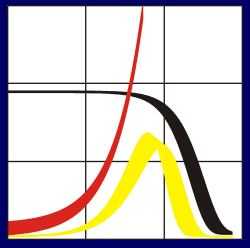


Max Planck Institute for Demographic Research

Backcasting National Transfer Accounts in Sweden from 1800 to 2000 (Still work in progress)

Thomas Lindh Gustav Oeberg Miguel Sánchez-Romero

Institute for Future Studies

Laboratory for Economic and Social Demography (MPIDR)

Motivation

The Reconstruction of the Economy and Transfers

Swedish economy 1800-2000

Model

NTA Backcasting

Why?

Historical Transfers could shed light on the accumulation of physical and human capital

- Endogenous growth theories (Romer, 1986; Lucas, 1988)

Bad news!

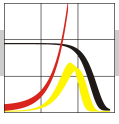
- Lack of historical microdata prevent us to reconstruct age profiles of transfers

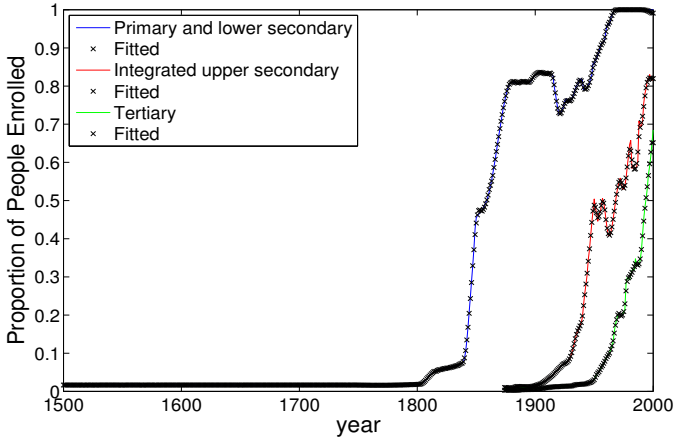
Good news!

- There exists large time series of National Accounts for some countries
  - Publicly provided goods and services
  - Taxes (?)
- There exists good demographic information even before XX century for some countries
  - Family reconstruction$\rightarrow$ household size, number of siblings, orphans, etc..

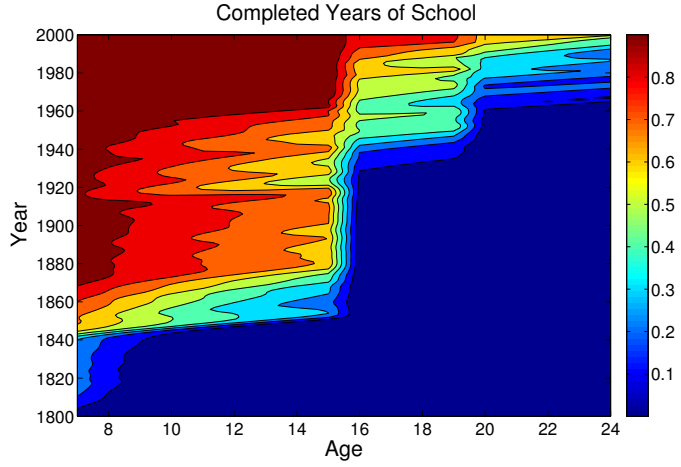
To reconstruct the economy we have done the following steps:

1. Reconstruction of the population (HMD and HFD)
2. Reconstruction of input factors (NA, Edvisson, R. (2005), and many others)
3. Reconstruction of transfers
   - Education
   - Health
   - Childrearing cost
   - Old-age support (public and private)
   - Taxes, contributions, and familial costs of supporting elderly people.

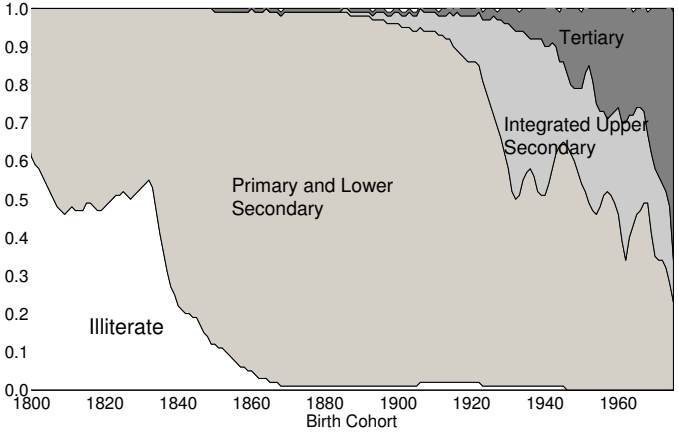




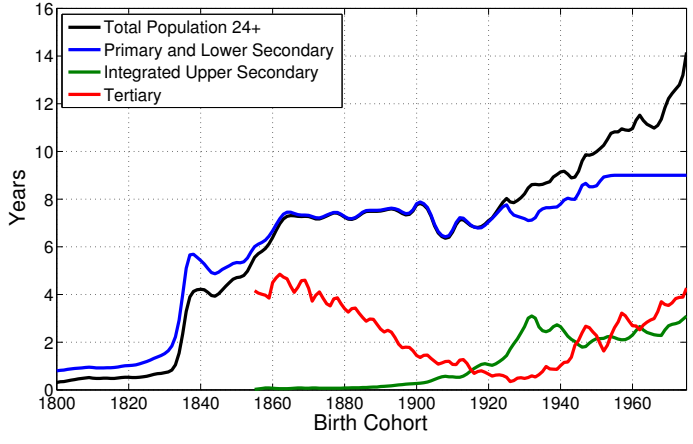
(a) Actual (-) and Fitted (x) Proportion of People Enrolled by Education Level



(b) Transition by Age



(c) Educational Transition



(d) Average Number of Years by Education Level

Figure: The Educational Transition in Sweden, 1800-2000.

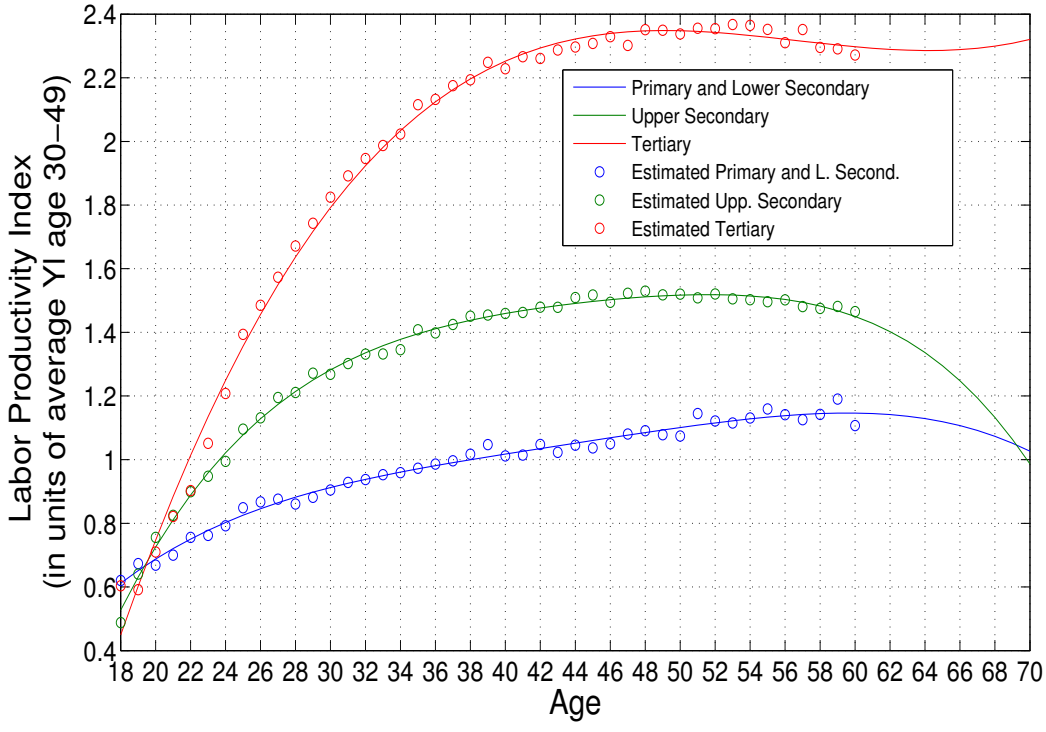
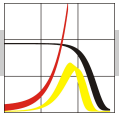


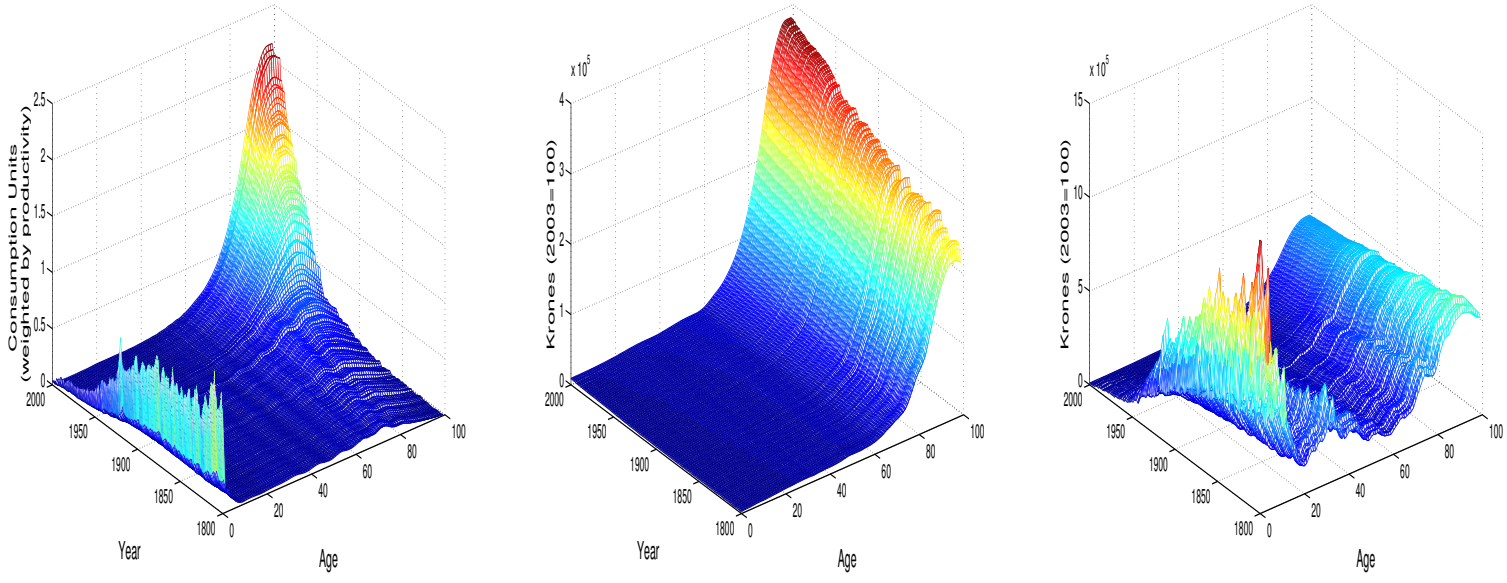
Figure: Age-specific productivity Index by Education level, US 1962-2010.

Source: IPUMS-CPS and own calculations.



Health Care Costs:

Assumption: Health care expenditures per capita are correlated with mortality (Breyer, Lorenz, Niebel, 2011)

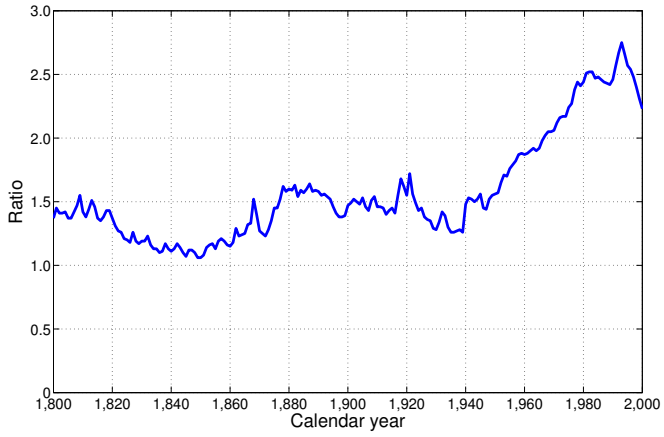


(a) q(x) (b) log(m(x)) (c) m(x)

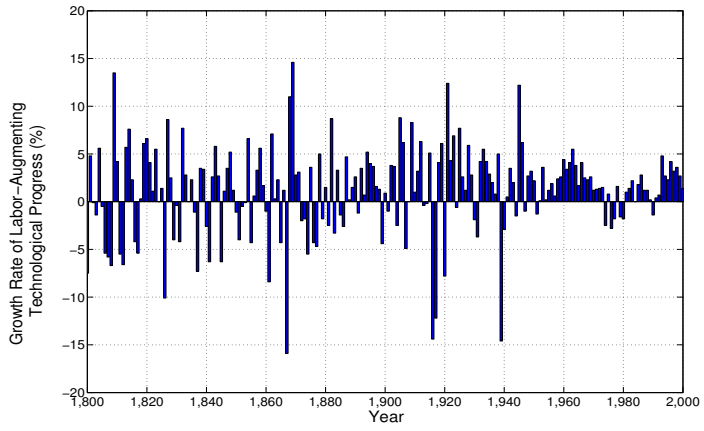
Figure: Underlying Health Care Expenditures per capita in Sweden, 1800-2000.

Pension Reforms

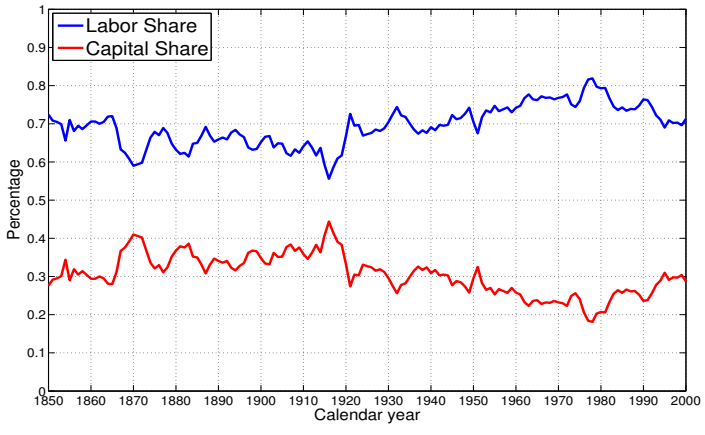
- 1913: first compulsory public old-age pension insurance, defined-contribution funded system with a means-testing component (11.3% of the average income of an industrial worker).
- 1935: the old-age pension system switched from a fully funded system to a pay-as-you-go system.
- 1945: first universal system, which abolished means-testing (People's Pension).
- 1960: a general complementary pension benefit was implemented, known as ATP. The ATP component of the pension benefit followed the rule 30-60-15.
- 1994: notional defined pension system (NDC). 16% (NDC), 2.5% (FFP), and (GP).



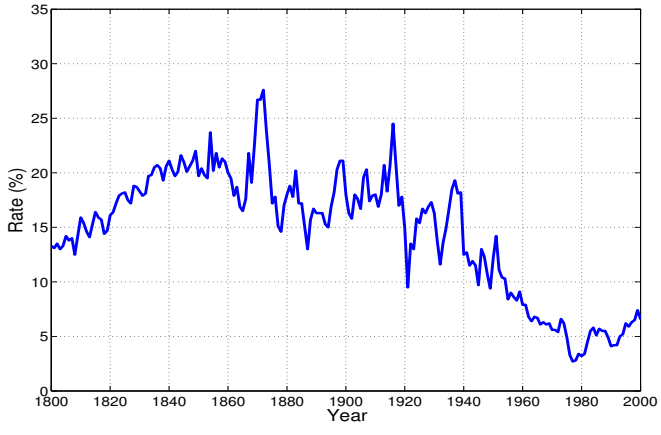
(a) Capital-to-Output Ratio (K_t / Y_t)



(b) Labor-Augmenting Technological Progress (A_t)



(c) Input Factor Shares (α_t)



(d) (Real) Rate of Return of Capital (r_t)

Figure: Macroeconomic Performance of Sweden, 1800-2000.

General Equilibrium OLG model:

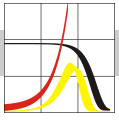
Assumptions: Closed economy, heterogeneity within the cohort (4 education groups), selfish individuals who face mortality risk (heterogeneity between cohorts).

Table: Modeled National Transfer Accounts by Flow and Economic Agent

	Individual	**Government**	**Firm**
Inflows	Gross Salary Asset Income Familial Transfers Public Consumption Public Benefits Bequests	Individual Income Tax Indirect Tax Corporate Tax Contributions	Revenues
Outflows	Consumption Childrearing Familial Transfers Taxes Saving Bequests	Pensions Benefits Public Health Public Education Public Others	Salaries Corporate Profits Corporate Tax Net Investment

Target

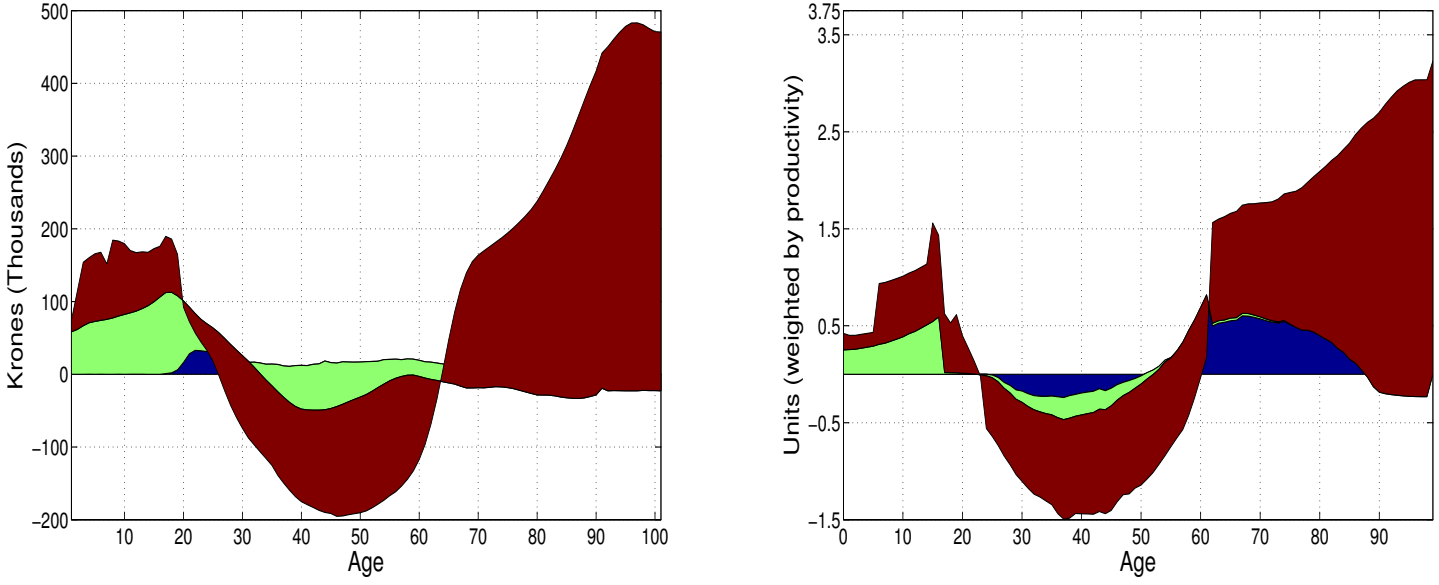
- National accounts (interest rate)
- NTA profiles in year 2003 (Private Consumption Others, CFX)



Model Parameters

Table: Model economy parameters

Parameter		
Household		
Risk aversion	σ	1.5
Subjective discount factor	β	0.92-1.00
Entrance into the labor market	T_w	18
Retirement age	T_r	63-68
Transfers		
Consumption units	θ_x	NTA
Private education and health	χ_x	NTA
Familial old-age support	π^{oas}	(60% replacement rate)
Technology		
Capital share	α	NA
Depreciation rate	δ	NA
Rental price of capital	r_t	NA
Productivity	A_t	NA
Labor efficiency profile	ε_x	IPUMS-CPS
Education attainment	$F_{\mathscr{y}}(t)$	Check
Employment rates	$e_{t,x}$	ILO and NA
Government		
Public consumption to output	η	NA
Corporate income tax to output	τ_k	NA
Labor income tax to output	τ_l	NA

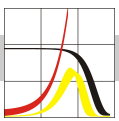


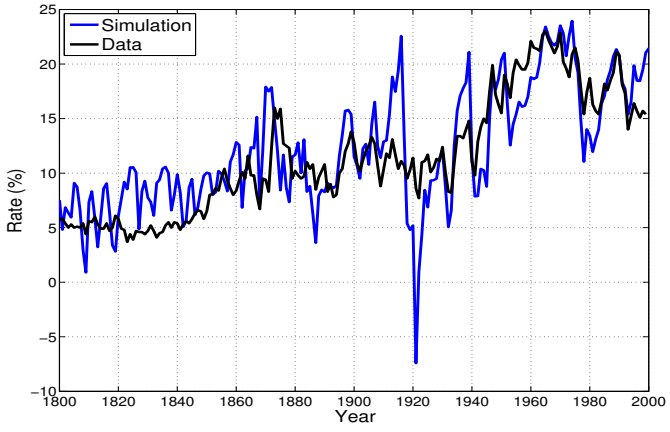
(a) Actual NTA

(b) Simulated NTA

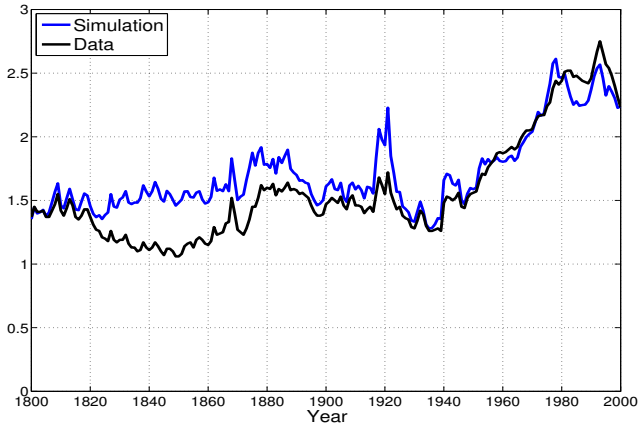
Figure: Life Cycle Deficit Reallocation, Sweden 2003.

Note: ABR (blue),TF (green), and TP (red).

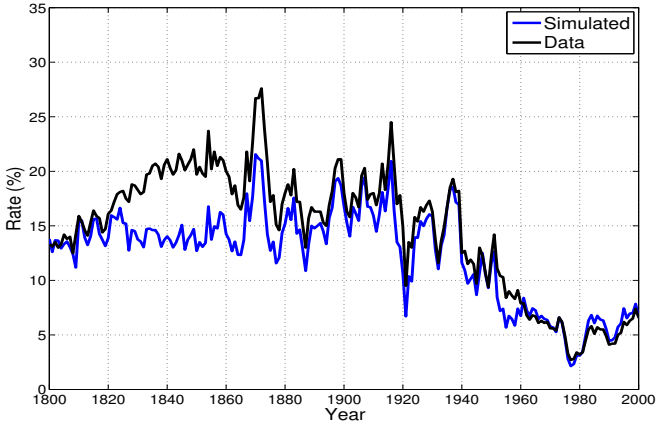




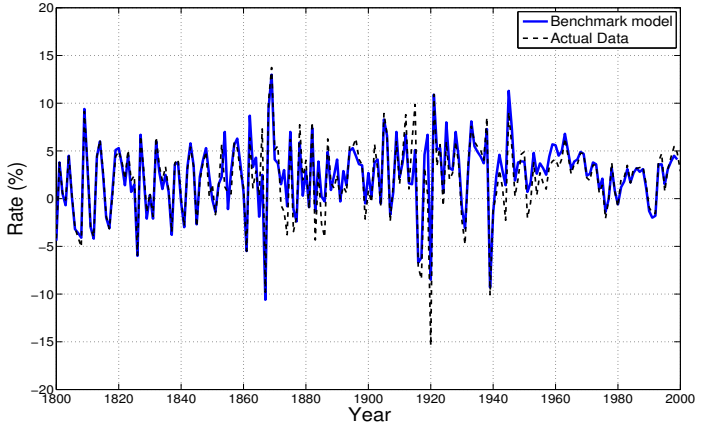
(a) Investment-Output Ratio



(b) Capital-Output Ratio



(c) (Real) Interest Rate



(d) Output growth rate

Figure: In-sample performance of the model, Sweden 1800-2000.

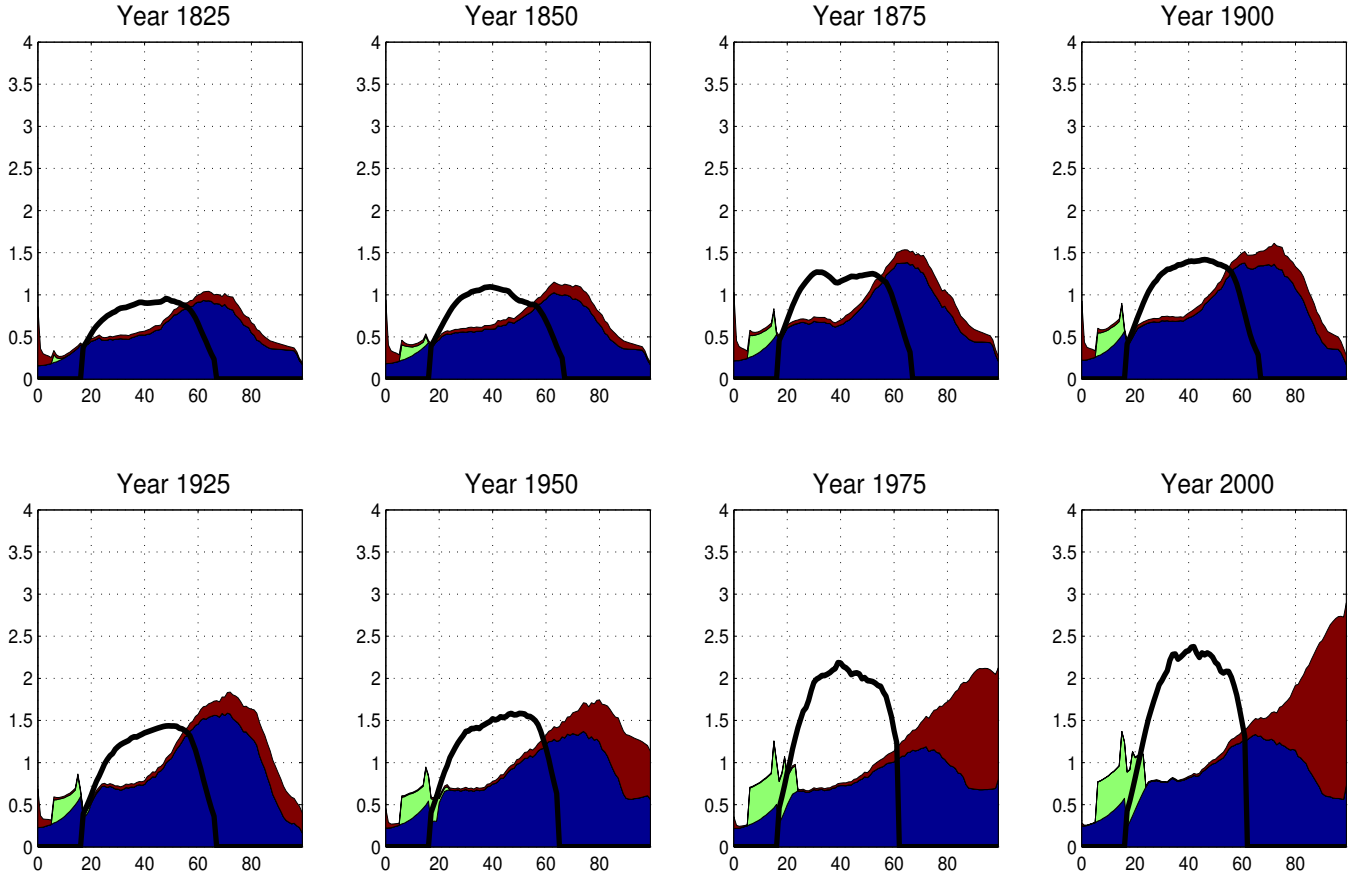
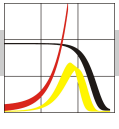


Figure: Life Cycle Deficit (per capita), Sweden 1825-2000.

Note: Gross Labor Income (black), Other Consumption (blue), Health expenditure (red), Education (green)



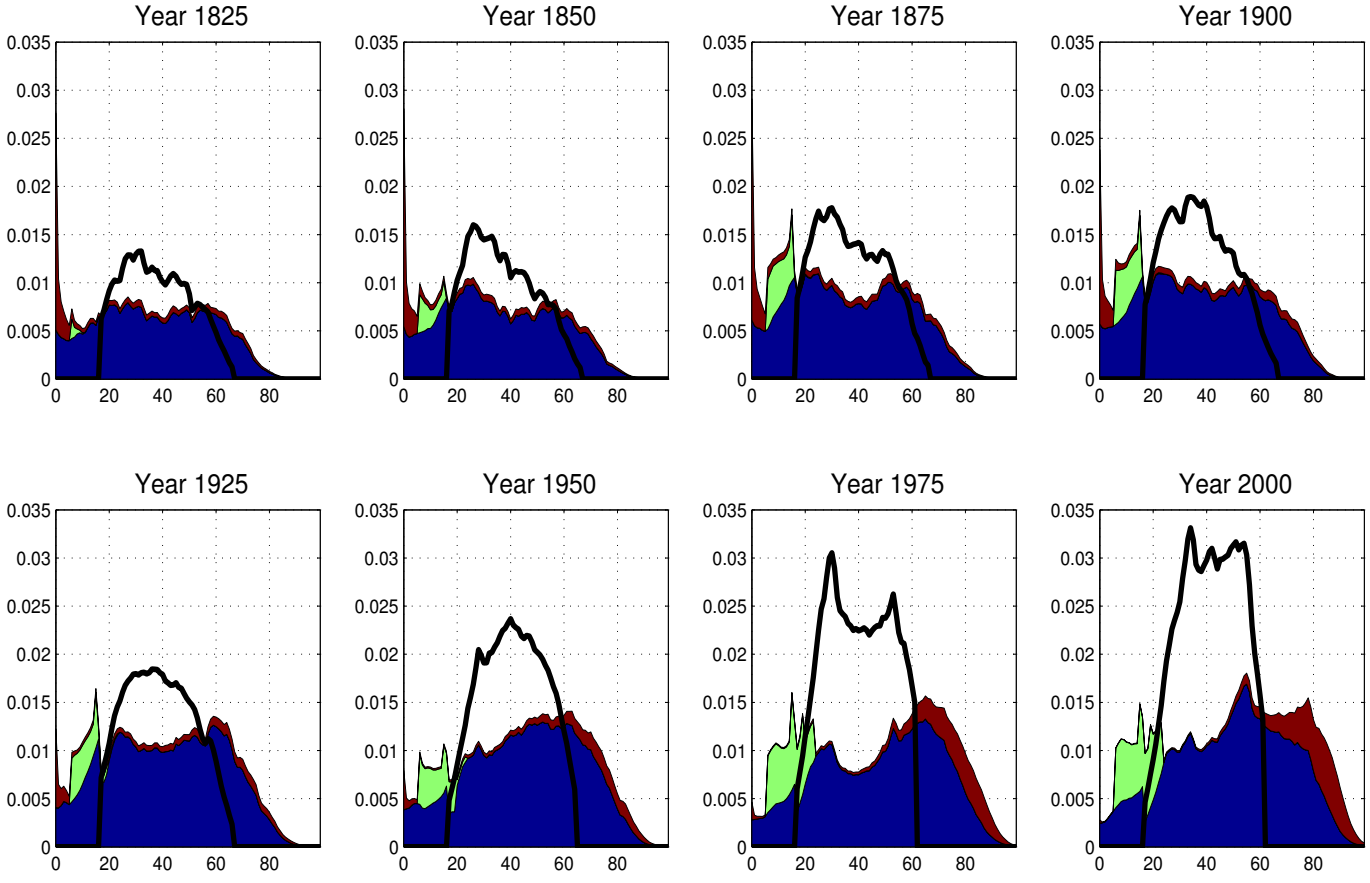


Figure: Life Cycle Deficit (population weighted), Sweden 1825-2000.

Note: Gross Labor Income (black), Other Consumption (blue), Health expenditure (red), Education (green)

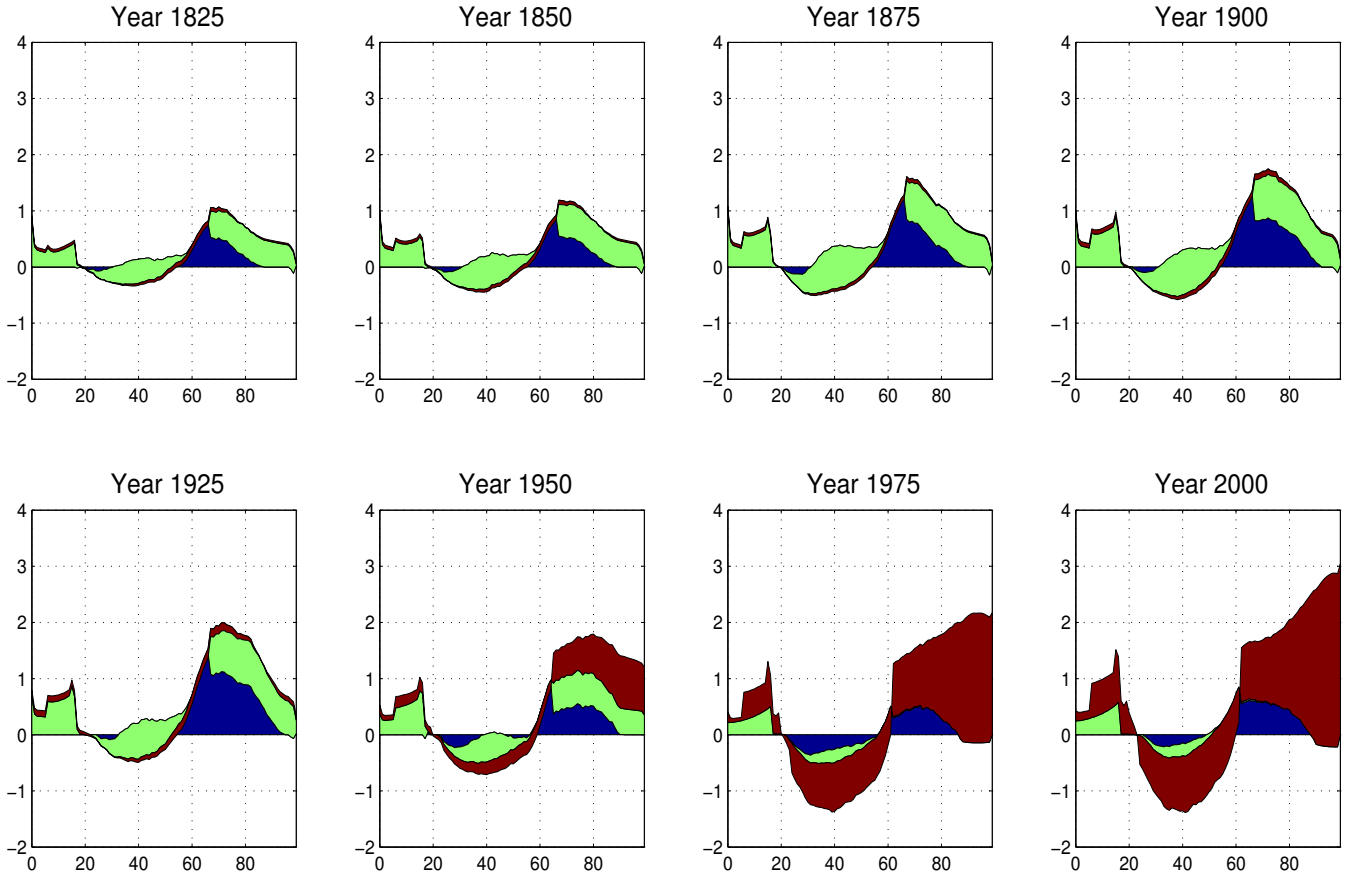


Figure: Life Cycle Deficit Reallocation (per capita), Sweden 1825-2000.

Note: Private transfers (greengreen), Asset-based reallocation (blue), Public transfers (red)

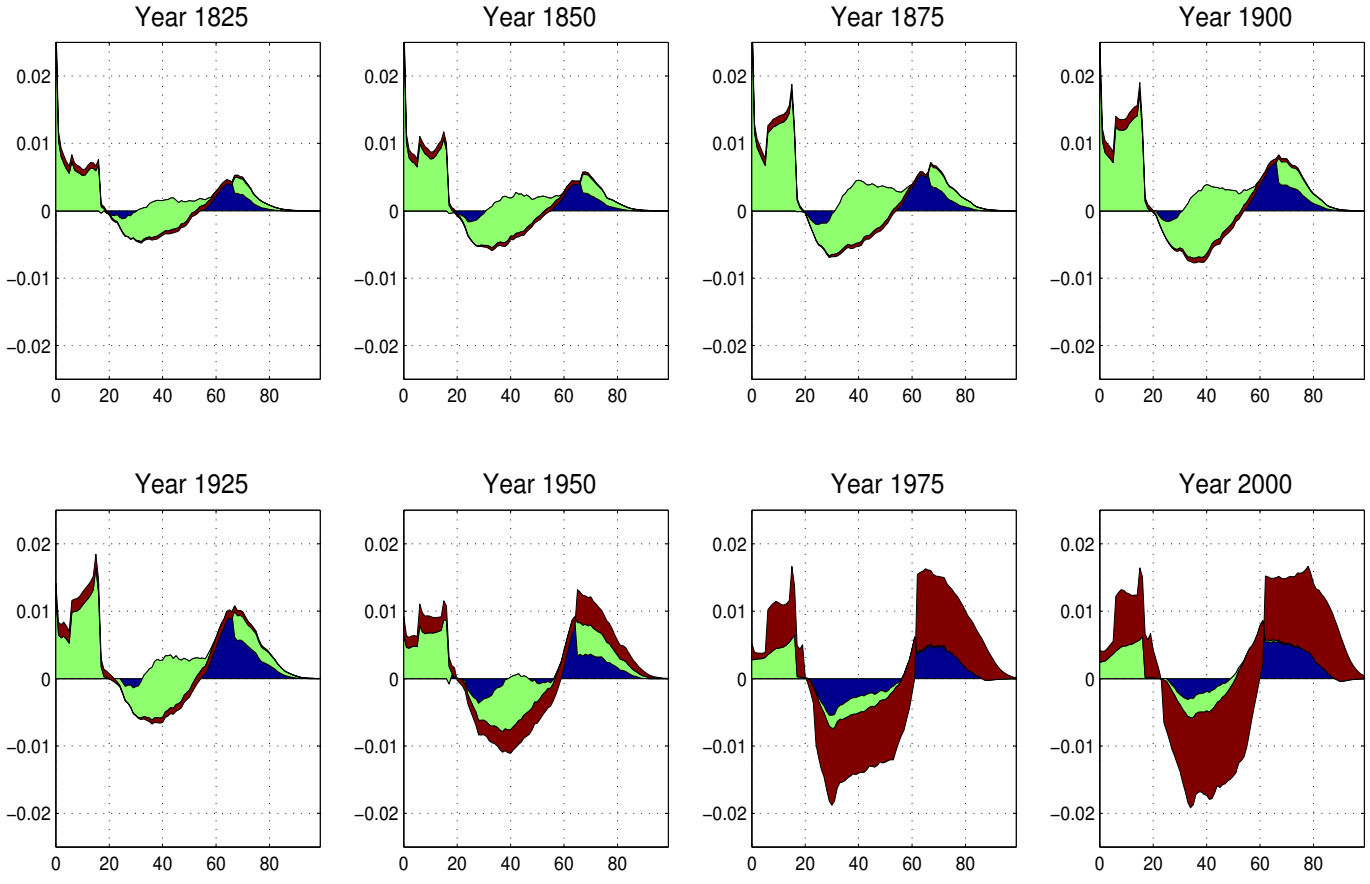


Figure: Life Cycle Deficit Reallocation (population weighted), Sweden 1825-2000.

Note: Private transfers (greengreen), Asset-based reallocation (blue), Public transfers (red)

Thank you

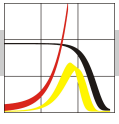
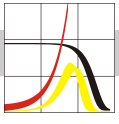


Table: Macroeconomic Performance in Sweden 1800-2000 (growth rates %)

	Output per capita (Y/N)	Output (Y)	Capital (K)	Labor Aug. (H)	Population (N)	Demo. Dividend	Productivity (A)	Capital Share (α)
1800-1999	**1.6**	**2.3**	**2.6**	**1.0**	**0.7**	**0.4**	**1.0**	**0.30**
1800-1849	**0.4**	**1.2**	**0.7**	**0.9**	**0.8**	**0.1**	**0.5**	**0.30**
1800-1809	-1.0	-0.8	0.5	0.4	0.2	0.2	-1.8	0.30
1810-1819	-0.2	0.4	0.5	0.6	0.6	0.0	-0.3	0.30
1820-1829	0.9	2.0	0.3	0.7	1.0	-0.3	1.9	0.30
1830-1839	0.3	1.1	0.5	1.0	0.7	0.3	0.3	0.30
1840-1849	0.9	1.8	1.4	1.4	0.9	0.5	0.5	0.30
1850-1899	**1.6**	**2.4**	**2.9**	**1.3**	**0.8**	**0.5**	**0.7**	**0.33**
1850-1859	1.4	2.3	3.2	1.3	0.8	0.5	0.6	0.30
1860-1869	0.1	0.9	2.9	0.9	0.9	0.0	-1.0	0.32
1870-1879	1.1	2.1	4.3	1.3	0.9	0.4	-0.4	0.36
1880-1889	1.3	1.7	1.7	0.9	0.4	0.5	0.8	0.35
1890-1899	2.4	3.0	1.7	1.4	0.6	0.8	2.1	0.34
1900-1949	**2.2**	**2.8**	**2.9**	**1.0**	**0.6**	**0.4**	**1.5**	**0.33**
1900-1909	1.7	2.4	2.8	0.6	0.6	0.0	1.4	0.36
1910-1919	0.6	1.2	2.3	1.0	0.6	0.4	-1.0	0.39
1920-1929	2.9	3.3	1.5	0.8	0.4	0.4	3.1	0.31
1930-1939	2.9	3.2	3.1	1.4	0.3	0.9	1.9	0.30
1940-1949	2.4	3.3	3.8	0.9	0.9	0.0	2.1	0.29
1950-1999	**2.2**	**2.7**	**3.5**	**0.9**	**0.5**	**0.4**	**1.5**	**0.25**
1950-1959	2.1	2.7	4.7	0.9	0.6	0.3	1.1	0.27
1960-1969	3.6	4.3	5.2	0.8	0.6	0.2	3.2	0.24
1970-1979	1.4	1.7	3.3	1.2	0.3	0.9	0.1	0.22
1980-1989	1.7	1.9	1.8	1.0	0.2	0.8	1.0	0.25
1990-1999	1.1	1.5	0.8	-0.2	0.3	-0.5	2.0	0.28

Source: Edvisson, R. (2005) and authors' calculations.

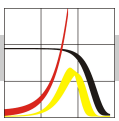


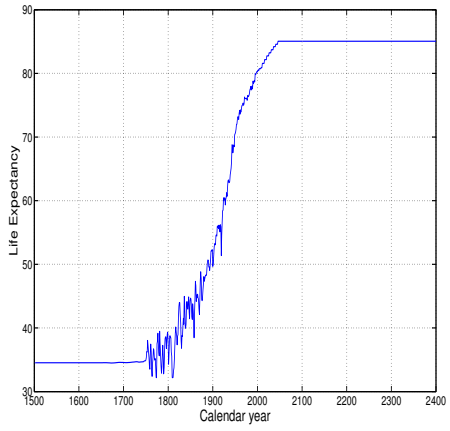
Effective Labor (H_t)

Effective labor in year t is given by

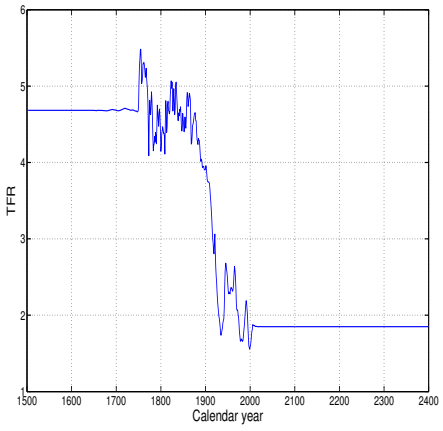
$$H_t = \sum_{x=T_w}^{T_r-1} e_{x,t} N_{x,t} \int_{\mathscr{U}} \varepsilon_x(u) dF_{\mathscr{U}}(t), \tag{1}$$

where T_w is the age at first entrance into the labor market, T_r is the retirement age, $e_{x,t}$ is the employment rate of age x in year t, $N_{x,t}$ is the population size at age x in year t, $\mathscr{U}$ is the set of education groups, $\varepsilon_x(u)$ is the age-specific productivity conditional on education $u \in \mathscr{U}$, and $F_{\mathscr{U}}(t)$ is the distribution of education attainment in year t.

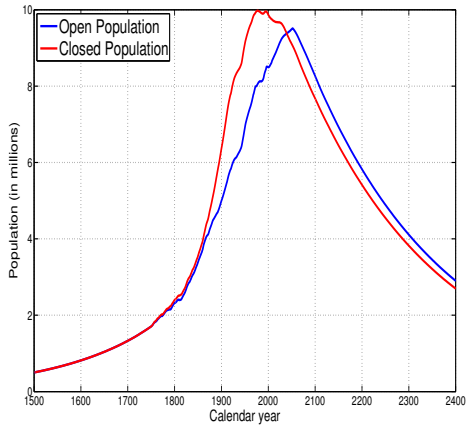




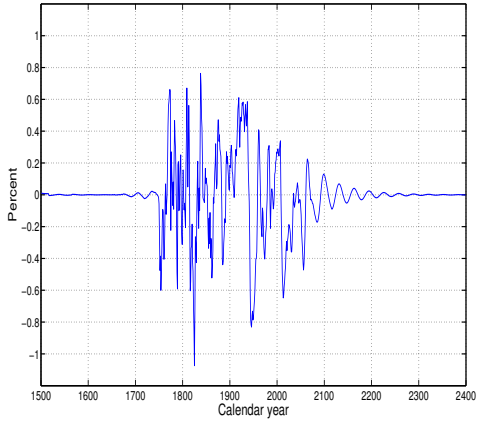
(a) Life Expectancy



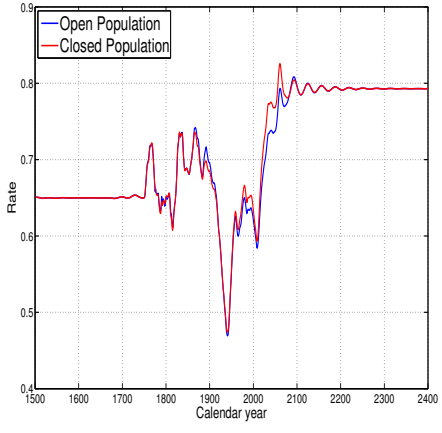
(b) Total Fertility Rate



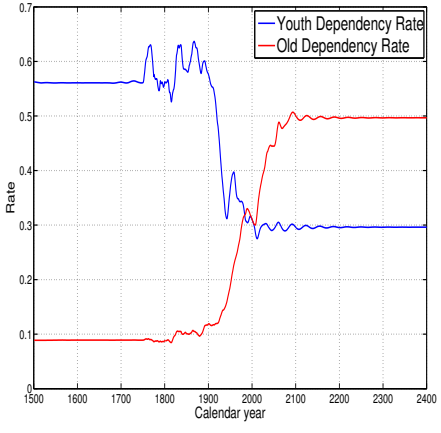
(c) Total Population



(d) Growth Rate Potencial Labor minus Population



(e) Total Dependency Rate



(f) Youth & Old Dependency Rates under an Open Population

Figure: Demographic information, Sweden 1500-2400.