1.501368	0.40	0.690	.2080462	10.71541
_Ibirthsocp_2	.8563077	.1489238	-0.89	0.372	.6089675	1.204108
_Ibirthsocp_3	.4929653	.1551466	-2.25	0.025	.2660267	.9134978
_Ibirthsocp_4	.7637281	.142553	-1.44	0.149	.5297347	1.10108
_Ibirthsocp_5	.506682	.2452375	-1.40	0.160	.1962222	1.308347
_IHousehold_2	1.135788	.1502069	0.96	0.336	.8764495	1.471865
_IHousehold_3	1.124264	.2150675	0.61	0.540	.7727455	1.635686
_IHousehold_4	1.406807	.3384099	1.42	0.156	.8779631	2.2542

Full Model: hazard proportionality assumption

xi: stcox i.mobility i.Sex i.married i.period i.migration i.birthsocpo i.HouseholdSizeCat if _t0>=35 & _t0<55

Test of proportional-hazards assumption

Time: Time

	rho	chi2	df	Prob>chi2
_Imobility_1	0.02082	0.13	1	0.7180
_Imobility_3	-0.05538	0.97	1	0.3236
_ISex_2	0.05585	0.93	1	0.3344
_Imarried_1	-0.08890	2.51	1	0.1132
_Iperiod_2	0.04642	0.64	1	0.4226
_Iperiod_3	0.04069	0.50	1	0.4806
_Imigratio~1	0.00173	0.00	1	0.9758
_Ibirthsoc~2	-0.03618	0.38	1	0.5393
_Ibirthsoc~3	-0.02001	0.12	1	0.7248
_Ibirthsoc~4	-0.03663	0.44	1	0.5069
_Ibirthsoc~5	-0.01848	0.10	1	0.7462
_IHousehol~2	0.11128	4.08	1	0.0433
_IHousehol~3	0.12037	4.43	1	0.0353
_IHousehol~4	0.04698	0.66	1	0.4170
global test		13.39	14	0.4961

Interaction Mobility * Period

xi: stcox i.mobility*i.period i.Sex i.married i.migration i.birthsocpo i.HouseholdSizeCat if _t0>=35 & _t0<55

_t	Haz. Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_Imobility_1	.7602018	.1884314	-1.11	0.269	.467672	1.23571
_Imobility_3	1.01247	.2131648	0.06	0.953	.6701477	1.529655
_Iperiod_2	.988569	.1953313	-0.06	0.954	.6711478	1.456116
_Iperiod_3	.8075466	.1985646	-0.87	0.385	.4987339	1.307574
_ImobXper_1_2	.7653349	.2639675	-0.78	0.438	.3892855	1.504648
_ImobXper_1_3	.8591597	.3437019	-0.38	0.704	.3922434	1.881881
_ImobXper_3_2	.7087474	.210664	-1.16	0.247	.3958086	1.269105
_ImobXper_3_3	.9023311	.3233012	-0.29	0.774	.4470789	1.821158
_ISex_2	.961113	.1112483	-0.34	0.732	.7660346	1.20587
_Imarried_1	.7814222	.0939274	-2.05	0.040	.617406	.9890101
_Imigration_1	1.48954	1.498198	0.40	0.692	.2074447	10.69552
_Ibirthsocp_2	.8603348	.150423	-0.86	0.390	.610719	1.211975
_Ibirthsocp_3	.4909421	.1546706	-2.26	0.024	.2647649	.9103326
_Ibirthsocp_4	.7643658	.1428405	-1.44	0.150	.5299481	1.102476
_Ibirthsocp_5	.5010898	.2427553	-1.43	0.154	.1938863	1.295043
_IHousehold_2	1.13661	.1503495	0.97	0.333	.877032	1.473016
_IHousehold_3	1.128979	.2160943	0.63	0.526	.7758181	1.642902
_IHousehold_4	1.429006	.3446643	1.48	0.139	.8906995	2.292644

Interaction Mobility * Birthsocpo

xi: stcox i.mobility* i.birthsocpo i.period i.Sex i.married i.migration i.HouseholdSizeCat if _t0>=35 & _t0<55

_t	Haz. Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_Imobility_1	.7321115	.194783	-1.17	0.241	.4346199	1.233232
_Imobility_3	1.217959	1.36539	0.18	0.860	.1353305	10.96149
_Ibirthsocp_2	.7123051	.1886348	-1.28	0.200	.4238853	1.196971
_Ibirthsocp_3	.7803101	.3323784	-0.58	0.560	.3386041	1.798218
_Ibirthsocp_4	.8966663	.2075091	-0.47	0.637	.5696962	1.411297
_Ibirthsocp_5	.4101085	.4185178	-0.87	0.382	.0554936	3.030779
_ImobXbir_1_2	.9962517	.3721073	-0.01	0.992	.4791143	2.071567
_ImobXbir_1_3	.600547	.4463662	-0.69	0.493	.1399193	2.577604
_ImobXbir_1_4	1.398563	.7052824	0.67	0.506	.5205096	3.757812
_ImobXbir_1_5	1	(omitted)				
_ImobXbir_3_2	1.23765	1.420991	0.19	0.853	.1304076	11.74608
_ImobXbir_3_3	.2645572	.3481875	-1.01	0.312	.0200558	3.489781
_ImobXbir_3_4	.5409728	.6147757	-0.54	0.589	.0583241	5.017683
_ImobXbir_3_5	1	(omitted)				
_Iperiod_2	.8044799	.1067741	-1.64	0.101	.6202118	1.043495
_Iperiod_3	.715662	.1152111	-2.08	0.038	.5220077	.9811581
_ISex_2	.9590931	.1110933	-0.36	0.718	.7643015	1.20353
_Imarried_1	.784997	.094403	-2.01	0.044	.6201594	.9936484
_Imigration_1	1.479722	1.493987	0.39	0.698	.2045373	10.70503
_IHousehold_2	1.121478	.1486186	0.87	0.387	.8649466	1.454093
_IHousehold_3	1.070551	.20606	0.35	0.723	.7341214	1.561158
_IHousehold_4	1.371714	.3311933	1.31	0.191	.8545656	2.20182

Interaction Mobility * Married

xi: stcox i.mobility* i.married i.birthsocpo i.period i.Sex i.migration i.HouseholdSizeCat if _t0>=35 & _t0<55

_t	Haz. Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_Imobility_1	.6999071	.173481	-1.44	0.150	.4305853	1.137684
_Imobility_3	.8046534	.1765057	-0.99	0.322	.5234709	1.236873
_Imarried_1	.7623715	.1389452	-1.49	0.137	.5333739	1.089686
_ImobXmar_1_1	.9146301	.2836356	-0.29	0.774	.4980578	1.679621
_ImobXmar_3_1	1.131734	.3080914	0.45	0.649	.6637772	1.929597
_Ibirthsocp_2	.8540189	.1486167	-0.91	0.365	.607213	1.201141
_Ibirthsocp_3	.4925316	.1550371	-2.25	0.024	.2657641	.912792
_Ibirthsocp_4	.7626438	.1423441	-1.45	0.147	.5289915	1.099499
_Ibirthsocp_5	.514562	.2492002	-1.37	0.170	.199161	1.329447
_Iperiod_2	.8306975	.1099687	-1.40	0.161	.6408551	1.076778
_Iperiod_3	.7550334	.1202439	-1.76	0.078	.5525948	1.031634
_ISex_2	.9607254	.1112466	-0.35	0.729	.7656582	1.20549
_Imarried_1	1	(omitted)				
_Imigration_1	1.489758	1.498465	0.40	0.692	.2074622	10.69775
_IHousehold_2	1.134423	.1500336	0.95	0.340	.8753852	1.470115
_IHousehold_3	1.12045	.2144683	0.59	0.552	.7699487	1.630509
_IHousehold_4	1.405409	.3381192	1.41	0.157	.8770354	2.252104

.

Conclusions and discussion

Results confirm previous studies, showing that SES has not a significant effect on mortality during the studied period (Bengtsson: 2011; Bengtsson and Van Poppel: 2011)

Other variables, as marital status, are more explanatory

The model results could indicate that <u>intergenerational upward mobility</u> have a positive impact in terms of mortality reduction

Future studies should consider the importance of social mobility on mortality controlling by other socio economic variables (e.g. HISCLASS, HISCO) as well as redefining the idea of social mobility in a more fitted concept

References

Bengtsson, T. et al. 2004, Life under Pressure. *MIT Press*, Appendix.

Bengtsson/Dribe (2010). Quantifying the Family Frailty Effect in Infant and Child Mortality by Using Median Hazard Ratio (MHR). The Case of Rural Sweden, 1766–1895. Historical Methods: A Journal of Quantitative and Interdisciplinary History Volume 43, Issue 1, 2010.

Bengtsson, T. and Dribe, M, 2011. The late emergence of socioeconomic mortality differentials: A micro-level study of adult mortality in southern Sweden 1815-1968, *Explorations in Economic History*, Vol. 48:3, 389-400.

Bengtsson, T. and van Poppel, F. 2011. Socioeconomic inequalities in death from past to present: An introduction, *Explorations in Economic History,* Vol. 48:3, 342-356.

Dribe, M., J. Helgertz and B. van de Putte (2013). Intergenerational social mobility during industrialization: A micro-level study of a transforming community in southern Sweden 1830-1968. *Unpublished manuscript.*

Gagnon et. Al. (2011). Once were farmers: Occupation, social mobility, and mortality during industrialization in Saguenay-Lac-Saint-Jean, Quebec 1840–1971. Explorations in Economic History Volume 48, Issue 3, July 2011, Pages 429–440.

Thank you for your attention!

For questions, doubts, comments, please contact:

Paolo Emilio Cardone (paoloemilio.cardone@uniroma1.it)
Joan Pau Jordà (jpjorda@ced.uab.es)