

Simulating a progressive loan system for Spain with real labor market data

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Summary (1/2)



- Motivation
- Motivation–continued
- Current University system in Spain
- Summarizing
- In this paper
- Implementation
- Data
- Model (I): Employment Transitions
- Model (II): Earnings dynamics
- Estimation
- Model Fit: Employment Shares
- Model Fit: Earnings Distribution
- Model Fit: Employment Transitions
- Loan Laboratory
- Key differences of loans-to-masters
- Examples loan system
- Baseline scenario



Summary (2/2)



- Other scenarios →
- Main findings →
- Feasibility →
- Loans: Pareto improvement? →
- Conclusions →
- Challenges →

- University system in Spain has suffered continuous budget cuts and given current fiscal situation it is not likely that will reverse soon

Figure changes expenditure 2008-2013

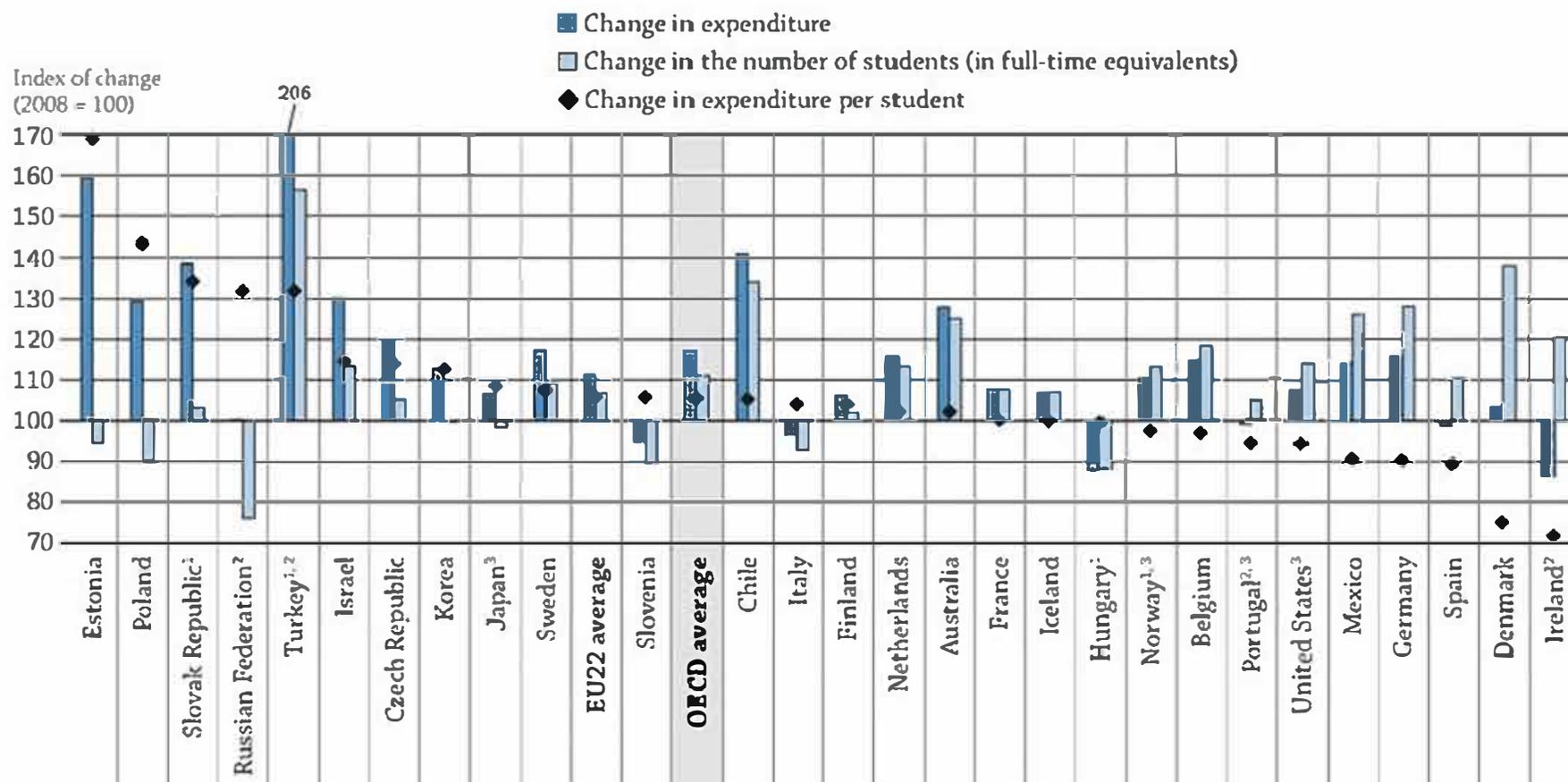
- Most likely is that the Spanish university system will not have more public resources in the near future
- The quality of the university system is at risk. Worrysome: quantity and quality of human capital are key nowadays
- Also, current system is not too progressive either

Figure changes expenditure 2008-2013



Figure B1.5b. Changes in the number of students, expenditure on educational institutions and expenditure per student in tertiary education (2008, 2013)

Index of change between 2008 and 2013 (2008 = 100, 2013 constant prices)



- Idea of this paper: think about alternative sources of resources, alternative financing system
- Literature that has studied different aspects of university financing in Spain (for example, Beneito, Boscá & Ferri 2016, De la Fuente & Jimeno 2009, Del Rey & Racionero 2012, Escardíbul Ferrá & Pérez Esparrells 2013, Mora, García-Montalvo & García-Aracil 2000, Nuñez 2006, Vázquez 2013)
 - Just one paper on loans, Callado Muñoz, Del Rey & Utrero González 2015: analysis loans-to-masters 2007-2011, important lessons for the parameters of the loan system
- Also in 2013 Ministry of Education put forward a group of experts to think about how to improve quality and efficiency of university system.

- Our paper contributes to this debate. Specifically, how would a progressive loan system subsidized by the government (as in the UK) work in Spain?
 - We simulate it with real labor market data, study its feasibility and impact on income distribution

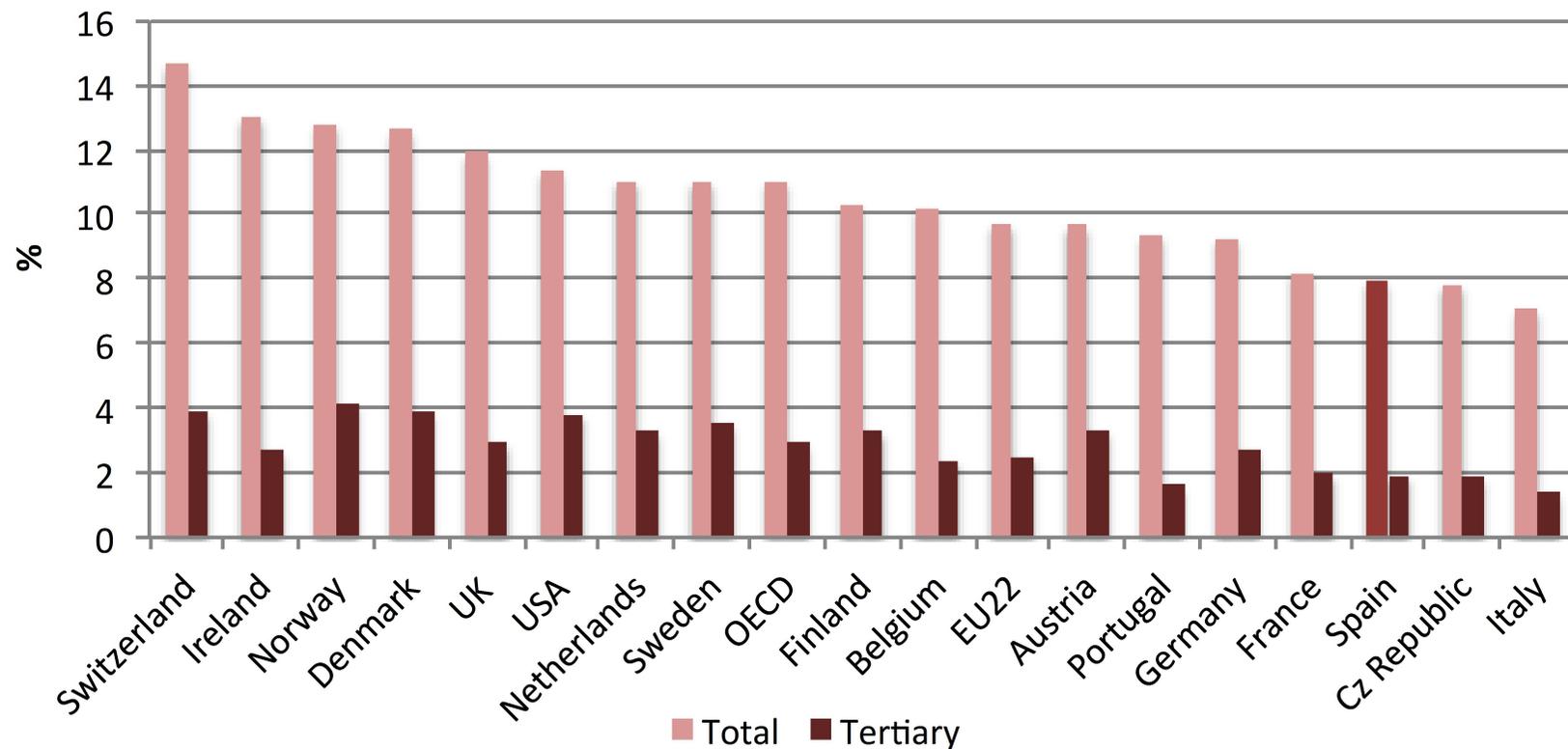
- UK (England and Wales) university system:
 - 1998-2006: low fees (means-tested), pay upfront, no loans
 - 2006/07: higher fees (not means-tested), not paid upfront, loans
- Why look at the UK university system for Spain?
 - System with more resources by mixing public and private financing that is **progressive and subsidized**
 - Progressive: repayments depend on ex-post labor market outcomes and maintenance loan depends on initial conditions
 - Subsidized: deb write-off (maximum years of repayment), lower interest rate than market and intertemporal subsidy (government pays upfront and individuals return in the future)
 - Evidence UK system works reasonably well in the UK (Deadren et al. 2008, Azmat and Simion 2017)

- University spending: Spain is at the tail compared to other countries
Figure expenditure on education
- Different university systems in the world can be classified according to level of fees and financial aid to students.
 - Spain: low in both; UK: high in both
- General numbers (de la Fuente and Boscá, 2014)
 - average fees: around 1100€ per year
 - total cost of a university degree: around 8500€
 - student fees pay on average around 15-20% of total cost
- Student help aid: some but very small (**Figure student help**)
 - Absence of a public loan system, except for loans-to-masters (only for postgraduate)

Figure expenditure on education



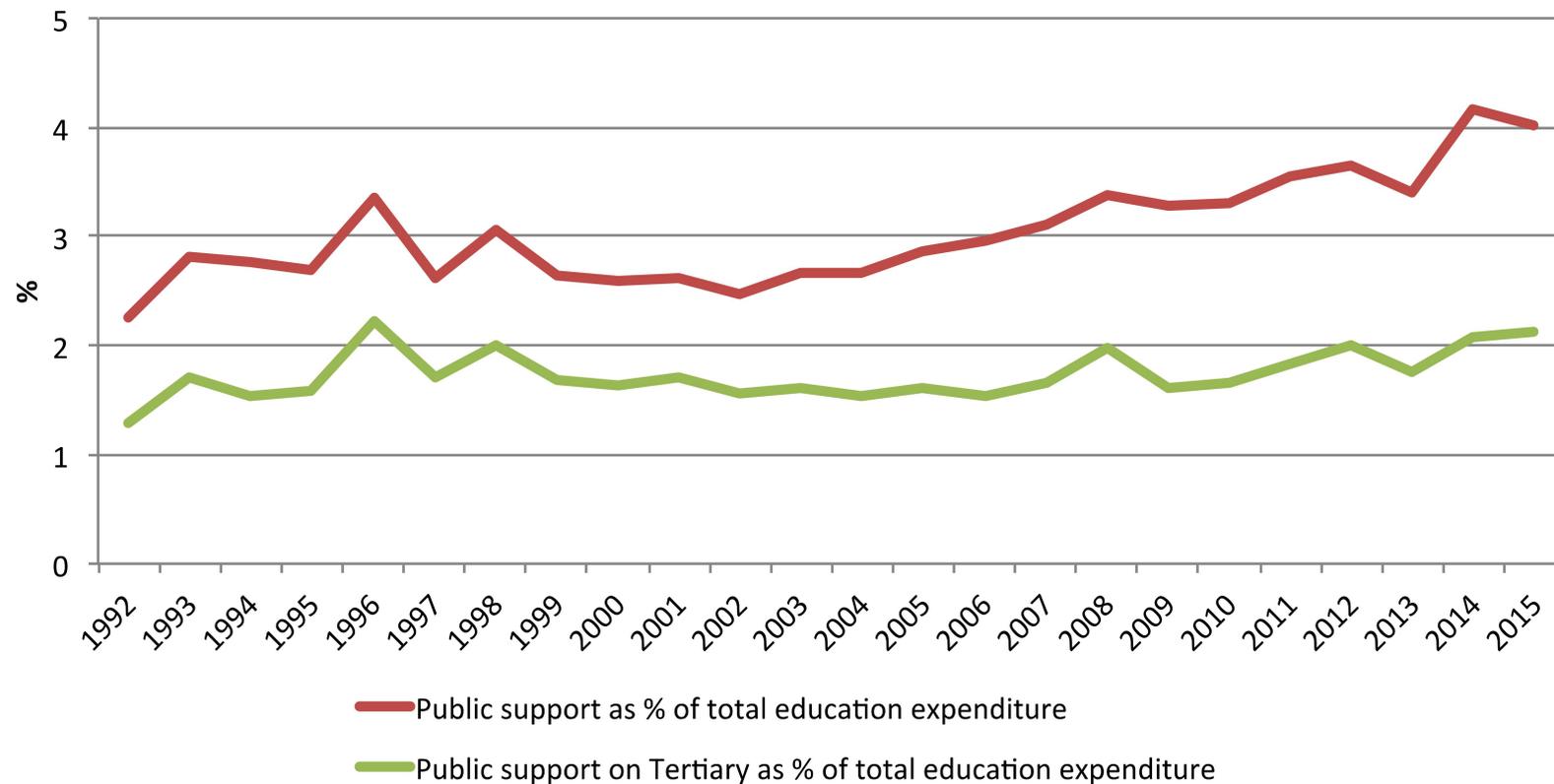
Public expenditure on education as % of total public expenditure



- OECD countries, 2013
- Education: on average 11% of total public spending (Spain 8%).
- Share to tertiary: on average 3% (Spain 2%)



Public scholarships and financial aid



- Spain 2013
- Low percentage assigned to scholarships and support to students and their families, below 5%.
- Tertiary education around 2%.

- In sum, in Spain:
 - Less spending in higher education than in other countries
 - Fees are relatively high because government budget is relatively lower
 - Also current system in general *regressive*: 60% does not go to university (disproportionally from lower income percentiles); and for the 40% that goes, one could interpret the 80-85% of cost of the university that is not paid by fees as the current “subsidy”, which is constant across income distribution *among* university graduates.
- Idea of this paper: study the implementation of UK system to improve this situation
 - Potentially provides access to everyone and is progressive

- We illustrate how a loan system similar to UK (as in 2007) would work for Spain to finance higher education and study implications for lifetime income and repayments
- The experiment is: increase fees and at the same time put a progressive loan system subsidized by the government
 - Fees can be deferred until starting work.
 - Progressive: Repayments will depend on ex-post labor income & minimum exempt
 - Subsidy: debt write-off and low interest rate
- Objective of this system (as in the UK):
 - Share costs between government and beneficiaries, with guarantees (no penalty if low realized returns of high education)
 - Increase universities funding per head
 - Increase degree of progressivity

- Goal: create a laboratory to explore different loan policies and the effects along the income distribution
- To do so, we need to simulate the income of individuals along their lifetime
- We do this by modeling: (I) the employment transitions and (II) earnings dynamics
 - We follow Deadren et al. (2008) and adapt it to Spain
 - Key: dual labor market in Spain, majority of flows into first jobs (and flows from unemployment) are to temporary contracts (TC). TC-cycle trap.

- Social Security records, the 4% sample since 2004
- *Muestra Continua de Vidas Laborales*
- Complete life histories since individuals entered the labor market, back to the 1960s until to today
- Variables: employment status (receiving wage or UI), type of labor contract, earnings. Also demographic variables: gender, age, education
- Sample: 22-60 years old that have finished a university degree

Model (I): Employment Transitions



- Three employment statuses: unemployed (U), permanent contract (P), and temporary contract (T)
- Π : transition matrix that determines changes between statuses

$$\begin{pmatrix} P' \\ T' \\ U' \end{pmatrix} = \underbrace{\begin{pmatrix} \pi^{PP} & \pi^{PT} & \pi^{PU} \\ \pi^{TP} & \pi^{TT} & \pi^{TU} \\ \pi^{UP} & \pi^{UT} & \pi^{UU} \end{pmatrix}}_{\Pi} \begin{pmatrix} P \\ T \\ U \end{pmatrix}$$

- We use the share of workers at age 22 in each state as initial point
- And estimate Π using probit regressions
details employment transitions

Estimating Π

- For a transition between state s_{t-1} and s_t (functions of income and duration in s_{t-1}):

$$\pi^{s_{t-1}, s_t} = \begin{cases} \Phi \left(\beta_1^y y_{t-1} + \beta_2^y y_{t-1}^2 \right) & \text{if } (s_{t-1}, s_t) \in \{(P, T), (P, U), (T, U)\} \\ \Phi \left(\beta_1^d dur1_{t-1} + \beta_2^d dur2_{t-1} \right) & \text{if } (s_{t-1}, s_t) \in \{(U, P), (U, T)\} \\ \Phi \left(\beta_1^y y_{t-1} + \beta_2^y y_{t-1}^2 + \beta_1^d dur1_{t-1} + \beta_2^d dur2_{t-1} \right) & \text{if } (s_{t-1}, s_t) \in \{(T, P)\} \end{cases}, \quad (1)$$

where:

$$dur1_t \equiv I \{s_t = s \mid s_{t-1} = r\} \text{ and } s \neq r$$

$$dur2_t \equiv I \{s_t = s \mid s_{t-1} = s\}$$

- All probit regressions also include a constant and a quartic in age as independent variables

Model (II): Earnings dynamics



- We use the standard earning dynamics model a la Karahan and Ozkan (2013)
- At the beginning of an employment spell, each worker draws a level of earnings
- If there is no employment status change, earnings follows an autoregressive process that is age-specific

details continuation earnings

- Whenever there is a change of status of the type PT , TP , UT , or UP , we estimate the new initial earnings as a function of age, duration of previous spell, and past earnings.

details transition earnings

Let the log earnings of a worker that stays in the same status be

$$\log Y_{iat} = \beta \underbrace{X_{iat}}_{\text{observables}} + y_{iat}, \quad (2)$$

$$y_{iat} = \alpha_i + \gamma_i a + u_{iat} + z_{iat} \quad \alpha_i \sim N(0, \sigma_\alpha^2), \gamma_i \sim N(0, \sigma_\gamma^2) \quad (3)$$

$$u_{iat} = \varepsilon_{iat} + \theta \varepsilon_{i,a-1,t-1} \quad \varepsilon_{iat} \sim N(0, \sigma_{\varepsilon,a}^2) \quad (4)$$

$$z_{iat} = \rho_a z_{i,a-1,t-1} + \eta_{iat} \quad \eta_{iat} \sim N(0, \sigma_{\eta,a}^2) \quad (5)$$

$$z_{i0t} = 0, \quad \varepsilon_{i0t} = 0 \quad (6)$$

Details transition earnings



Let the log of earnings of a worker who just moved from status s to s' :

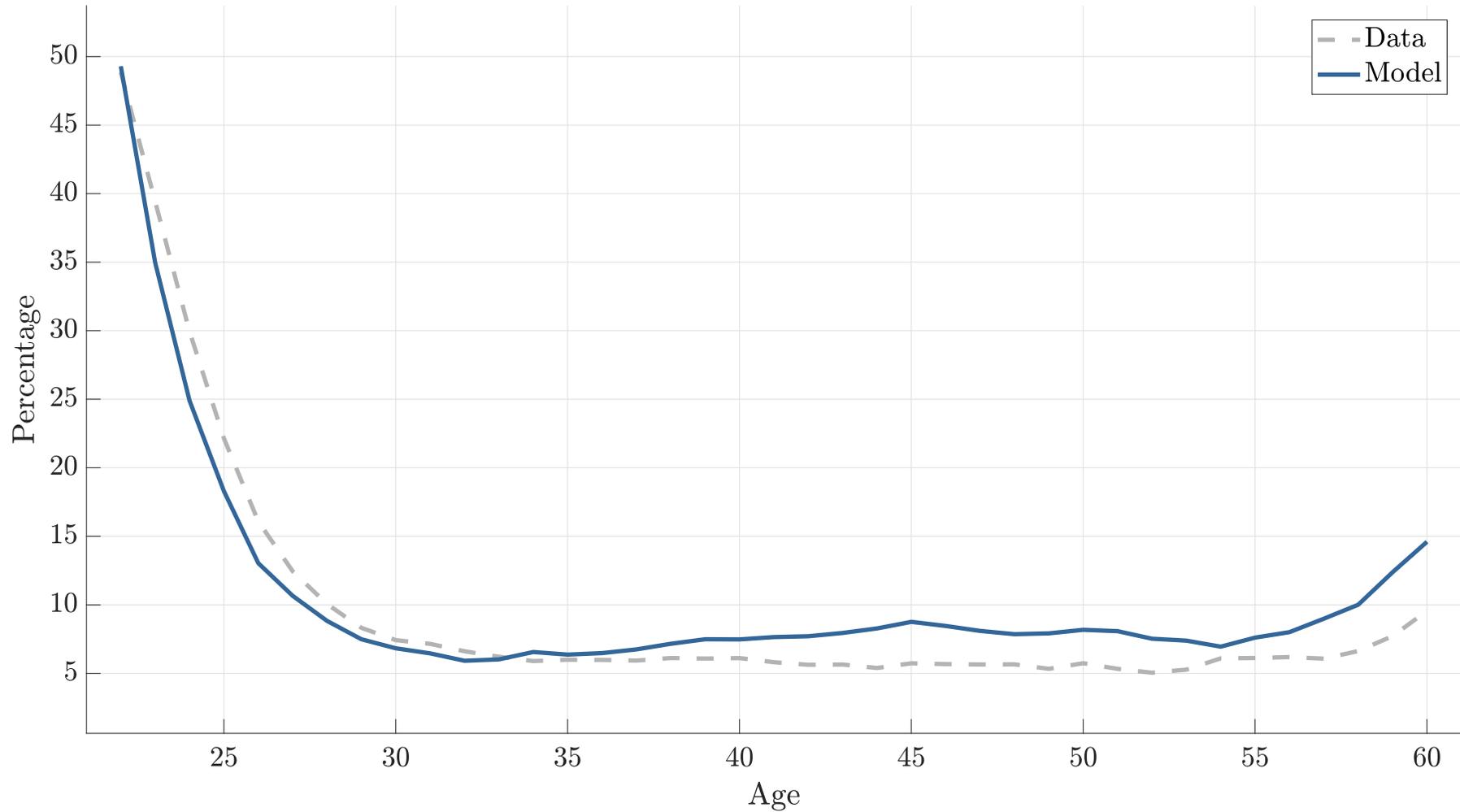
$$\log Y_t^{ss'} = \beta_1 dur1_{t-1}^s + \beta_2 dur2_{t-1}^s + \beta_2 y_{t-1}^L + \xi_t,$$

where y_{t-1}^L denotes

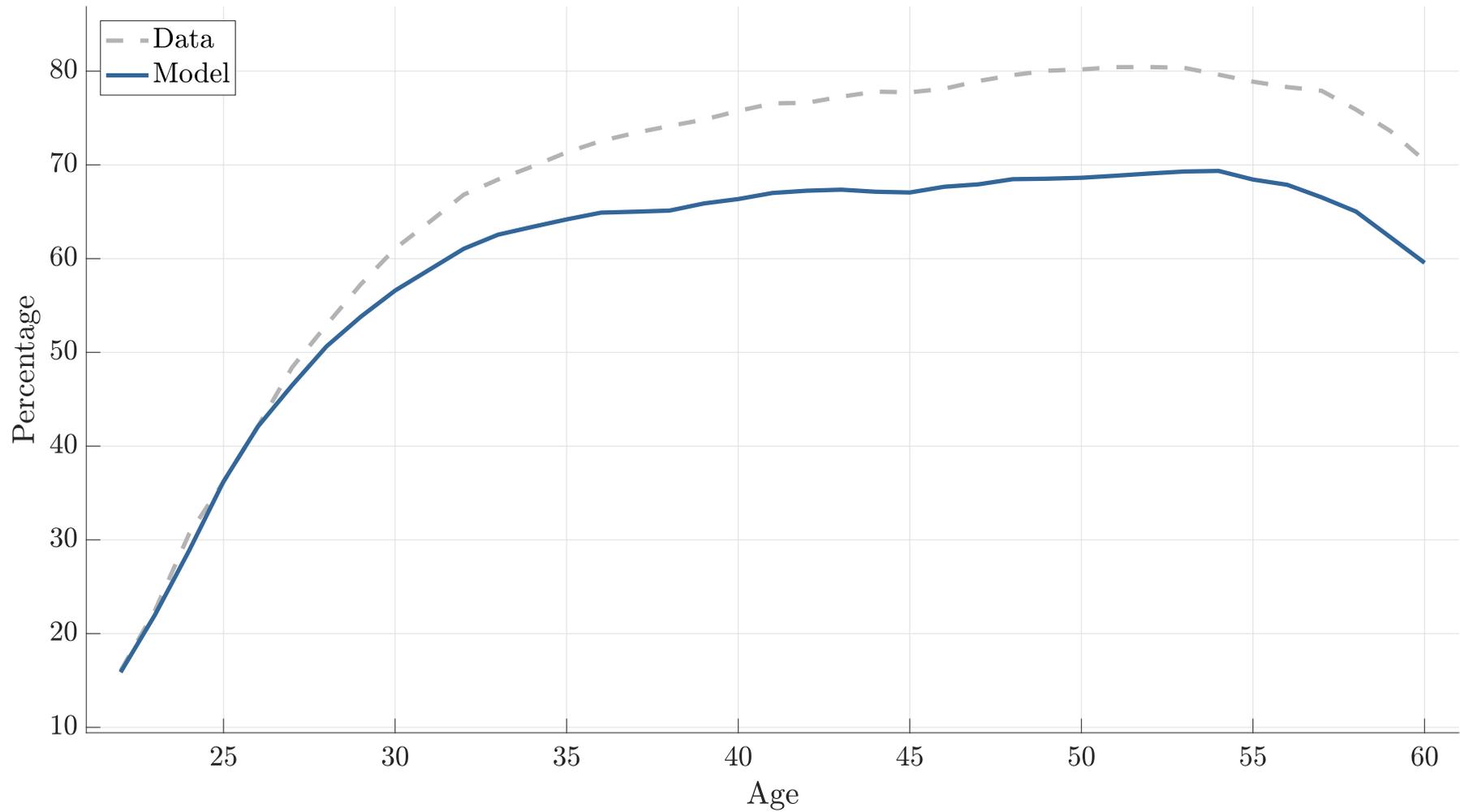
- the level of earnings in the previous status s if $s \in \{P, T\}$
- the last earnings observed if $s = U$ and the worker has been unemployed for only 1 year
- a dummy indicating that the last level of earnings is missing in the case the worker has spent 2 or more years unemployed
- A constant and a quartic in age have been omitted

- ρ , σ_ε , and σ_η are functions of age:
 - $\sigma_{\varepsilon,a}^2$ and $\sigma_{\eta,a}^2$ are quadratic
 - ρ is a cubic function of age
 - θ , σ_α , and σ_γ are fixed
- GMM
 - Autocovariance matrix up to 6 lags
 - Efficient weighting matrix

Unemployment

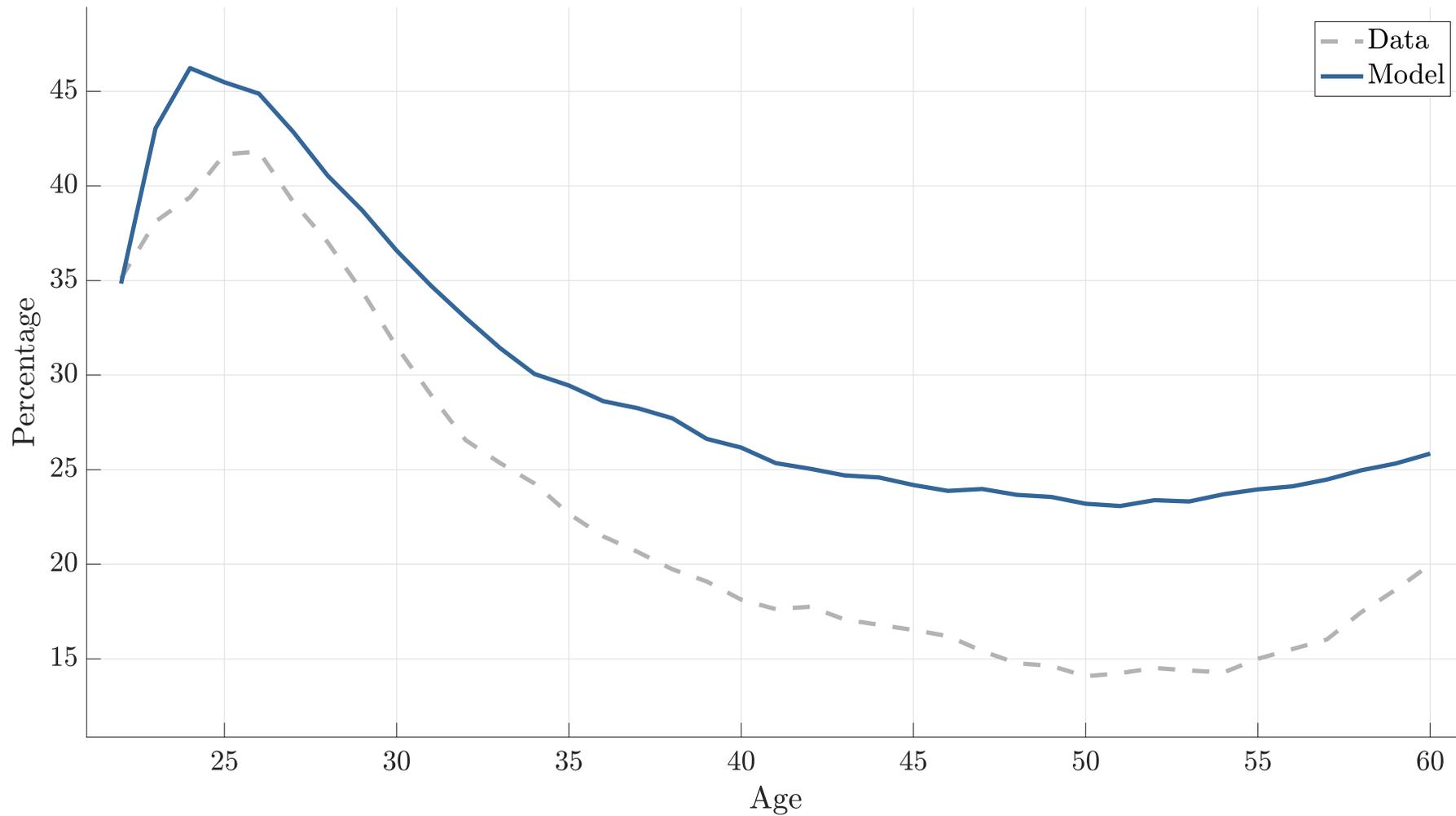


Permanent Contracts

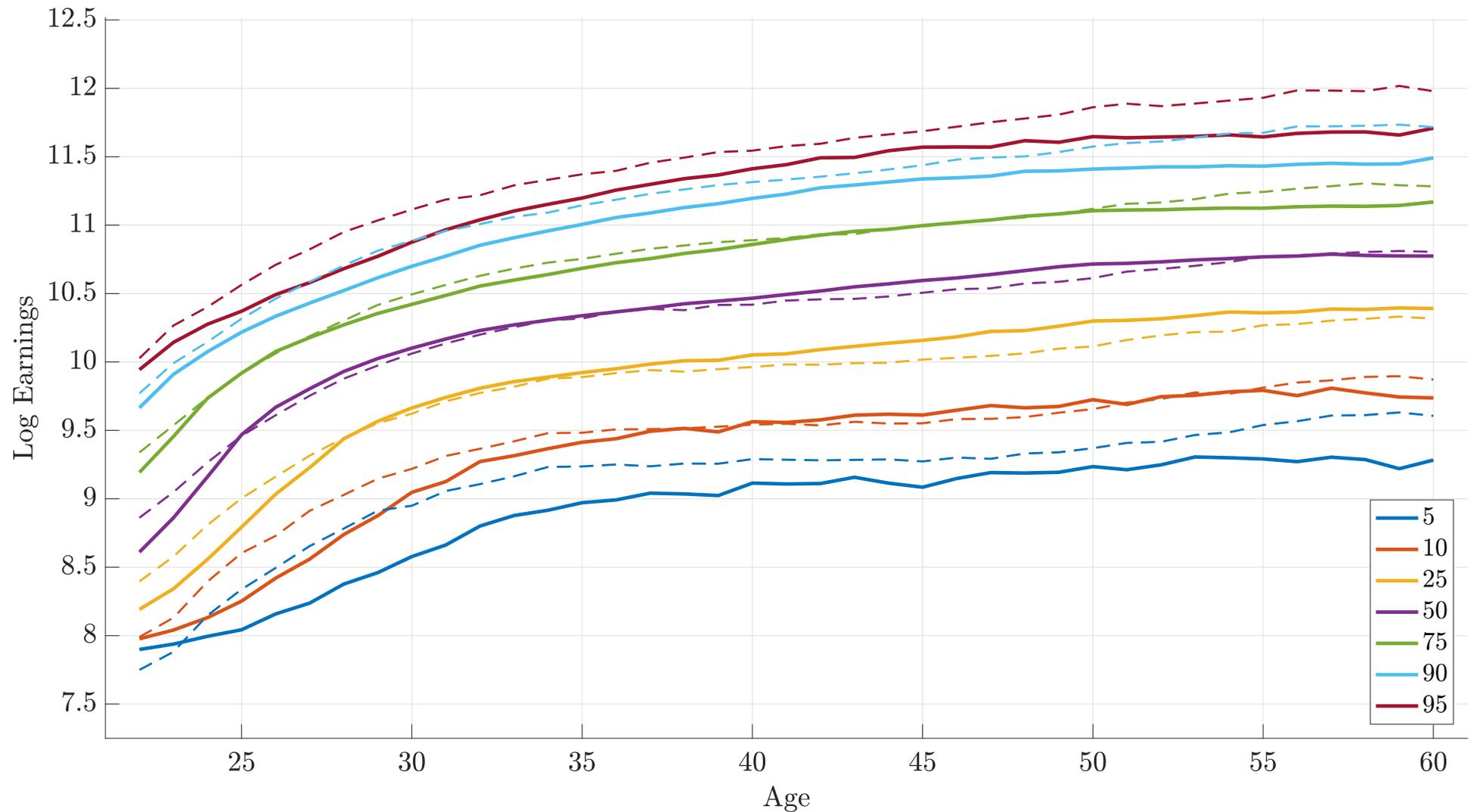




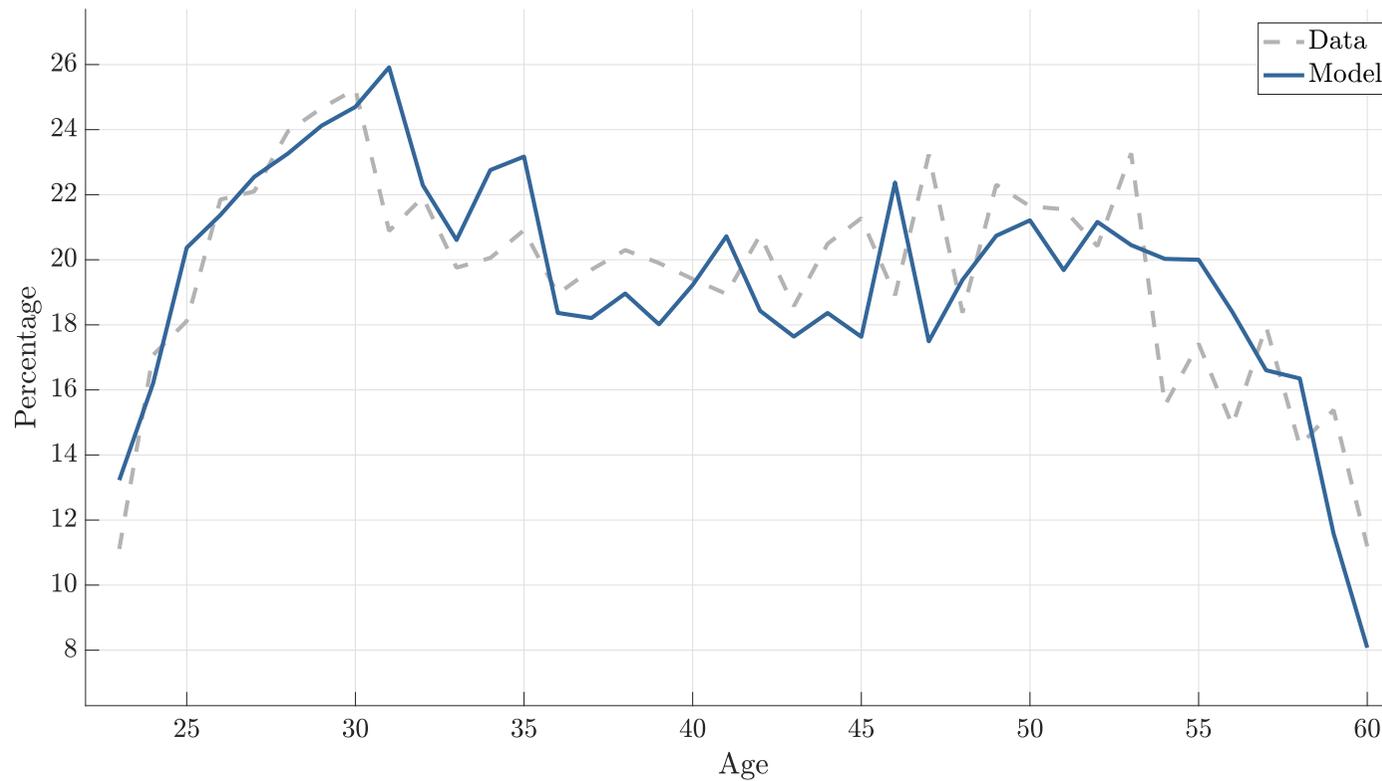
Temporary Contracts



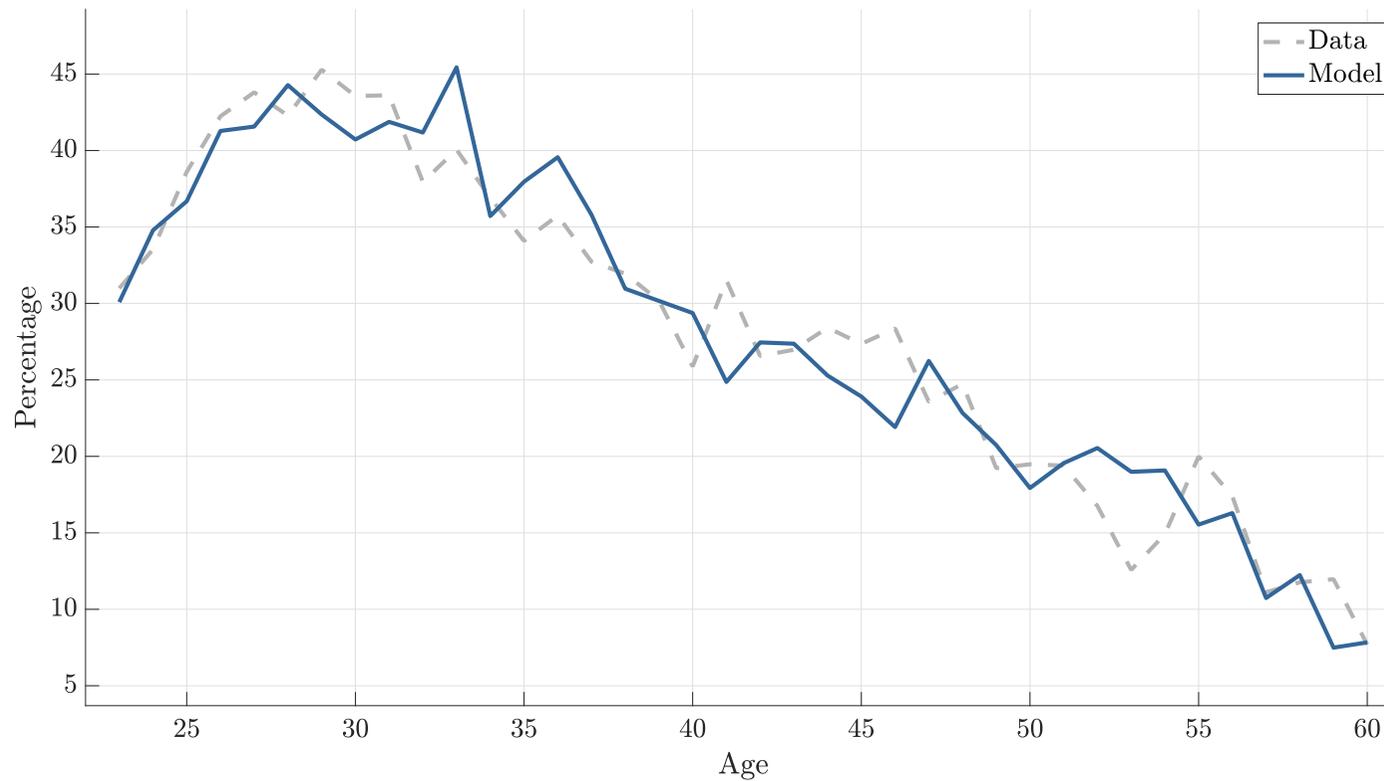
Quantiles of Log earnings



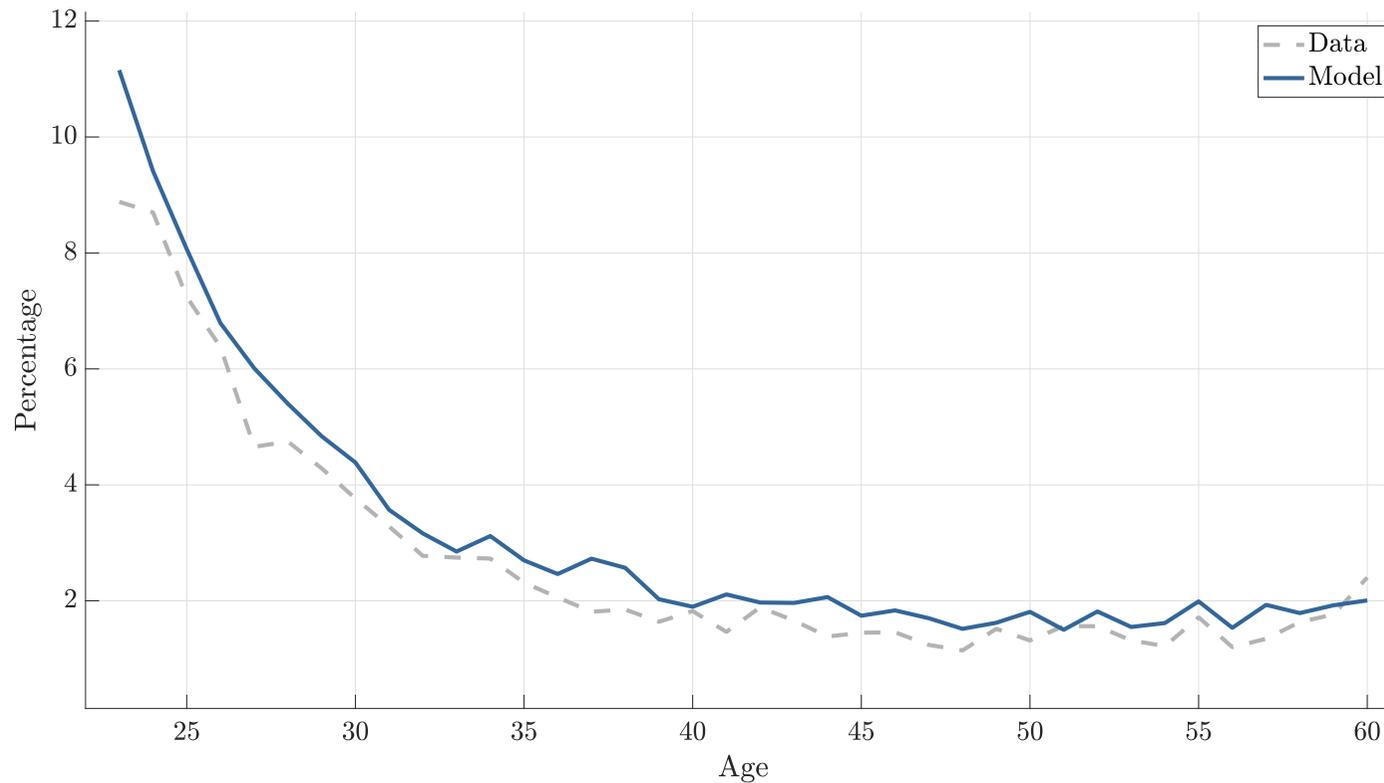
From Unemployment to Permanent Employment



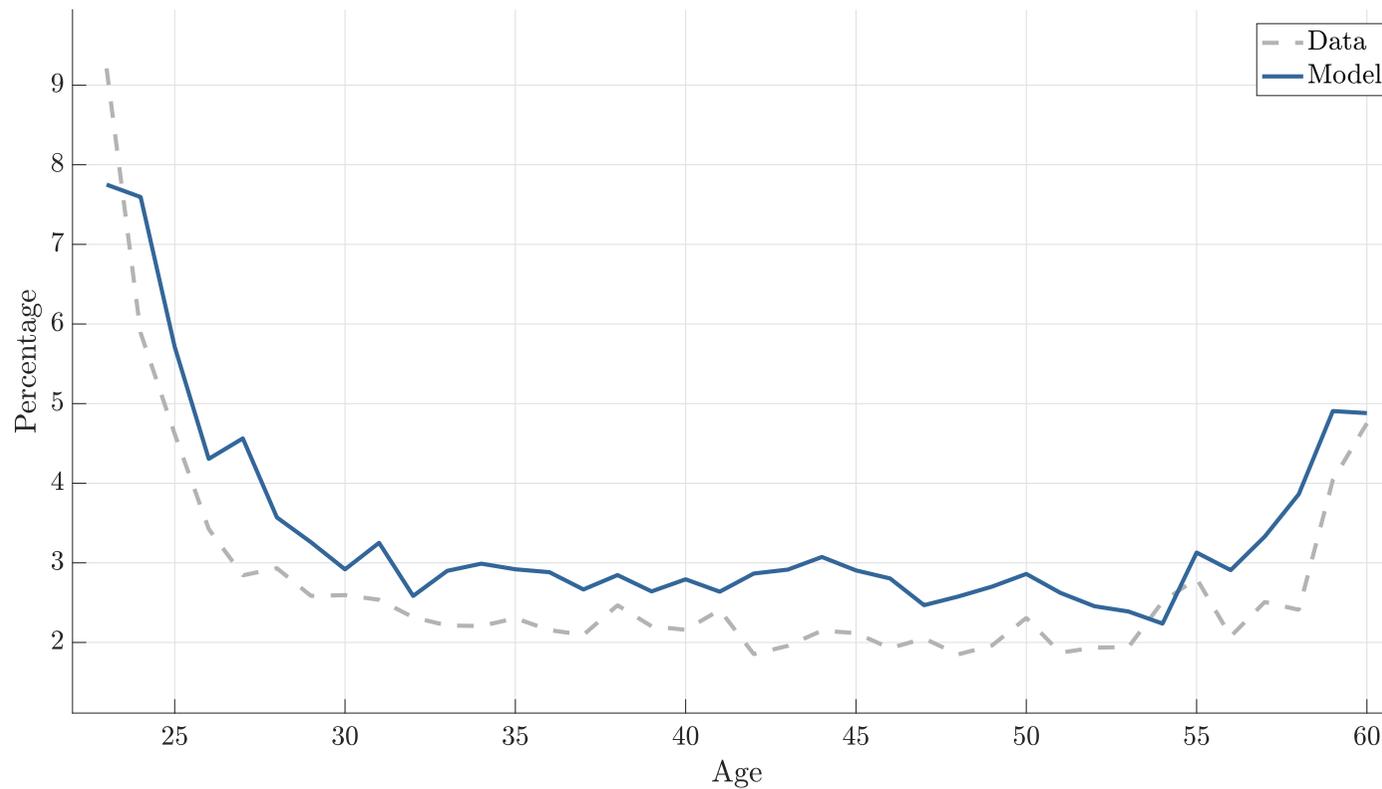
From Unemployment to Temporary Employment



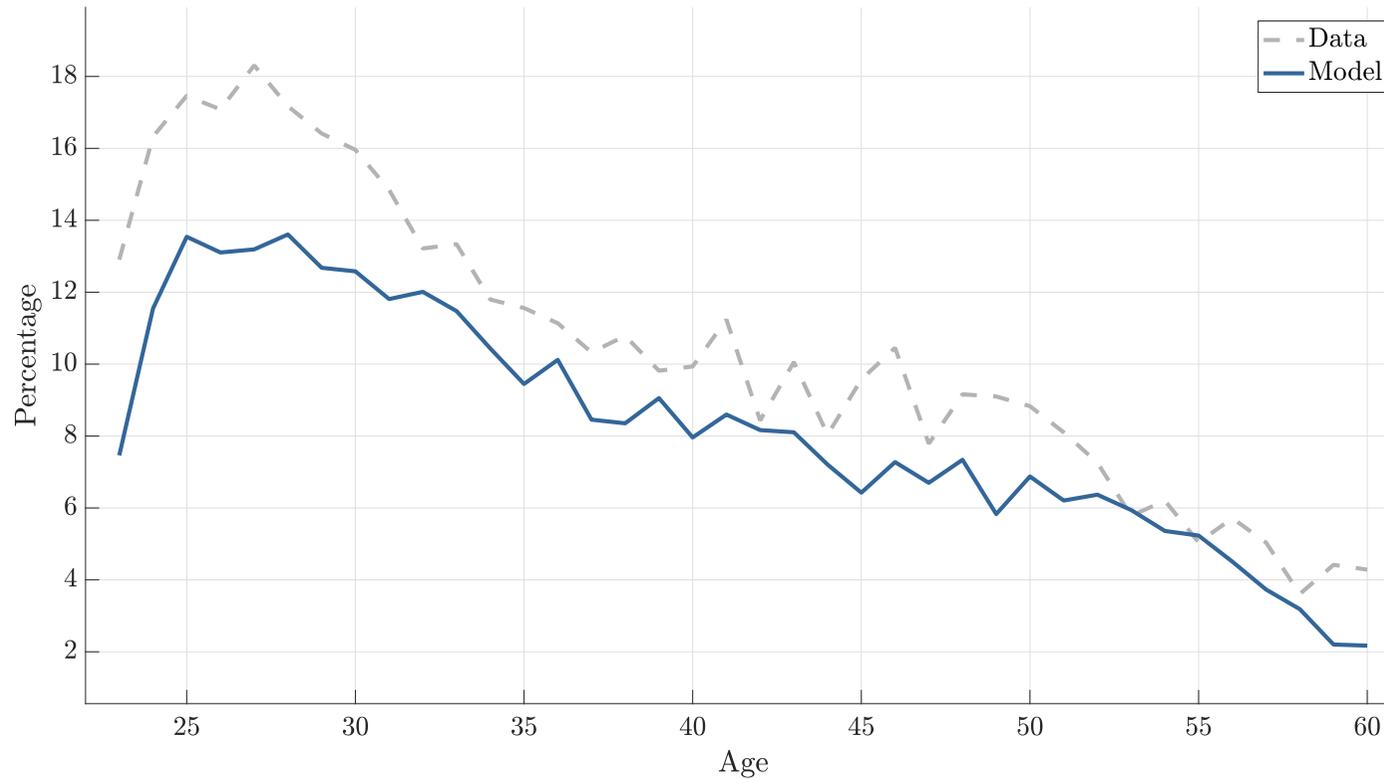
From Permanent to Temporary Employment



From Permanent Employment to Unemployment

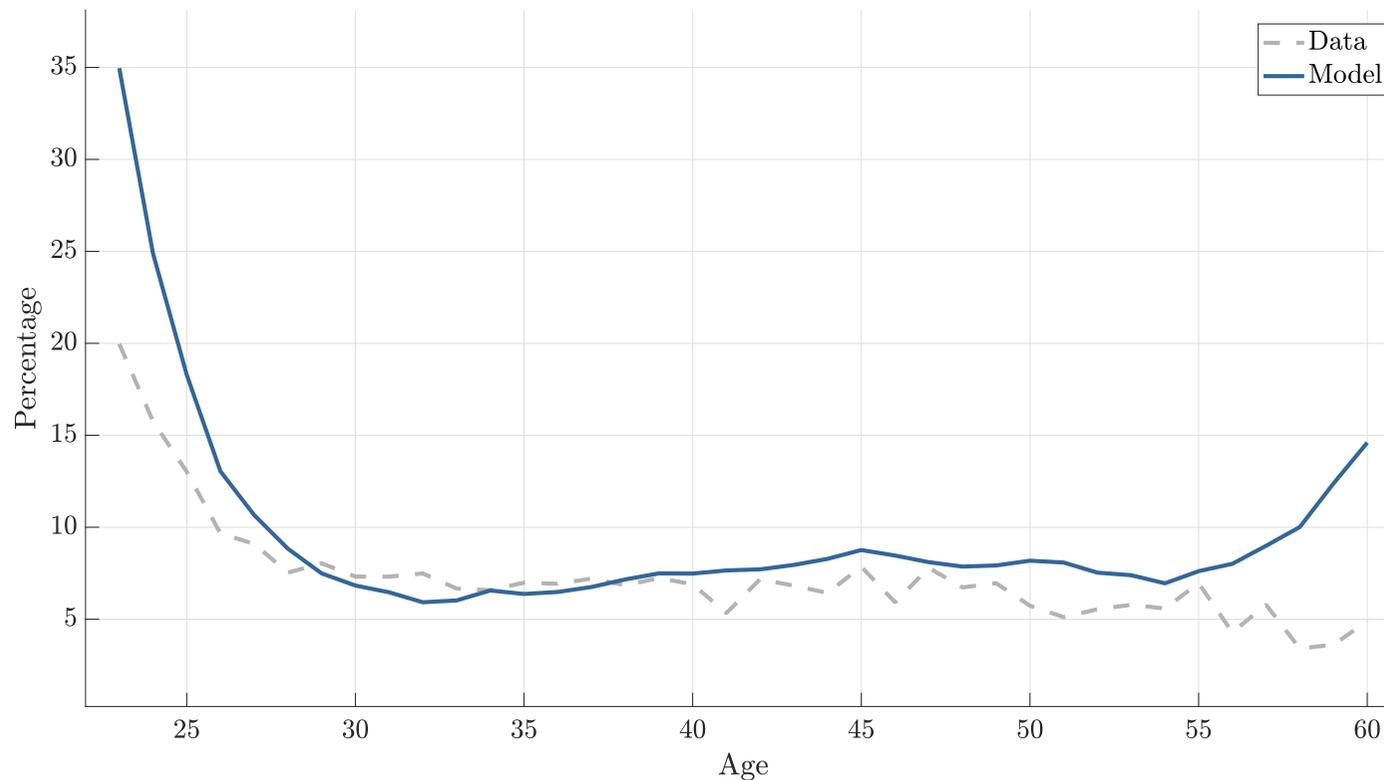


From Temporary to Permanent Employment





From Temporary Employment to Unemployment



Parameters of loan system:

1. Debt: amount of debt at the end of college (total fees)
 - maintenance loans not included (lack data)
2. Loan interest rate
 - Debt paid at an interest (subsidized)
3. Exemption income level: threshold at which people start repaying
 - for income below this threshold repayment is zero
4. Repayment rate: percent of earned labor income to repay debt (above exemption level)
5. Debt write-off, maximum years of repayment: years after which the debt is “forgiven”

Key differences of loans-to-masters



- Loans-to-masters: grace period: 2 year grace period after graduation independently of income level
 - Callado Muñoz, Del Rey & Utrero González 2015: deferment of payments due in case of hardship protects low earners, general grace periods costly and inequitable.
- Loans-to-masters: repayment rate. Callado Muñoz, Del Rey & Utrero González 2015: fixed monthly repayments exert an excessive burden to graduates at the lower end of the income distribution.
- Conditions were amended every year
 - Need political commitment to stability

Examples loan system



- Someone at bottom of income distribution that never earns above the exemption rate: never makes any payment, never returns any debt
- Someone at the top of the income distribution, pays every year according to repayment rate and returns his/her total debt well before the maximum years of repayment
- Someone in between: pays some years, but some other years does not earn enough and does not pay. Pays during the maximum period but does not return all the debt

- We start with a base scenario and then change the different parameters.
- Combination of parameters can be changed to accommodate fiscal situation/political preferences.
- For every case we show, across all percentile of lifetime earnings distribution:
 - Graph illustrating the *Net Present Value of repayments** per year
 - Graph illustrating the *Years to repay the loan*
 - Table showing the *Subsidy as a % of the loan*

*As in Deadren et al. 2008 we assume discount factor of 2.2%

- Base scenario parameters:

1. Debt: 21,000 Euros

- Close to current cost for the government

2. Loan interest rate: 0 %

3. Exemption income level: 15,000 Euros

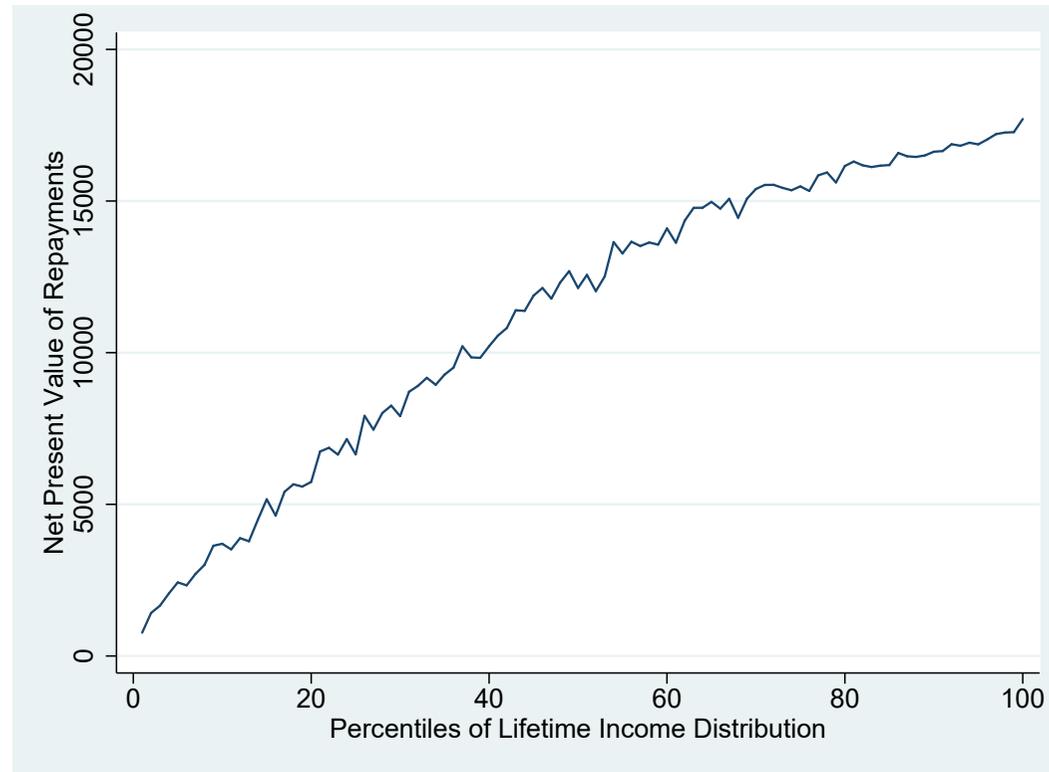
- No repayment if earnings below 15,000 Euros

4. Repayment rate: 10 %

- Pay 10% of your earnings above 15,000 Euros

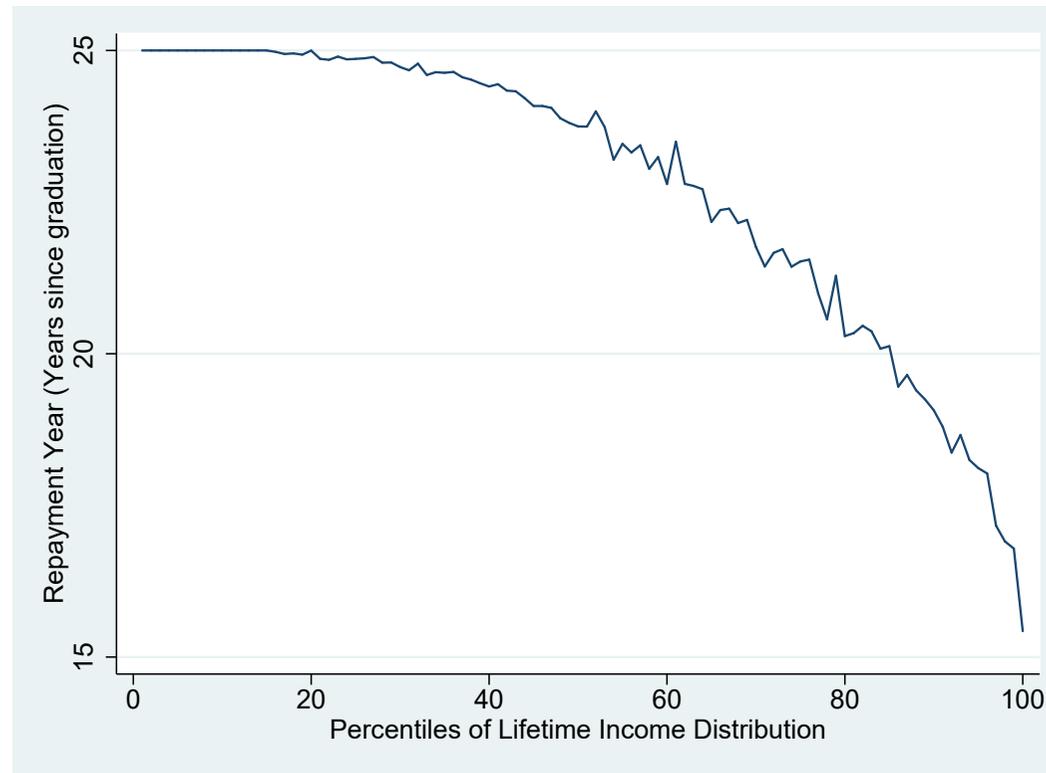
5. Debt write-off, maximum years of repayment: 25

NPV of Repayments for each Percentile of Income Distribution



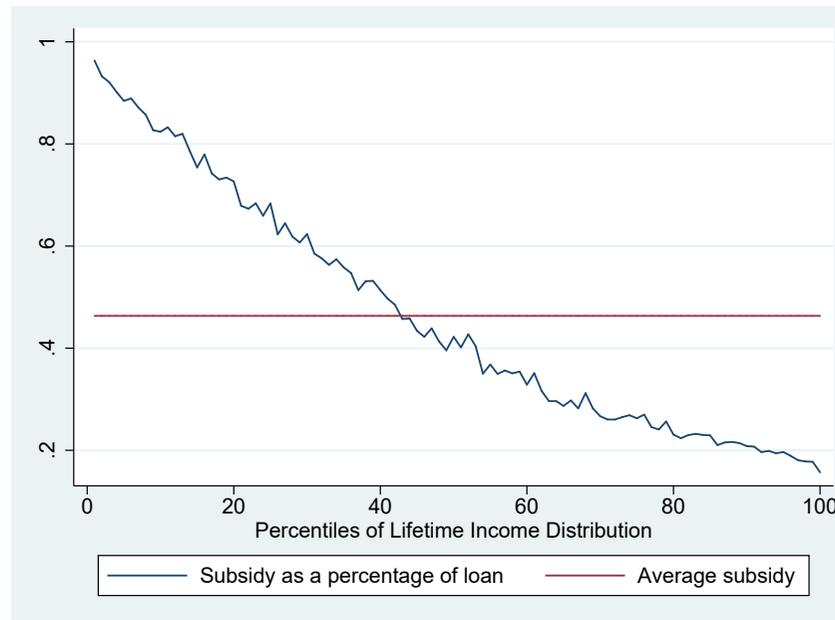
Features: increasing with income

Repayment Years for each Percentile of Income Distribution



Features: decreasing with income;
Range by percentiles: 25 years to 12 years.

Subsidy as Percentage of Loan[†]



Features: decreasing with income;
Range by percentiles: 96% to 15%; Average subsidy: 45%
Higher percentiles: mainly intertemporal subsidy

[†]Share university cost not paid by the individual: $1 - \frac{NPV}{TotalDebt}$.

- Different scenarios:
 - Different debt levels
 - Different exemption levels
 - Different debt write-off years
 - Different repayment rates
 - Different loan interest rates

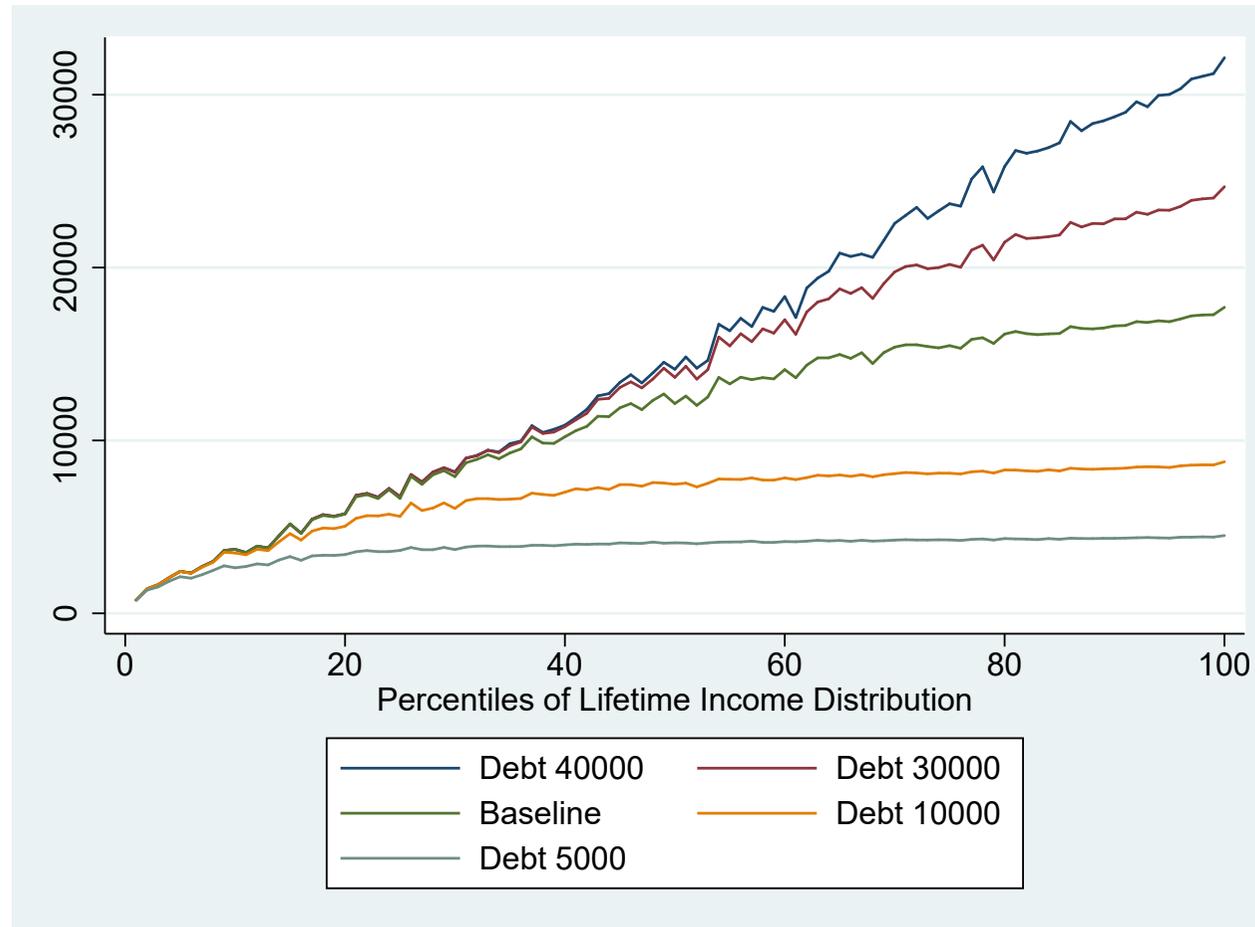
Different debt levels (1/4)



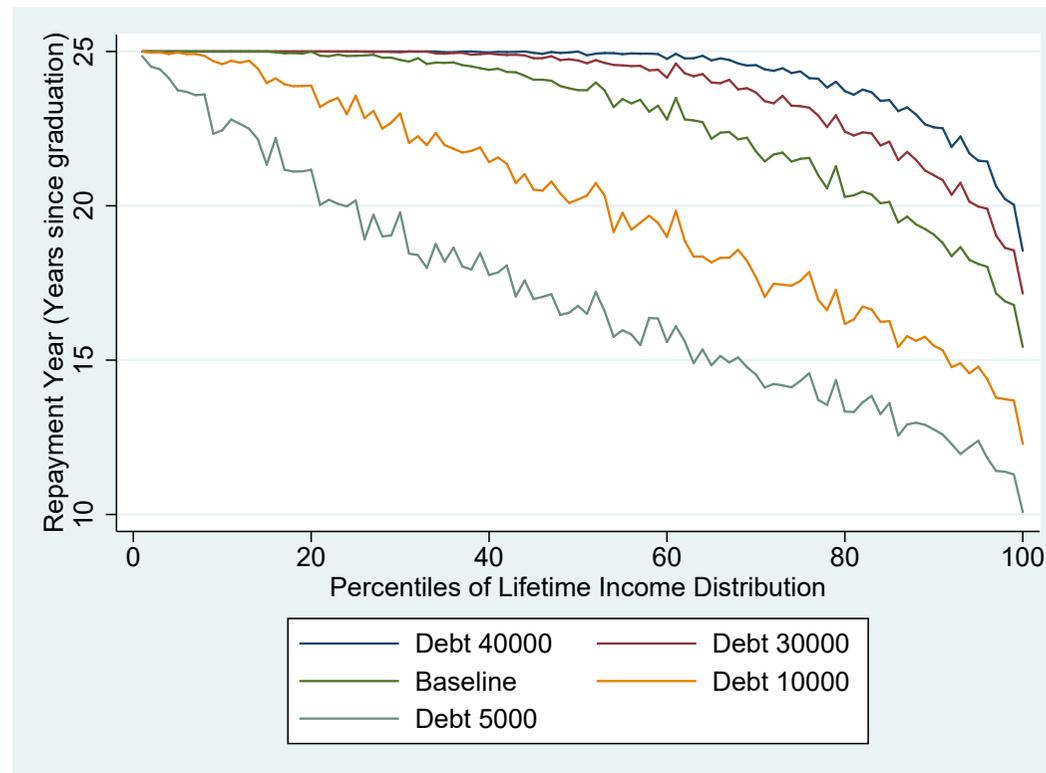
We consider 5 cases, everything else constant

- 5,000: current level of total fees for a degree
- 10,000
- 21,000: Baseline: close to current level of cost
- 30,000
- 40,000: can be thought of fees and maintenance

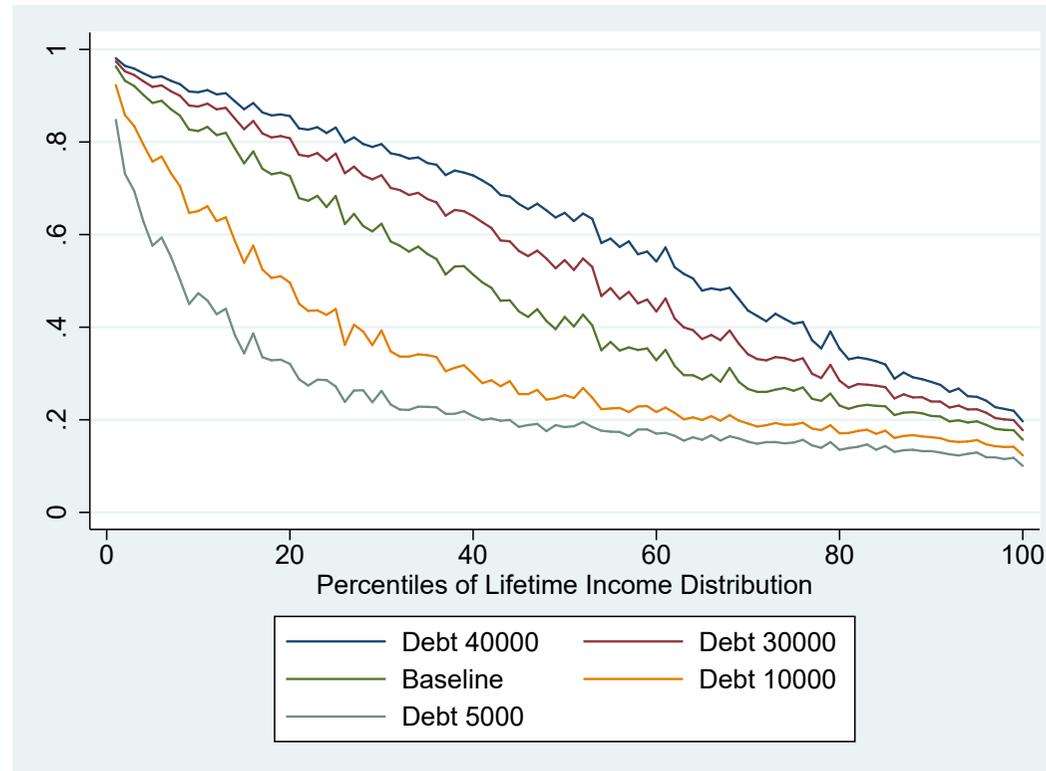
NPV of Repayments for each Percentile of Income Distribution



Repayment Years for each Percentile of Income Distribution



Subsidy as Percentage of Loan

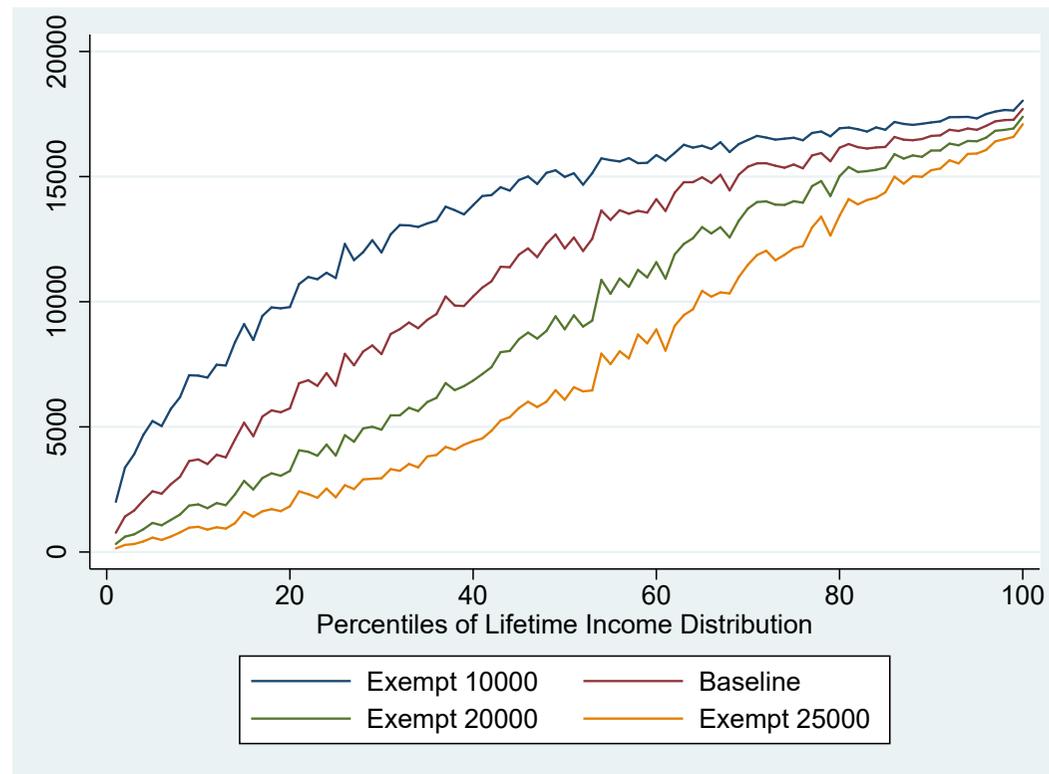


Subsidy increasing with debt (repayment rate constant)
Average subsidies for different debt levels: from 24% to 60%

Different exemption levels (1/3)



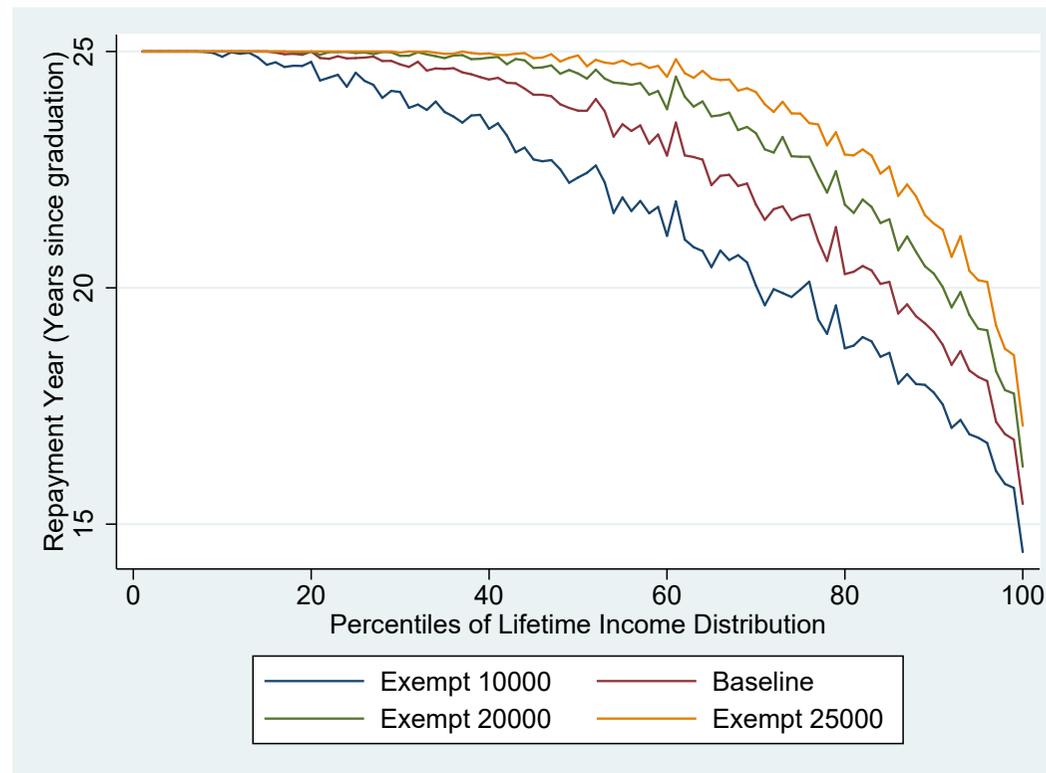
NPV of Repayments for each Percentile of Income Distribution



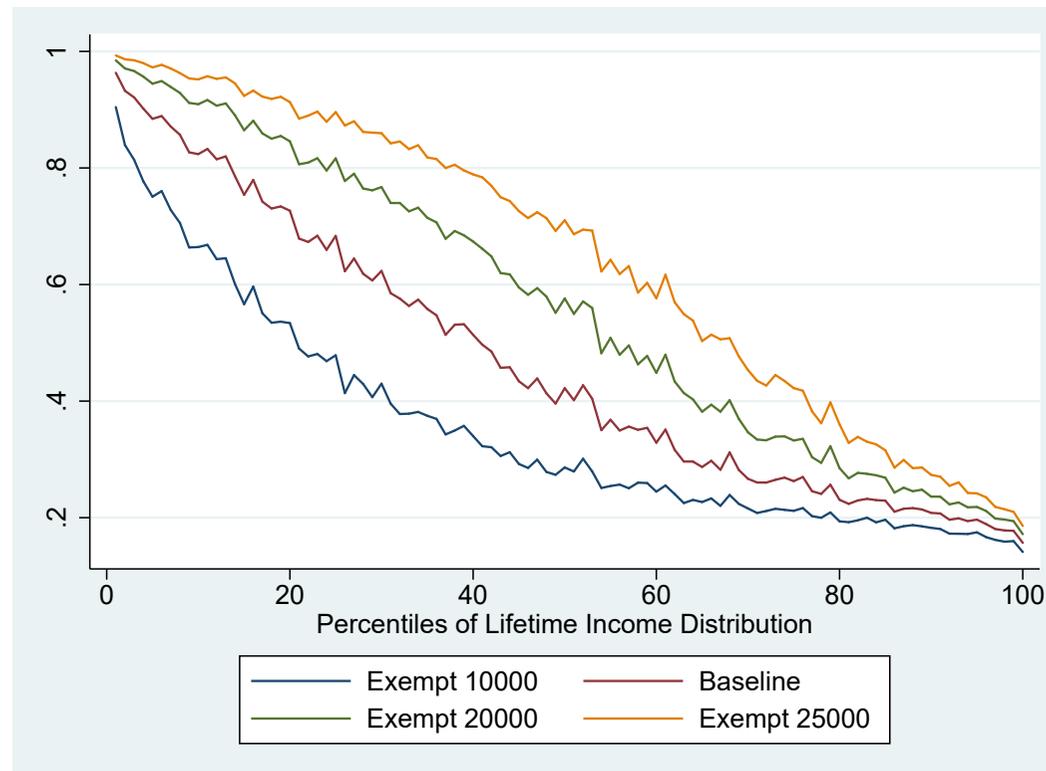
Different exemption levels (2/3)



Repayment Years for each Percentile of Income Distribution



Subsidy as Percentage of Loan

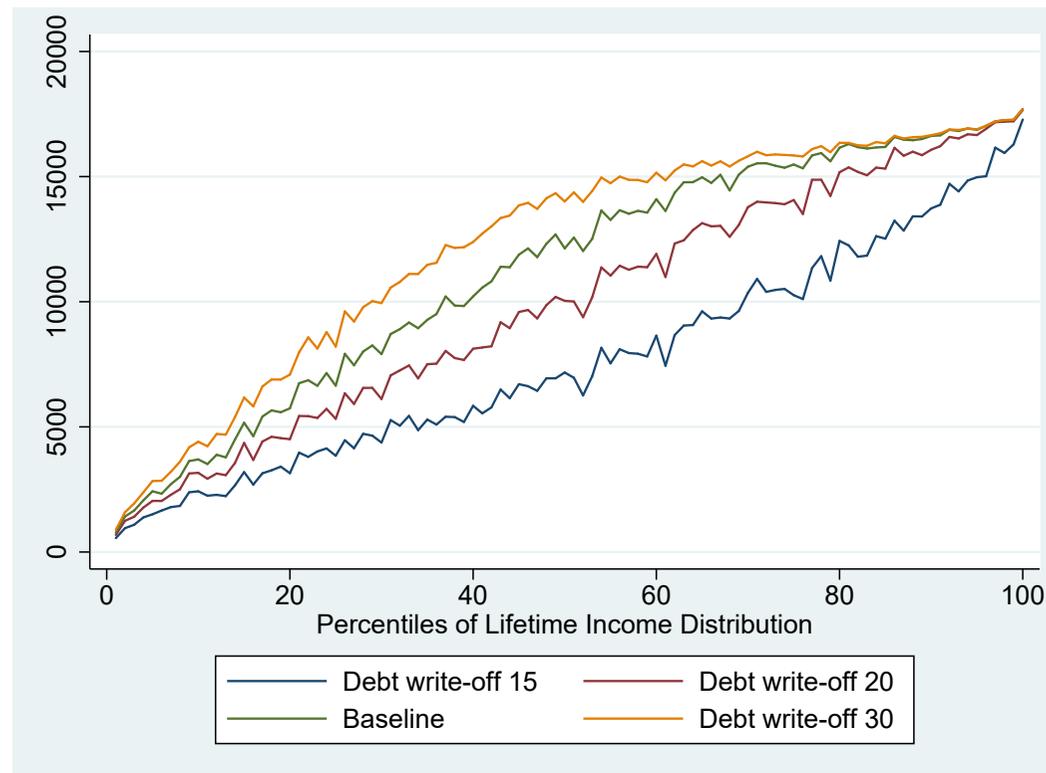


Higher exempt: higher probability not to pay, higher subsidy
Average subsidies for different debt levels: from 35% to 64%

Different debt write-off years (1/3)



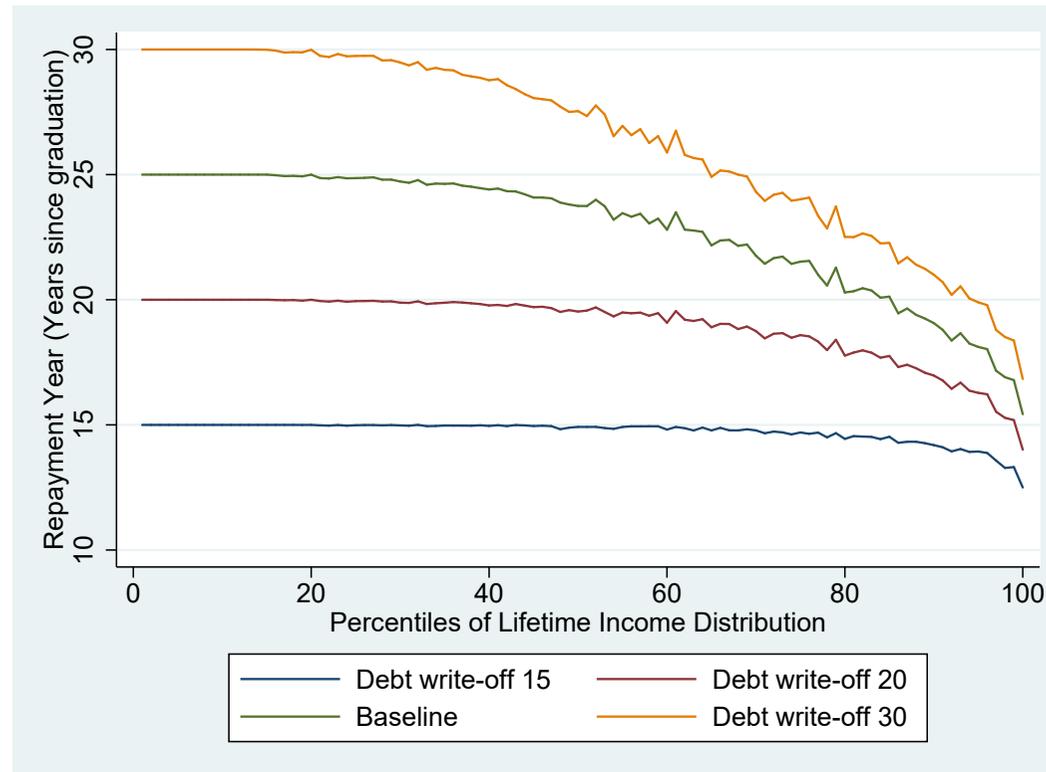
NPV of Repayments for each Percentile of Income Distribution



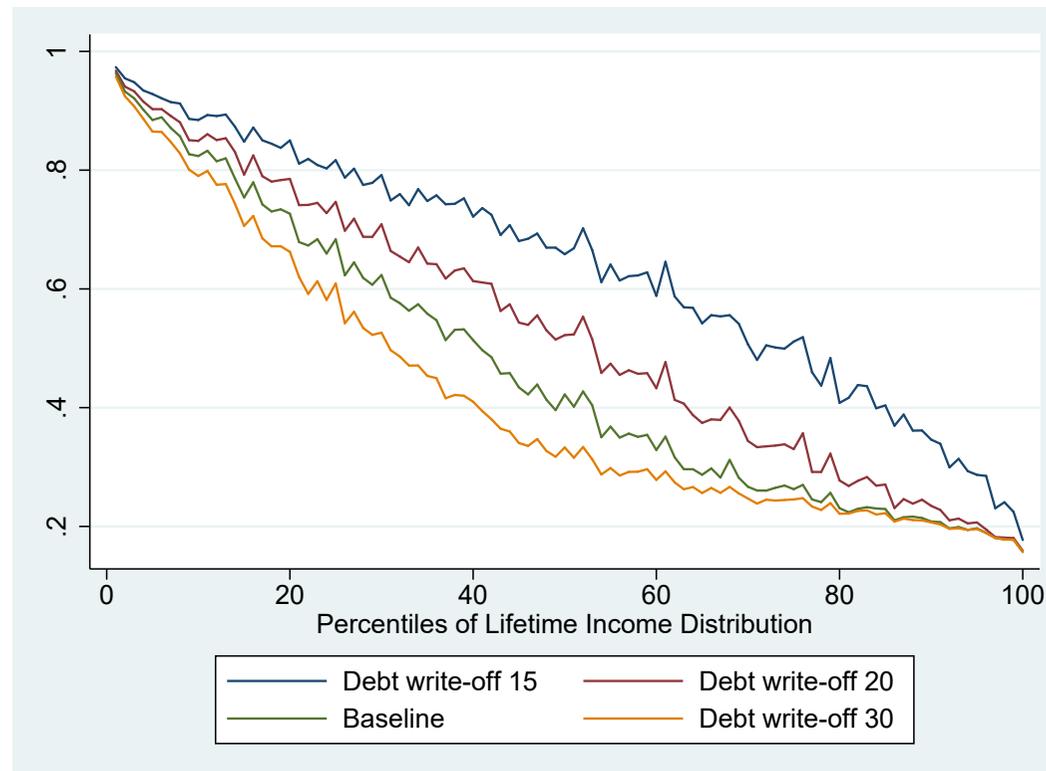
Different debt write-off years (2/3)



Repayment Years for each Percentile of Income Distribution



Subsidy as Percentage of Loan

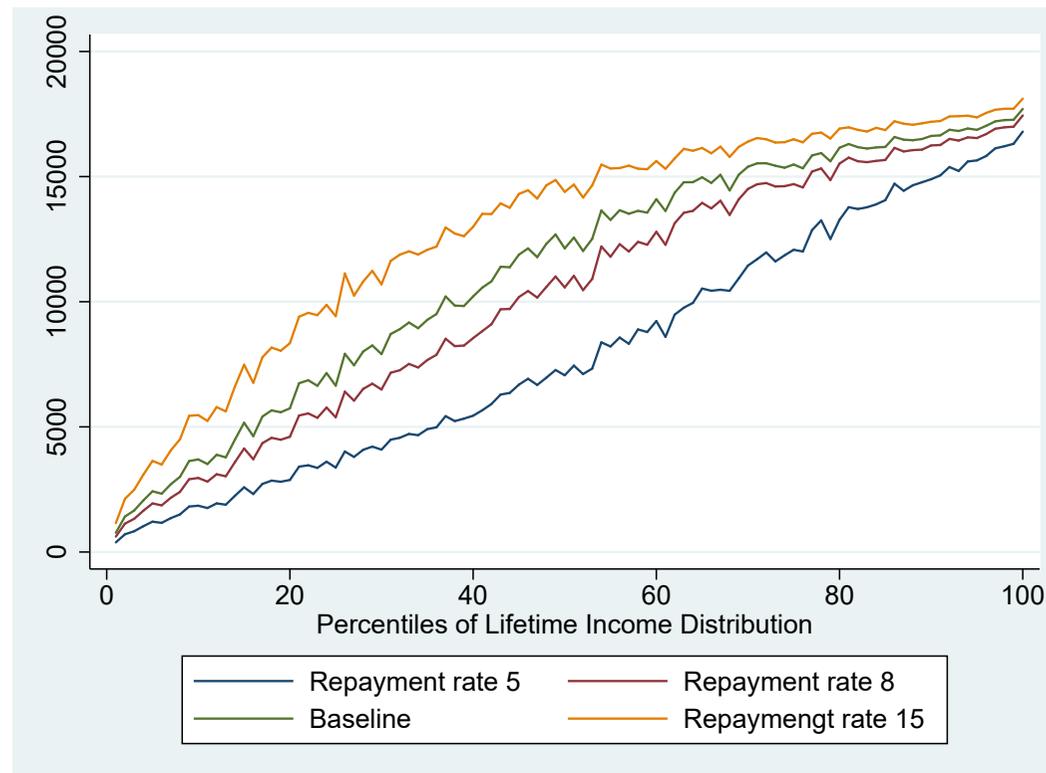


Higher exempt: higher probability not to pay, higher subsidy
Average subsidies for different debt levels: from 41% to 64%

Different repayment rates (1/3)



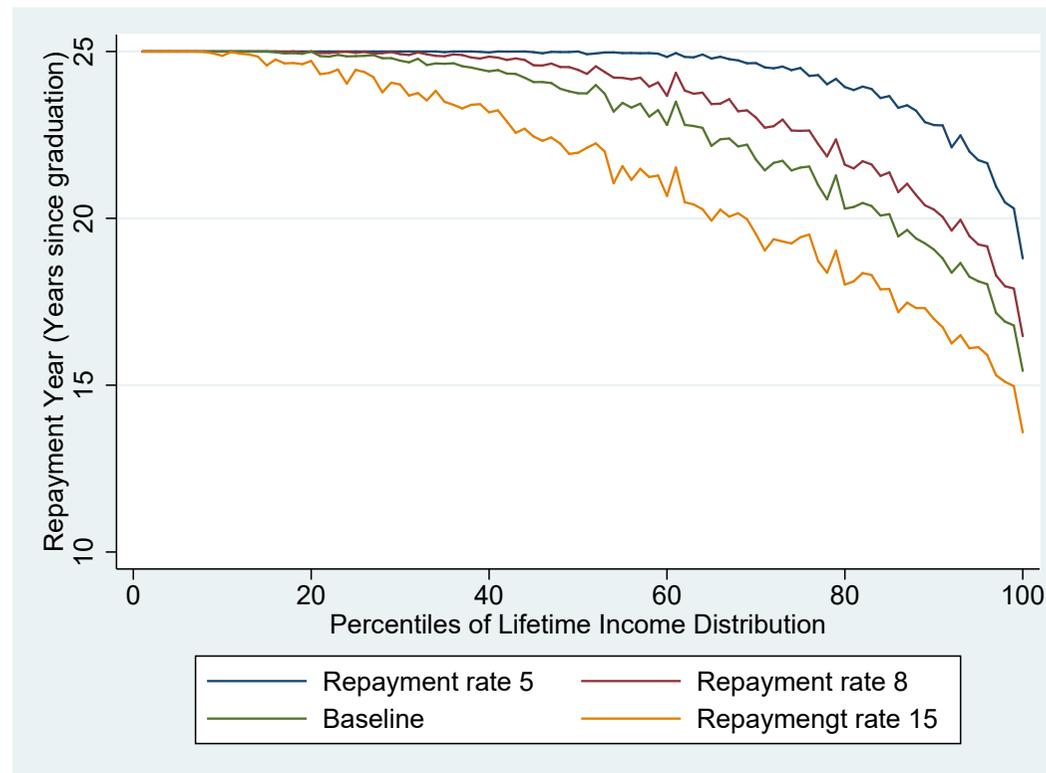
NPV of Repayments for each Percentile of Income Distribution



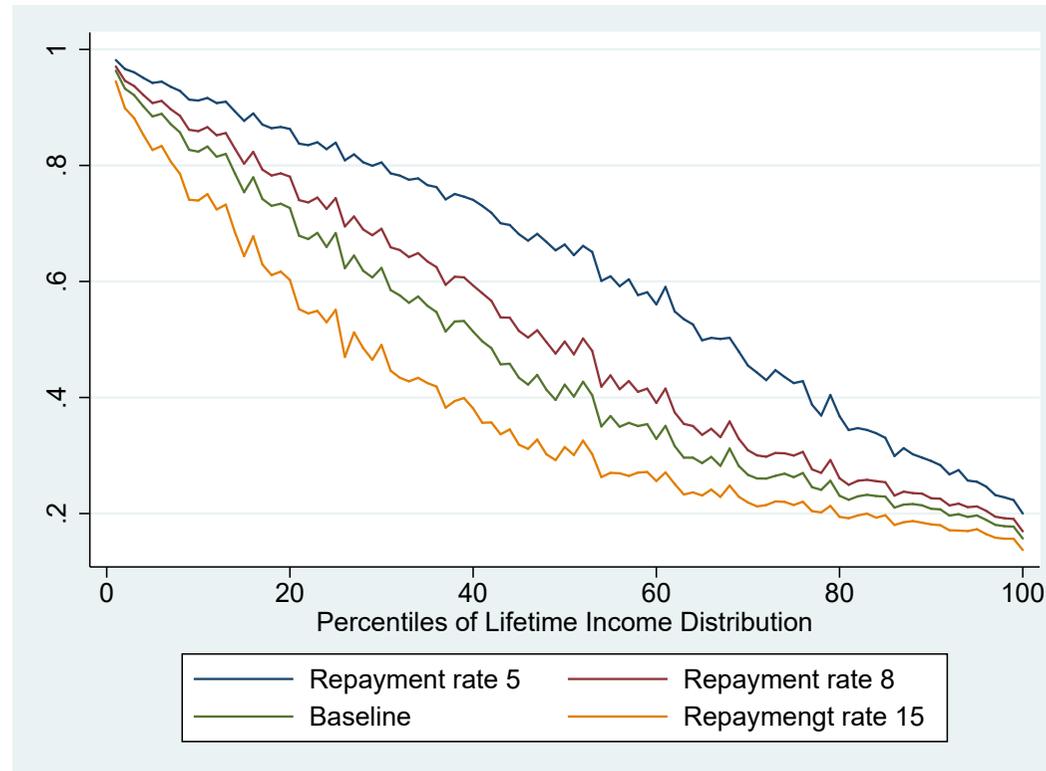
Different repayment rates (2/3)



Repayment Years for each Percentile of Income Distribution



Subsidy as Percentage of Loan

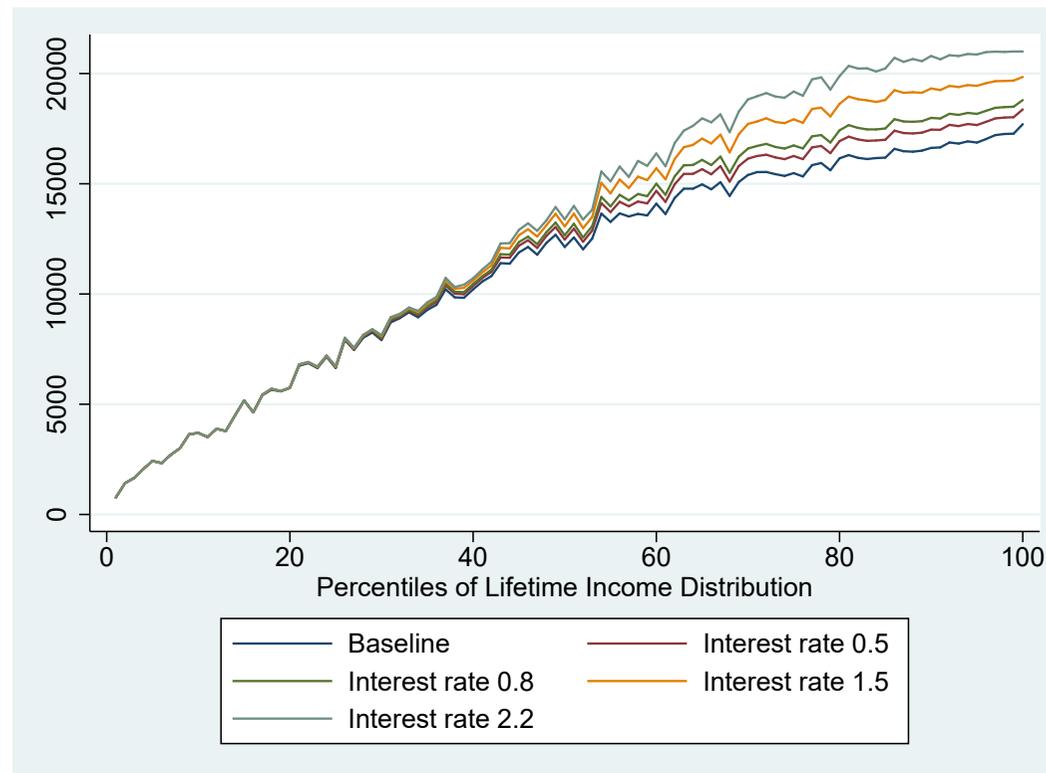


Higher exempt: higher probability not to pay, higher subsidy
Average subsidies for different debt levels: from 38% to 62%

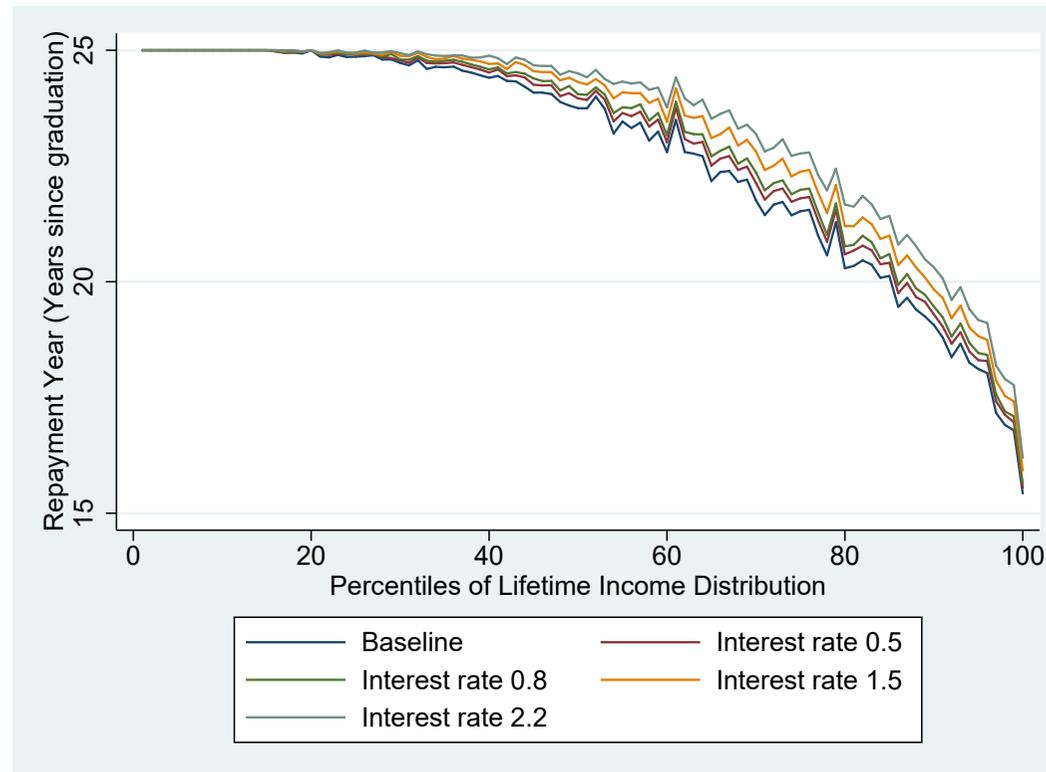
Different loan interest rates (1/3)



NPV of Repayments for each Percentile of Income Distribution

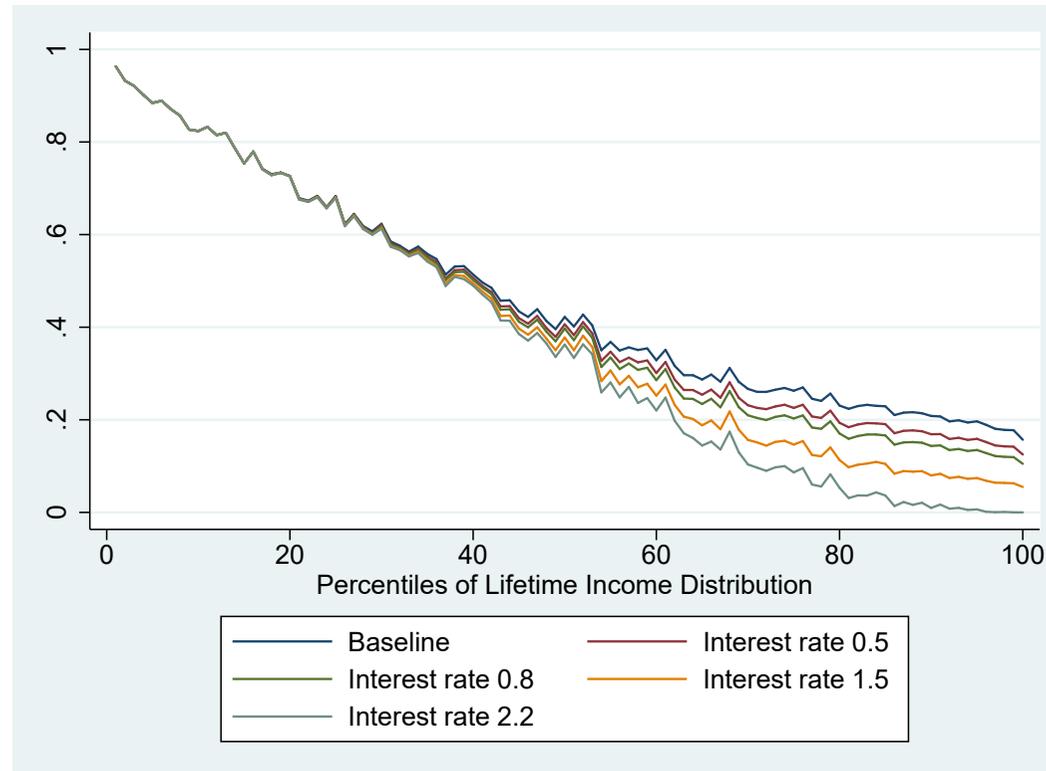


Repayment Years for each Percentile of Income Distribution



Not too sensitive to rates considered; more general, caution, it can revert progressivity (also in Callado Muñoz, Del Rey & Utrero González 2015)

Subsidy as Percentage of Loan



Higher exempt: higher probability not to pay, higher subsidy
Average subsidies for different debt levels: from 38% to 46%

- All scenarios follow a similar pattern along the income distribution
- NPV: given a certain level of debt, lowest lifetime earnings repay less of their debt while highest earners will repay more. Increasing in lifetime earnings.
- Years to repay: lowest lifetime earners, have more years to repay while highest earners have less years. Decreasing in lifetime earnings
- Percentage of loan: lowest lifetime earners receive a larger subsidy than higher lifetime earners. Decreasing in lifetime earnings.

Are these loan policies *feasible*?

- From the government perspective: yes
 - Government saves resources with respect to a flat 80% “subsidy”
- From individuals’ perspective: yes
 - We have built the exception income level (if earnings are not high enough you do not pay), debt write-off (you stop paying at some point even if you have not fully paid the debt)
- Evidence from the UK is useful

Loans: Pareto improvement?



- Universities have more resources (better universities)
- Government savings. So *all* individuals can have lower taxes or better primary schools
- Individuals:
 - Without university degree (60%): better
 - With university degree (40%): depends their position in income distr.
 - Lower tail: better university at no cost
 - Middle: better university with some subsidy
 - Upper tail: better university with no subsidy
- Exact consequences for everyone not trivial, but overall seems better: more resources, more progressive.

- We have analyzed the possibility of introducing higher fees together with **progressive and subsidized loans** in Spain.
- We have constructed a laboratory to explore different loan policies taking into account the dynamics of the Spanish labor market
 - Different loan policies to accommodate political preferences
- Each loan policy implies different levels of saving for the government that could be used elsewhere (primary school education, transfer to lower income families, etc.)
- In sum, proposed policy is more progressive than current system, increases resources for universities and seems feasible

- There are also some challenges:
 - Deterrence. Incentive to get higher paid jobs, might create a poverty-trap. Solution: make repayment more continuous
 - Leave participation into university almost unaffected (Azmat and Simion, 2017)
 - Participation increased among poorest students probably due to access to higher maintenance support
 - Different degrees have different returns to human capital
 - General, put forward the idea that free university is not as redistributive as investment elsewhere (i.e. early years education).
 - Would need political commitment
- Future research: maintenance fees means tested & incorporate regional differences (promote geographical mobility)

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