



*Seminar in demographic economics  
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# **Homogamy and returns on education: A Microsimulation Approach for France**

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# Outline of the presentation

## **1- Motivation**

1-1-The cost-sharing perspective

1-2-The GAMEO project

## **2- The distribution of ex ante returns on higher education**

2-1-The basic framework

2-2-The dynamics of the family formation

## **3-The implementation of a Family formation module**

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3-3-The simulation of partners' characteristics

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## **4- Results**

4-1-On homogamy

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# 1-Motivation

- The **recommendation for developing cost-sharing policies** for higher education is based on ill-specified arguments
- We use a **dynamic microsimulation model** to document distribution/risks in a life course perspective
- An important point is to take into account the **interactions between demographic events and careers**

## 1-1-The cost-sharing perspective

- OECD produces **average private rate of return** on tertiary education at a national level.
- These returns are **above interest rate**
- There is some opportunity to finance the development of tertiary education by **cost-sharing policies**
- ‘To make the students pay’ is **not disincentive to enrolment** in tertiary education
- This is an **ill-stated diagnosis**
  - national differences in the structure of risk (education system, fiscal and social policies)

# 1-2-The GAMEO project (1)

- **GAMEO** : *Generational Accounting and Microsimulation of Educational Output*
- **Features:**
  - Dynamic cohort model (focusing on a **birth cohort**)
  - A model focused on education (important **heterogeneity of diploma**)
  - Tax-benefit system (**not in the paper**)
- **Objective :**
  - Simulate a long term panel: **Stylized cohort**
  - GAMEO simulates trajectories of individuals of a given birth cohort (labour market positions and incomes over the life course)

## 1-2-The GAMEO project (2)

- **Why do demographic events matter in a life course perspective?**
  - Diploma does not only impact transitions on the labour market but it also influences **the timing of birth, union formation** and the partners' matching process (**homogamy**)
  - From an economic point of view, **partner's wages** could have an **"insurance function"** on individuals' labour market income (social risk perspective)
- **We introduce a demographic module (union formation, childbirth) in the GAMEO model**
- **to complement Courtioux, Gregoir, Houeto (2014).**

## 2-The distribution of ex ante returns...

- Based on the panel one could compute an individual rate of returns on higher education( $r$ )

$$\sum_{t=0}^M \frac{Y_t - \bar{X}_t}{(1+r)^{t+1}} = 0$$

- $t$  = age
- $M$  = age of death,
- $Y_t$  = individual income\* at age  $t$
- $X_t$  = mean of income\* of non-tertiary educated at age  $t$

\* Here only wages

## 2-1-The basic framework

- Four assumptions are necessary to interpret our results as an *ex ante* distribution (**taking into account the partner's effect**):

**H1**-Uncertainty about future earnings... **And the earning of the potential partner.**

**H2**-The student does not know his/her own talent/preferences for studying, work **and union**, but he/she knows that he/she can complete a tertiary degree.

**H3**-The individual decision does not concerns a marginal year of schooling but an education track which leads to a diploma.

**H4**-The decision of pursuing higher education is taken at 16 and is irreversible.

## 2-2-The dynamics of family formation

- We want to take into account the **partners effect** in a **dynamic perspective**.
- The partner effect may have an impact on  $Y_t$  and  $X_t$

- $Y_t = Y_{i,t} + Y_{p,t}$

- $X_t = X_{i,t} + X_{p,t}$

### 3-The implementation of a Family formation module

We need to take into account (conditionally to the diploma obtained by the reference individual):

1-differences in the **timing of union formation**

2-differences in the **partners characteristics**  
(diploma, age differences)

3-wages

# 3-1-An overview of GAMEO (1)

- **Data used**

- **The French Labour Force Survey (FLFS)**

- Yearly survey available for the 1969-2011 period (**long term perspective**)
    - Information on individual characteristics (**labour market activity** status, diploma, wages, union position)

- **Statistics on Income and Living Conditions (SILC)**

- Yearly survey available for the 2004-2010 period
    - Precise information on **conjugal transitions** (4 years panel)

- **Inputs**

- **Probabilities of transitions** (Logistic regressions ):

- Labour market position (employment, unemployment, inactivity)
    - Union position (in a relationship, single)

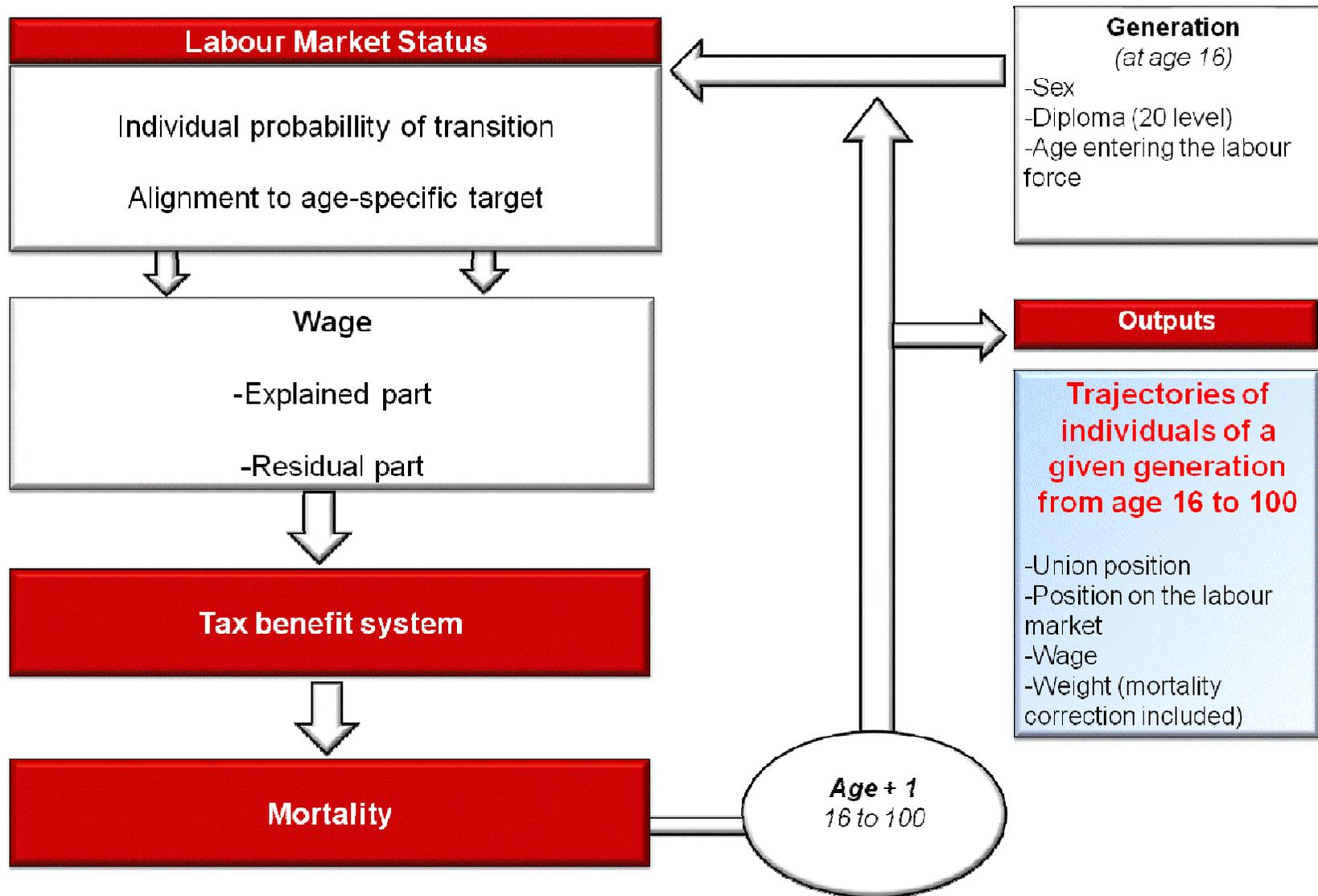
- **Age-specific target** (alignment process)

- **Age differential between partners** (Binomial negative regressions)

- **Matching function** by diploma (multinomial logit)

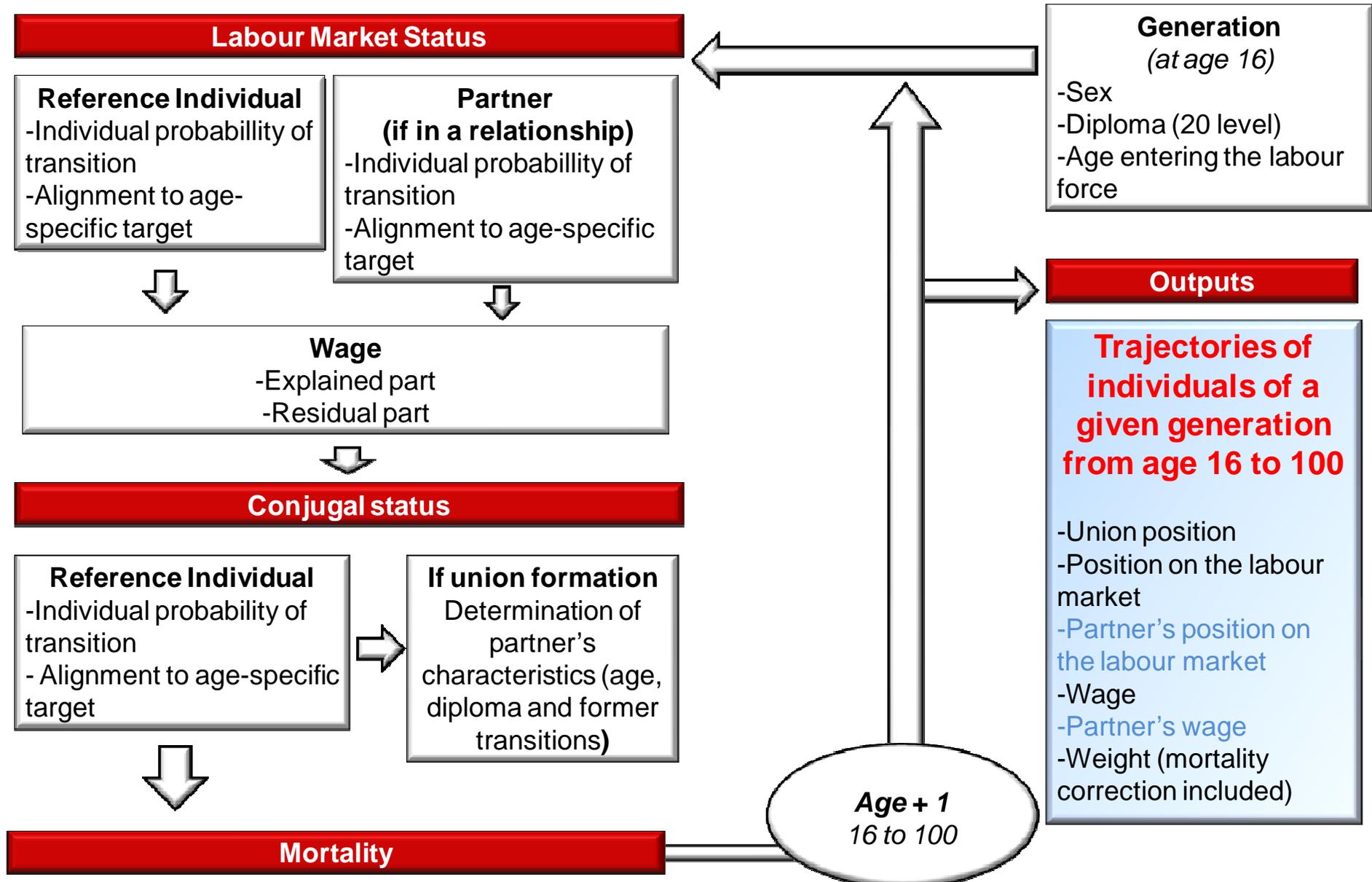
- **Wage Model** (equations à la Mincer by diploma)

# 3-1-An overview of GAMEO (2)



First step of the simulation  
(previous version of GAMEO)

# 3-1-An overview of GAMEO (3)



## 3-2-The simulation of unions' timing (1)

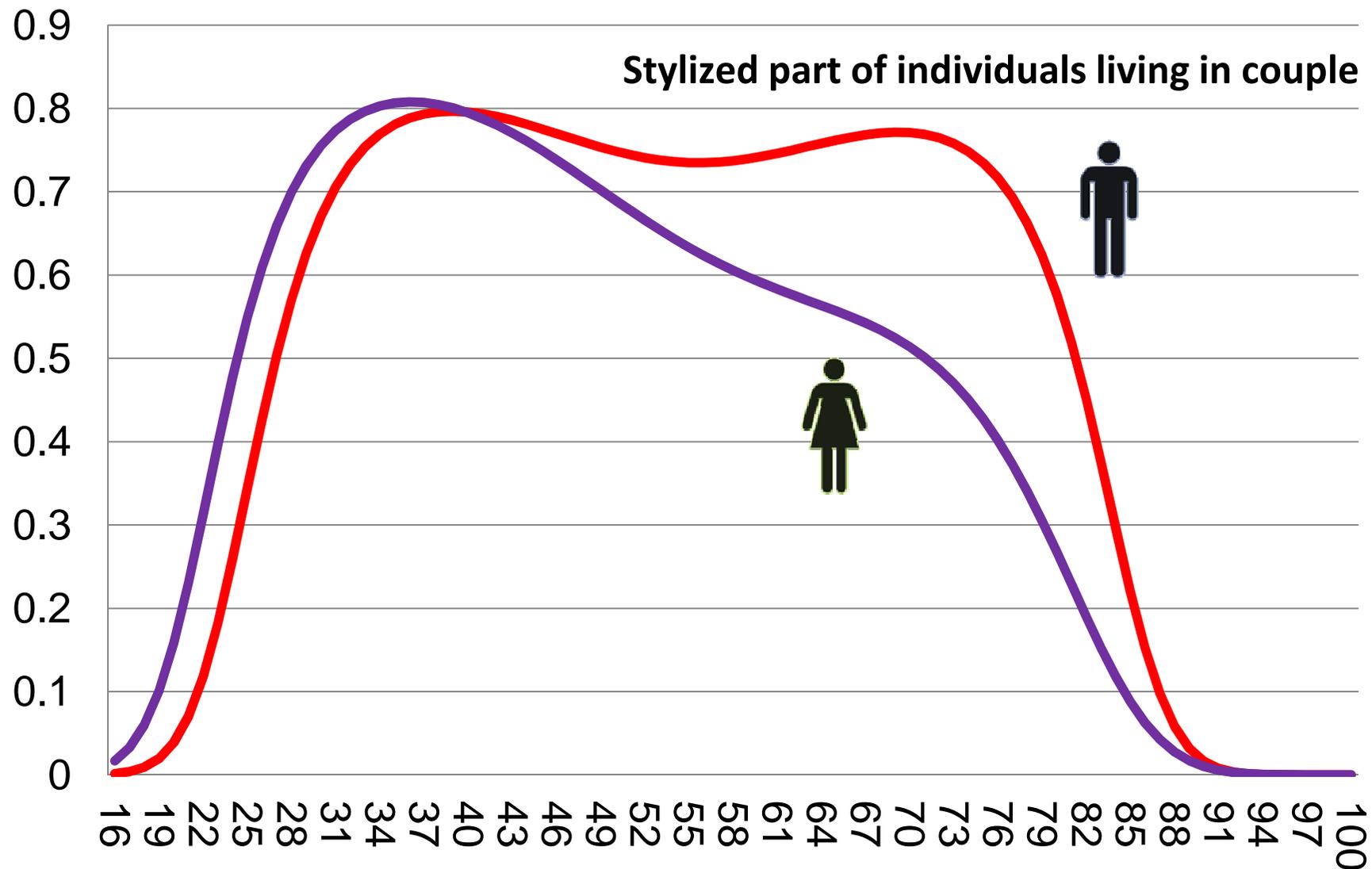
### Two steps:

- Simulation of age-specific macro-target for unions (LFS 1969-2005)

$$\begin{aligned} \text{Log} (Y_{gt} / (1 - Y_{gt})) = \\ \alpha + \beta (t - g) + \gamma (t - g)^2 + \delta (t-g)^3 + \phi (t - g)^4 \\ + \mu (g - 1970) + \omega (g - 1970)^2 + u (u_t) \end{aligned}$$

- Simulation of individual relative probability of being in a union position (SILC)

## 3-2-The simulation of unions' timing (2)



Source : FLFS 1969-2010 –INSEE – authors' calculation

Scope : 1970 cohort with the hypothesis of a current unemployment rate of 8% during the period

## 3-2-The simulation of unions' timing (3)

Single

	Men	Women
<b>Intercept</b>	-1,86	-0,65
Age	-4,37E-02	-6,09E-02
Age <sup>2</sup>	6,61E-04	3,75E-04
Age*End of school	5,40E-02	3,45E-02
Age <sup>2</sup> *End of school	-1,56E-03	-1,15E-03
<b>Having a child &lt; 3 years old</b>	1,58	-0,27
<b>Activity status year <i>n</i></b>		
Employment	<i>ref.</i>	<i>ref.</i>
Out of employment	-	0,26
<i>Unemployment</i>	0,17	-
<i>Inactivity</i>	-0,02	-
<b>Activity status year <i>n+1</i></b>		
Employment	<i>ref.</i>	<i>ref.</i>
Out of employment	-	-0,32
<i>Unemployment</i>	-0,24	-
<i>Inactivity</i>	-0,55	-
P. Conc. (%)	78,4	85
ROC (%)	79,1	85,9
Number of observations	1 841	3 424

Source: SILC 2004-2009 – authors' calculation

## 3-2-The simulation of unions' timing (4)

### Couple

	Men	Women
<b>Intercept</b>	1,92	3,85
<b>Age</b>	-5,65E-03	-1,74E-01
<b>Age<sup>2</sup></b>	3,60E-04	2,09E-03
<b>Human Capital</b>	0,28	0,05
<b>Union duration</b>		
<i>&lt;3 years</i>	<i>ref.</i>	<i>ref.</i>
<i>3 years-10 years</i>	1,79	2,90
<i>11 years-19 years</i>	2,17	3,61
<i>&gt;19 years</i>	2,33	4,45
<b>Having a child &lt; 3 years old</b>	0,91	0,20
<b>Age differential with the partner</b>	-0,09	0,07
<b>Human capital of the partner</b>	-0,29	0,03
<b>Job losses year <i>n</i> (partner out of employment year <i>n-1</i>)</b>	-0,21	-
P. Conc. (%)	68,5	70,5
ROC (%)	72	72,9
Number of observations	8 492	8 816

Source : SILC 2004-2009 – authors' calculation

## 3-3-The simulation of partners (1)

### **Partner's Diploma**

Multinomial logistic regression estimated on the FLFS 2003-2007

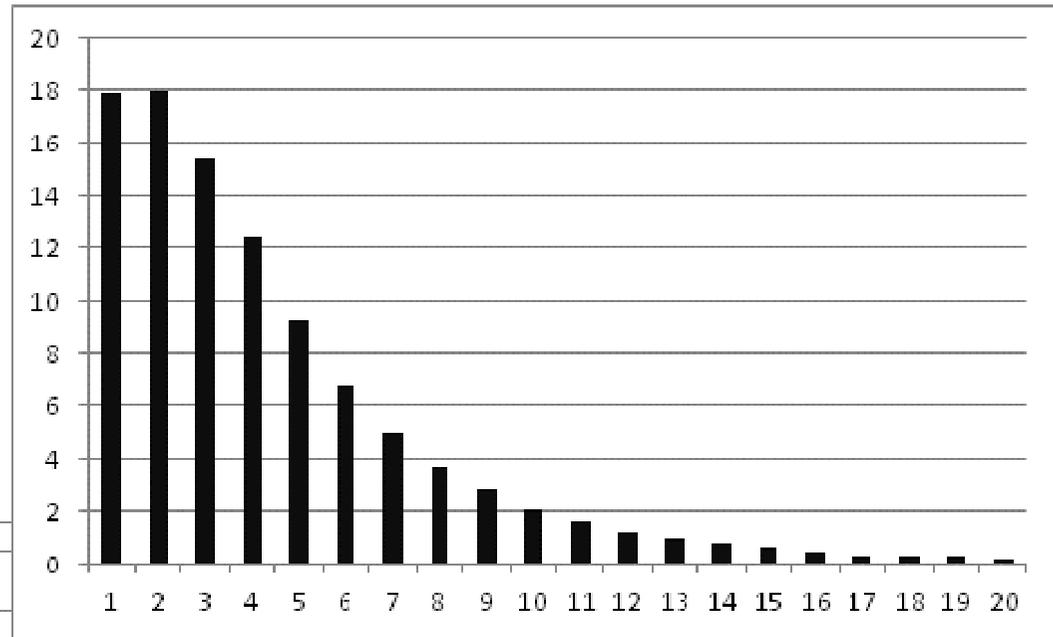
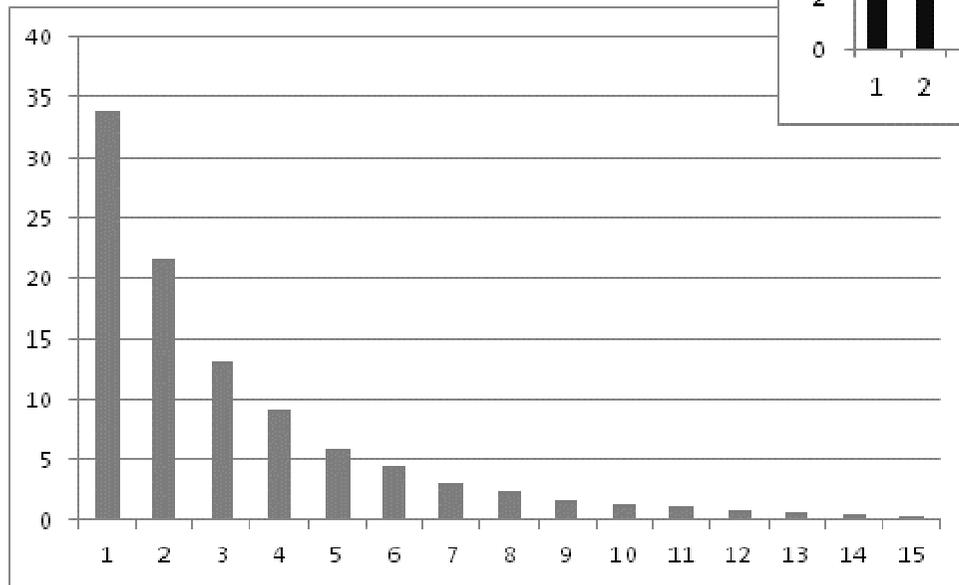
- Partner's diploma is explained by
  - Reference individual's diploma
  - A generational trend
- Estimations differentiated by sex
- 20 diploma categories (only available in FLFS 2003-2007)

**Age difference with the partner** (variables: age, age<sup>2</sup> and a generational trend)

- 2 Cumulated logit to estimate : younger/same age/older
- 4 Negative binomial regressions

# 3-3-The simulation of partners (2)

1- Men older than their partner



2- Women older than their partner

## 3-4-The simulation of wages

- Objective = produce an unbiased estimate of **the effect of diploma on wages** with earning equation à la Mincer
- A set of earning equations (one equation by diploma)
  - The effect of experience is differentiated by diploma
  - The level is enough disaggregated to control for endogeneity between education level and residuals
  - We consider the residuals as the result of a matching process (it is used as such in the simulation).

## 4-Results

### Two kinds of results :

- Specific results on homogamy  
(stemming from the diploma matching function)
- Results on financial returns  
(complementing Courtioux, Gregoir, Houeto, 2014)

## 4-1-On homogamy (1)

We produce a measure of the **part of homogamous couples** by **birth cohort**

(versus **cohort of union** like in Vanderschelden (2006a, 2006b) )...

It allows **differences between men and women** (because “on average” the partners stems from older cohort for the women)

-It depends strongly on the number of item of the education variable. Ex: for men;

-40% (five items)

-35% (8 items)

-26% (19 items)

NB. for Vanderschelden (2006a, 2006b) 54-56%

## 4-1-On homogamy (2)



diplôme	diplôme du conjoint						Part de la cohorte
	Sans diplôme	CAP/BEP	Bac	Bac+2 à Bac+4	Bac+5 et plus	Total	
Sans diplôme	41%	26%	16%	15%	2%	100%	26%
CAP/BEP	26%	37%	18%	17%	1%	100%	30%
Bac	16%	19%	28%	33%	4%	100%	14%
Bac+2 à Bac+4	8%	11%	18%	53%	10%	100%	21%
Bac+5 et plus	4%	4%	10%	47%	35%	100%	8%



diplôme	diplôme du conjoint						Part de la cohorte
	Sans diplôme	CAP/BEP	Bac	Bac+2 à Bac+4	Bac+5 et plus	Total	
Sans diplôme	49%	36%	8%	6%	1%	100%	25%
CAP/BEP	29%	51%	10%	9%	1%	100%	25%
Bac	24%	31%	20%	19%	5%	100%	16%
Bac+2 à Bac+4	14%	19%	16%	37%	15%	100%	29%
Bac+5 et plus	8%	6%	9%	30%	47%	100%	7%

Source : FLFS 2003-2010 (Insee) – authors' calculations

Sample: individuals living in couple, 1970's generation.

## 4-1-On homogamy (3)



diplôme	diplôme du conjoint									Part de la cohorte
	Sans diplôme	CAP/BEP	Bac	Bac+2	Bac+3	Bac+4	Bac+5	plus de Bac+5	total	
Sans diplôme	41.4%	26.3%	15.9%	10.2%	2.8%	1.6%	1.4%	0.4%	100%	26.2%
CAP/BEP	25.6%	37.3%	18.3%	13.4%	2.6%	1.5%	1.1%	0.2%	100%	30.4%
Bac	15.6%	18.7%	28.1%	21.6%	7.1%	4.5%	3.3%	1.1%	100%	13.7%
Bac+2	9.2%	13.8%	20.7%	33.4%	9.4%	6.5%	5.6%	1.4%	100%	13.6%
Bac+3	5.3%	6.3%	14.9%	22.5%	25.4%	11.0%	11.4%	3.2%	100%	4.2%
Bac+4	4.2%	4.8%	14.3%	19.5%	17.3%	22.8%	13.6%	3.5%	100%	3.5%
Bac+5	3.9%	4.5%	10.5%	22.5%	13.8%	11.8%	28.1%	4.9%	100%	7.0%
plus de Bac+5	1.8%	2.2%	7.8%	19.6%	11.9%	12.3%	21.2%	23.1%	100%	1.4%



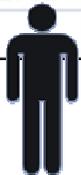
diplôme	diplôme du conjoint									Part de la cohorte
	Sans diplôme	CAP/BEP	Bac	Bac+2	Bac+3	Bac+4	Bac+5	plus de Bac+5	total	
Sans diplôme	48.8%	35.7%	8.2%	4.6%	0.9%	0.5%	1.1%	0.1%	100%	25.5%
CAP/BEP	28.9%	50.6%	10.3%	7.1%	1.0%	0.5%	1.3%	0.2%	100%	25.0%
Bac	23.9%	31.4%	20.5%	14.0%	3.2%	2.1%	3.9%	0.8%	100%	16.4%
Bac+2	15.8%	24.0%	16.7%	24.5%	5.1%	3.0%	8.9%	2.1%	100%	17.0%
Bac+3	11.9%	12.7%	14.8%	18.7%	16.1%	7.4%	15.1%	3.4%	100%	6.8%
Bac+4	9.7%	11.0%	14.1%	18.9%	9.8%	14.0%	18.0%	4.6%	100%	5.3%
Bac+5	7.8%	6.8%	9.4%	14.3%	9.4%	7.5%	38.2%	6.6%	100%	5.4%
plus de Bac+5	7.5%	4.3%	9.6%	12.7%	8.1%	6.1%	21.3%	30.4%	100%	1.8%

Source : FLFS 2003-2010 (Insee) – authors' calculations

Sample: individuals living in couple, 1970's generation.

## 4-1-On homogamy (4)

Diplômes Bac+5 et plus	diplôme du conjoint										part dans la cohorte
	Licence	Autre Bac+3	Maitrise	Master recherche	Master pro.	Ecole de commerce	Ecole d'ingé.	Doctorat (hors médical)	Doctorat (médical)	Total	
Master recherche	12.6%	4.1%	17.3%	12.5%	11.7%	1.1%	2.5%	2.6%	2.5%	67%	1.1%
Master pro.	9.4%	4.6%	12.0%	4.2%	18.8%	3.1%	1.7%	2.3%	3.1%	59%	1.8%
Ecole de commerce	6.6%	5.5%	10.2%	4.1%	9.8%	18.0%	1.6%	1.1%	2.9%	60%	0.9%
Ecole d'ingé.	9.6%	3.6%	10.3%	3.2%	7.7%	3.1%	12.9%	2.2%	2.6%	55%	3.2%



Diplômes Bac+5 et plus	diplôme du conjoint										part dans la cohorte
	Licence	Autre Bac+3	Maitrise	Master recherche	Master pro.	Ecole de commerce	Ecole d'ingé.	Doctorat (hors médical)	Doctorat (médical)	Total	
Master recherche	4.6%	5.8%	7.8%	9.9%	8.1%	3.4%	10.8%	7.3%	1.8%	59%	1.3%
Master pro.	5.5%	4.6%	9.1%	3.7%	14.5%	3.5%	11.0%	3.9%	2.2%	58%	2.7%
Ecole de commerce	3.1%	4.6%	4.7%	1.3%	9.1%	23.6%	16.4%	3.9%	1.6%	68%	0.8%
Ecole d'ingé.	3.0%	3.1%	3.9%	2.2%	3.6%	1.5%	49.6%	3.9%	1.4%	72%	0.7%



Source : FLFS 2003-2010 (Insee) – authors' calculations  
 Sample: individuals living in couple, 1970's generation.

## 4-2-On returns (1)

### IRR to tertiary education

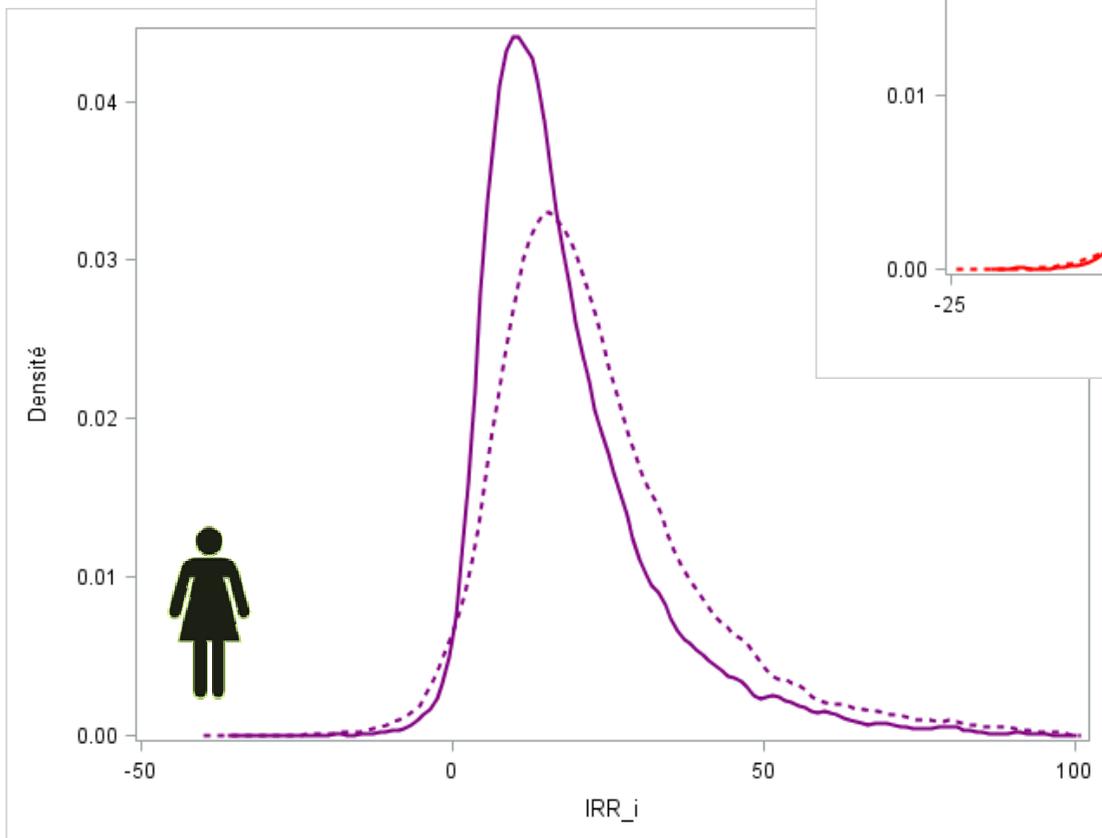
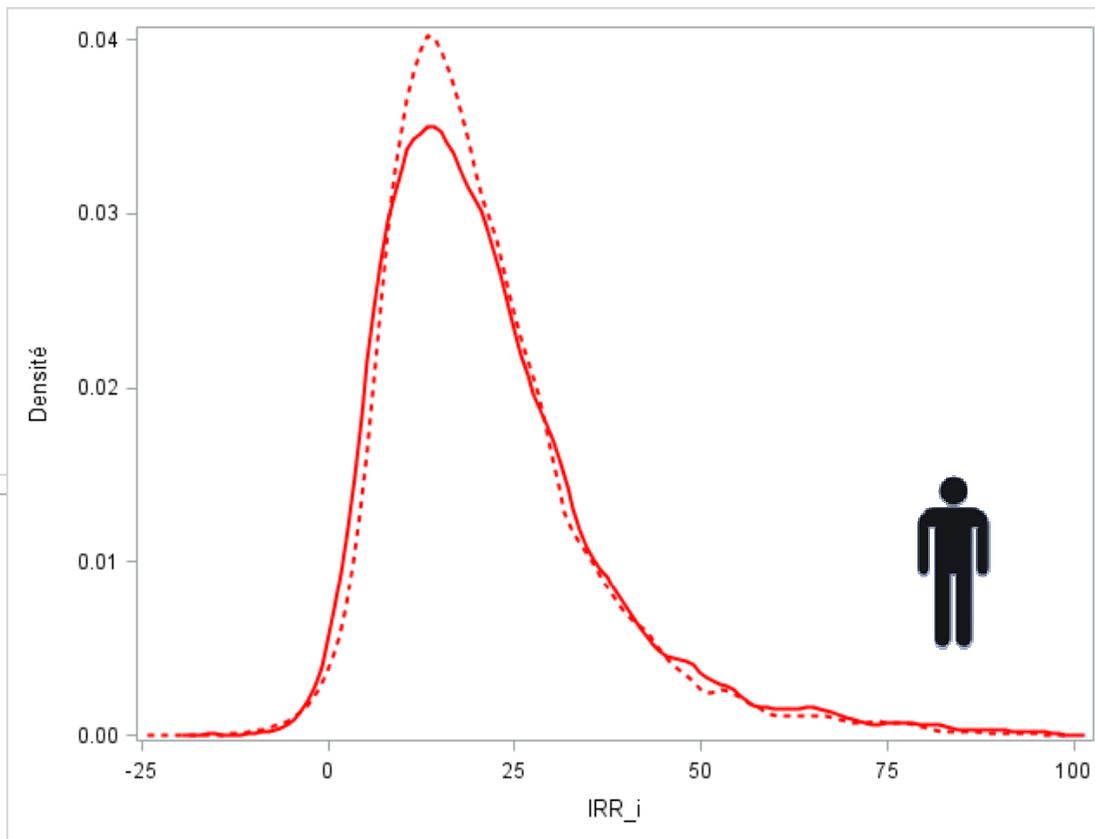
Tertiary degrees	P50		IRR<0	
	IRR <sub>i</sub>	IRR <sub>c</sub>	IRR <sub>i</sub>	IRR <sub>c</sub>
Men	16.7%	16.6%	10.1%	8.0%
Women	13.3%	18.5%	11.3%	9.4%

**Source** : Gameo (Edhec) - authors' calculations.

**Sample**: 1970's generation.

# 4-2-On returns (2)

Men →



← Women

## 4-2-On returns (3)

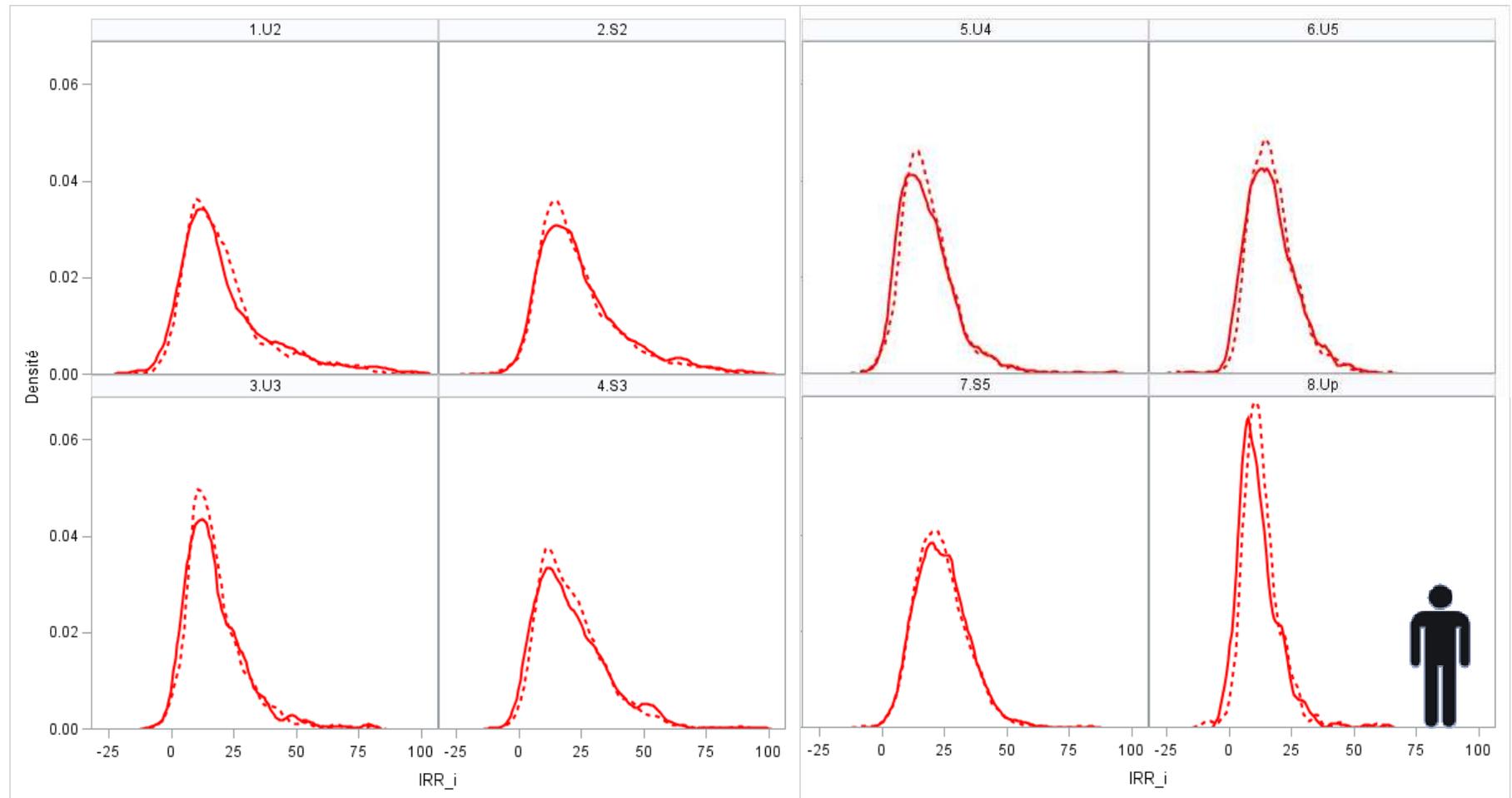
### Part of negative returns

Tertiary degrees		IRR<0	
		IRR <sub>i</sub>	IRR <sub>c</sub>
<b>All men</b>		<b>10.1%</b>	<b>8.0%</b>
Bac+2	University	33.3%	20.0%
	School	11.2%	10.1%
Bac+5	University	6.4%	4.1%
	School	0.9%	1.4%
<b>All women</b>		<b>11.3%</b>	<b>9.4%</b>
Bac+2	University	31.0%	22.7%
	School	11.0%	10.7%
Bac+5	University	5.3%	3.6%
	School	2.9%	1.5%

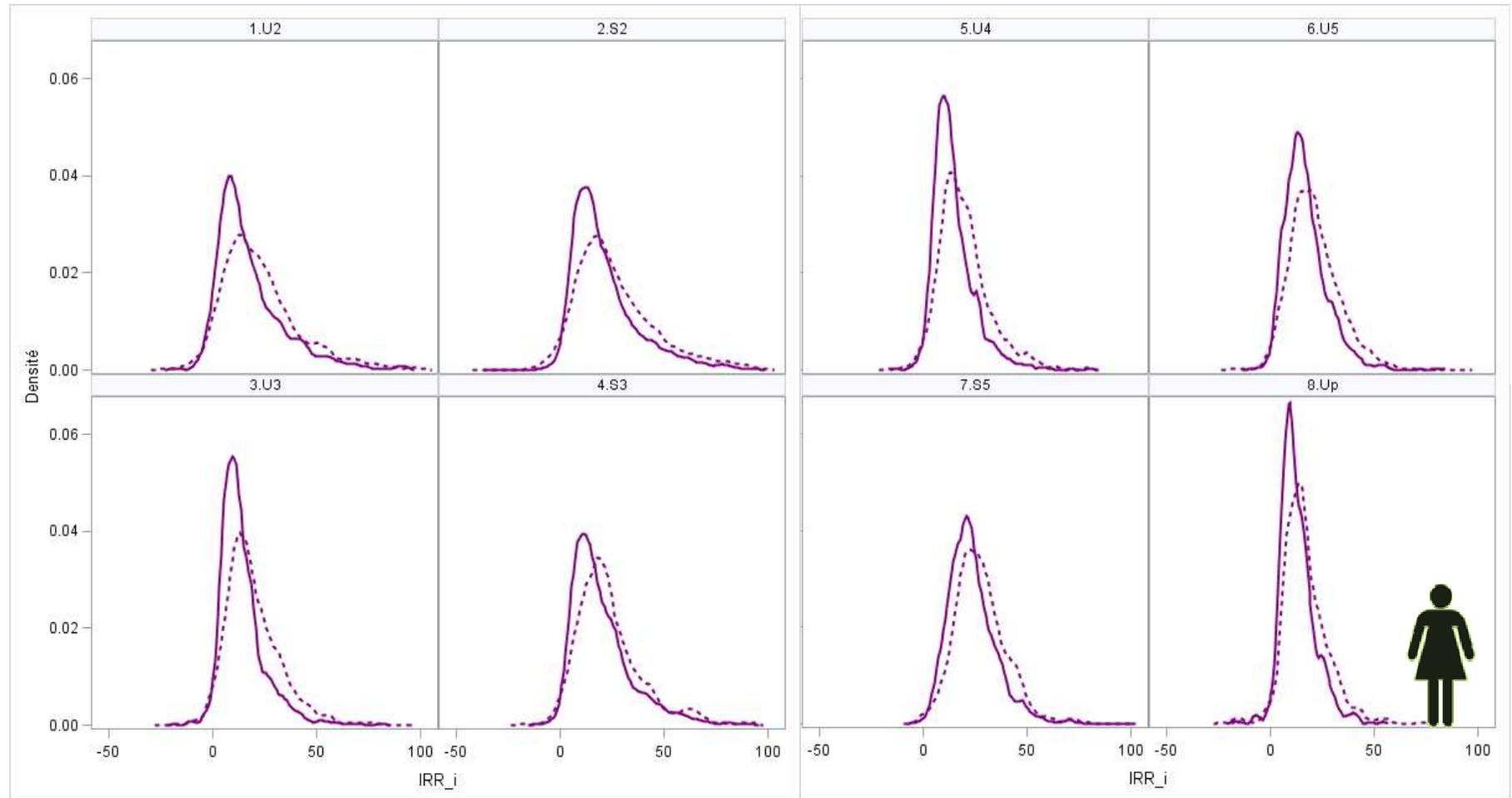
**Source** : Gameo (Edhec) - authors' calculations.

**Sample**: 1970's generation.

# 4-2-On returns (4)



# 4-2-On returns (5)



## 5-Conclusion

- The main results concerning IRR on tertiary education:
  - For men: the **risk** decrease but not the **value**
  - For women: the **risk** decrease but the **value increase** (5 points at the median level)
- Next developments for the modelling:
  - Parenthood
  - The ‘family dimension’ of fiscal and social policies
  - Introduce the risk in a structural model of education choice

# References

- Courtioux P., Gregoir G., Houeto (2014, forthcoming), “Modelling the distribution of returns on higher education”, *Economic Modelling*.
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- Vanderschelden M.(2006b), “L'écart d'âge entre conjoints s'est réduit”, *Insee Première*, n°1073.