Public Employment and Higher Education: Analysing Risk of Return to Diploma

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Abstract
The issue of reforming tertiary education is broadly based on national standardized indicators published by OECD. However, these indicators do not take into account the institutional complementarities between education system and labour market which are put forward by socio-economic theories. In this article, we propose a micro-analytical framework to develop a more comprehensive approach of one of these indicators. Based on a dynamic microsimulation modelling of careers for France, we compute individual returns to higher education. Our results show that national labour market context characterized here by the careers opportunities in the public sectors has an impact on the relative valorisation risk of pursuing tertiary education. The impact is particularly high for the University degrees which is the less selective part of French higher education system. More generally, our results show that the issue of increasing individual incentives to pursue higher education cannot be tackled independently of career opportunities which are partly determined by the links between the different type of degree and the relative specialization of the national economy in terms of industrial sectors.

1. Introduction
Higher education has become a crucial issue for most developed countries. This issue has been put to one of the top priorities of the political agenda. For instance in Europe, the educational part of the Lisbon Strategy, the so-called Education and Training 2010, put the stress on the links between educational system and social cohesion and establishes some educational targets in this area like the share of early school leavers or the increase in the part of graduates in master of science and technology –see Commission for the European Communities (2005). More recently in the United States, the American Recovery and Reinvestment Act points out the need of heavily investing in education, and notably in higher education, in order to ‘provide jobs now and lay the foundation of a long-term prosperity’. From a labour market point of view, the basic idea is that education and more particularly higher education could provide better wages, lower unemployment risk and more generally a better
inclusion for workers. In this view, the incentives to pursue higher education are put forward. The private return to higher education is one of the most popularised indicators –see for instance OECD (2008).

In this article, we argue that such aggregated national indicators are not sufficient to apprehend the incentives of entering a higher education curriculum. The appraisal of higher education returns has to be more comprehensive: it has to take into account the diversity of higher education diplomas produced by the education system, their relative inclusion in the high wages industrial sectors as well as their relative unemployment risk. This perspective put the stress on the level of career heterogeneity which is central to propose integrated reform recommendations concerning both higher education system and labour market policies (training rights, unemployment protection, etc.). Such an approach has to be rooted at a national level: it has to take into account the set of institutions related to education systems and labour market. From an industrial relation perspective, an important question is a description of the heterogeneity of the incentive structure because it has some implications for the management of social risks for workers when one considers their career perspective. In this view, the existence of labour market segmentation for tertiary degrees calls for diploma specific lifelong learning programmes. Based on a dynamic microsimulation modelling of the valorisation of a tertiary degree, this article explores such an issue for France.

In section 2, we propose an interpretation of segmentation theory in a social risk management framework. Considering evidence of higher education system, we argue that the French case is interesting to investigate, because of a dualisation of tertiary curriculum which could have an impact on the valorisation of a tertiary degree. We show that in France the proportion of degrees pursuing a career in the public sector differs importantly when one considers the type of degree: the University track which is characterized by low level of public investment per capita is overrepresented in public careers, whereas the School system which is characterized by high level of public investment per capita is underrepresented. In section 3, we argue that microsimulation techniques are an adequate way to analyse this issue and we present the model retained. In section 4, we present the results of the simulation. We show that the national regime characteristics of labour market have an impact on the individual valorisation risk of tertiary diploma. In this view, a comprehensive reform of incentive scheme to pursue higher education has to take into account the
relation between diploma and career perspective. In France, the University —versus the tertiary schools— which is the least valorised part of the French dual higher education system, is dependant of administration careers for the valuation of its degrees.

2. Higher education and segmentation in a risk management perspective

In the section, we explain how we reinterpret the segmentation socio-economic theories in a transitional labour market perspective (TLM): segmentation is then identifies as a transition risk that impacts career output. Considering tertiary education development context, this leads to put the stress on distribution of return rather than the OECD’s mean return indicator. We argue that the French higher education system characterized by a dualisation of diploma types is interesting to illustrate this case.

Reformulating the segmentation hypothesis in a TLM perspective

The idea that the analysis of interactions between education system and labour market has to be comprehensive is not new. The societal approach recommends that a comprehensive analysis considers simultaneously the educational, the professional and the social paths at a national level. For instance Maurice et alii (1982) put the stress on the national consistency characterized by stable relations which define the national regimes. More recently the Variety of Capitalism approach (VoC) put also the stress on the consistency of this various dimensions at the national level. For instance Amable (2003) points out the complementarities of education system with other systems: labour market, industrial system and social protection. From an empirical point of view, the richness of the education system’s institutions and the links of these institutions with other systems makes it difficult to produce a metrics: Amable (2003), after a review of comparative analysis of national education systems concludes that an analysis at the macro level has to focus on a small set of aggregated variables to produce a typology.

However, an aggregated approach of education systems remains unsatisfactory in a perspective of social risk management which focus on individuals, their career and their monetary incentives to enrol in education. In this view, prolonging and completing the societal approach of individual paths, the Transitional Labour Market approach (TLM)—Gazier and Schmid (2002), Schmid (2006)—integrates social
policies and the family sphere into the analytical framework. This leads to put the stress on the management of transitions between various positions during the life course as well as the institutions which sustain these transitions. In this view, a good management of social risks leads the individuals to avoid bad transitions characterized by negative effect on their remaining lifetime—in terms of job and life quality, income, etc. In this perspective, the seminal concept of segmentation—Doeringer and Piore (1971)—could be re-interpreted as a polarization of different level of social integration due to a pattern of successive transitions. For Schöman and O’Connel (2002), in a TLM perspective, social integration across the life course is a multi-level phenomenon where both individual decisions and societal opportunity determine actual outcomes over the life course. Following these authors, the life course dimension of TLM approach requires a microanalytic research design based on individual and household surveys as well as micro-level analysis of the demand side of labour market that is firms’ employment strategies: the next section explains how microsimulation is a well-fitted method for this research agenda.

In this view, the higher education institutions can be analyzed as a selection system which produces potential labour market outputs for individuals. There could be important gaps between these potential outputs for the various types of diploma depending on degree level, field of study, ranking of the University, etc. From a regulation point of view, if the mean return to higher education is an important indicator of monetary individual incentives to enrol in higher education, the risk of a weak valorisation has also to be identified in order to recommend some specific targeted programmes to develop a better social inclusion. Of course, as explained previously, these risks are linked to a specific national context and more precisely the links existing between types of diploma and the career opportunities in the various industrial sectors. Public policy aiming at developing higher education has to check that the modalities of this development are not damaging for the careers of those who decide to postpone entering the labour force in order to obtain a tertiary degree.

The case of France

The French higher education system is particularly interesting to test this formulation of the segmentation hypothesis because it is characterized by a dualisation: historically, there is a structural opposition between elite’s schools (grandes écoles) and the University.
In France before tertiary education, school is compulsory until the age of sixteen. There are some mid-school professional degrees for those who choose to enter early the labour force: the *Certificat d’Aptitude Professionnelle* (CAP) and the *Brevet d’Etudes Professionnelles* (BEP). At the end of the High School there is an exam, the so-called *Baccalauréat* that it is necessary to pass in order to enrol in higher education.

Traditionally, at the end of High School, students have to choose between two paths: the State universities and the higher education institutions known as *grandes écoles*. Having a *Baccalauréat* is the only condition to enter the universities: they are legally compelled to not select their students, for instance on their results or on a specific interview for the first year degree’s enrolment. In France, the universities are a quasi no-charge system whatever is the subject area chosen by the student. On the contrary, the *grandes écoles* involve two steps; both of them are highly selective. The first step consists of two years in a State-subsidized preparatory class (*Classe préparatoire aux grandes écoles*). It is free of charge. The second involves three years in a *grande école*. For this second step the choice of the student subject area has financial consequences: engineering schools are subsidized by the State, whereas business schools are much less heavily subsidized and charge their students high fees.

Aside from these two traditional main paths, there are some other specific diplomas: a two-year technical one known as a BTS (*Brevet de Technicien du Supérieur*) and offered by technical schools, the DUT (*Diplôme Universitaire de Technologie*) and the DEUST (*Diplôme d’Etude Universitaire Scientifique et Technique*); these last two are two-year specialized degrees offered at some universities. These degrees are more closed to elite schools in terms of high public subsidies, small classes’ pedagogy and selection process at entry.

France is particular when one considers the great heterogeneity of tertiary education paths and their corresponding costs of training—for a presentation, see Courtiou (forthcoming). This heterogeneity goes beyond the evidence that scientific programmes of study are generally more costly than other programmes, and relates to the different institutions in charge of higher education paths and their place in the educational system. Public expenditures for a student in France are thus closely related to the student’s higher education path. These differences stem mainly from staff spending: preparatory classes and *grandes écoles* offer small classes, whereas
university teaching is generally done in large lecture halls. French higher education system is quasi-universal—you only need a *Baccalauréat to enter*—and strongly meritocratic—public spending are polarized on few selected students. In France, there is a dualisation of the higher education system that is independent of the number of years of schooling and of the field of study. It makes the mean return to higher education questionable as an index to apprehend the incentive to pursue higher education.

3. A microsimulation approach of higher education output

From a risk management perspective, a strictly empirical life course approach could be disappointing: one needs long panel data which are not easily available—technically they are available at the end of individuals’ life. Another way to proceed is to use cross-sectional data or/and small panel and then to simulate the life course of individuals under a set of assumptions—for a general presentation of microsimulation methods, see for instance Harding (1993), Mitton *et alii* (2000). In this section, we present the microsimulation model which is used to simulate a distribution of individual monetary return to education—for a more detailed presentation of the model see Courtioux *et alii* (2009). Our methodological choices are strongly linked to a transition risk management perspective as describe in the previous section.

*The entry data base*

Consistently with a life course perspective, we retain a generational approach for the simulation. We decide to focus on a given cohort: taking year 1970 as a reference, we focus on individuals born in the 1968-1972 period—from now on, the ‘generation 1970’. It is possible to compute from the French Labour Force Survey (FLFS 2003-2005) the part of individuals of a given gender with a given diploma who enter the labour force at a given age. This leads to distinguish 416 classes for this cohort; for instance, the females with a Business School degree, entering the labour force at 24 constitute a class, which corresponds to 13 observations in the FLFS 2003-2005 and represent less than 0.01% of the cohort born in 1970.
Table 1  
Part of diploma per gender  

<table>
<thead>
<tr>
<th></th>
<th>total</th>
<th>men</th>
<th>women</th>
</tr>
</thead>
<tbody>
<tr>
<td>no tertiary degree</td>
<td>68%</td>
<td>70%</td>
<td>65%</td>
</tr>
<tr>
<td>two-year degrees</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University (a)</td>
<td>4%</td>
<td>2%</td>
<td>5%</td>
</tr>
<tr>
<td>Schools (b)</td>
<td>12%</td>
<td>12%</td>
<td>11%</td>
</tr>
<tr>
<td>three-year degrees</td>
<td>6%</td>
<td>4%</td>
<td>7%</td>
</tr>
<tr>
<td>University (c)</td>
<td>4%</td>
<td>3%</td>
<td>5%</td>
</tr>
<tr>
<td>Schools (d)</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>four-year degrees</td>
<td>4%</td>
<td>3%</td>
<td>5%</td>
</tr>
<tr>
<td>Université (e)</td>
<td>4%</td>
<td>3%</td>
<td>5%</td>
</tr>
<tr>
<td>five-year degrees</td>
<td>6%</td>
<td>7%</td>
<td>5%</td>
</tr>
<tr>
<td>University (f)</td>
<td>3%</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>Business schools</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Engineering schools</td>
<td>2%</td>
<td>3%</td>
<td>1%</td>
</tr>
<tr>
<td>more than five-year degrees</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>University (g)</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
</tbody>
</table>

Note: individuals born in 1968-1972.  
(a) include ‘Deug’ and ‘paramedical degrees’,  
(b) include ‘BTS’, ‘higher technicien’ and ‘DUT/Deust’,  
(c) include ‘licence’,  
(e) include ‘maîtrise’,  
(f) include ‘DEA, DESS,  
(g) include doctorates.

In FLFS, the diploma variable has 20 items—14 items concerning higher education diplomas. The number of class enables to distinguish the different higher education paths described in the previous section for each degree level. The table 1 presents the relative proportion of each degree for the individuals of the generation born in 1970. This table shows that 32% of this generation have a tertiary degree. When one considers type of diploma, there are gender differences: women are more likely to have a tertiary degree; they are overrepresented from the two-year to the four-year degrees, but at the five-year degree they are under-represented. This under-representation for the five-year degree only concerns the elite diplomas—business schools and engineering schools--; for the University diplomas they are still overrepresented.  

This input data is enhanced by information concerning industrial sector. The basic idea is to reproduce the links between industrial sectors and the education system as they are observed in the FLFS 2003-2005. We attribute randomly to each individual an industrial sector for his entire life course, based on education—20 items—and gender; this imputation is based on the observed probability in the FLFS 2003-2005.
for individuals in employment aged 16-30. The table 2 presents aggregated descriptive statistics corresponding to these observed links between the higher education system and the industrial sectors. This table shows that tertiary degrees are overrepresented in energy sector, finance, firm services and administration. But there are some important differences between diplomas level and type. Not surprisingly, the engineers are over-represented in the manufacture and the construction sectors, whereas business schools are over-represented in the financial sector. Noteworthy, the university degree whatever their level is, are strongly overrepresented in the administration sector. This sector includes education, health as well as public administration at the local and the central level. It is mainly composed of public employment.

Table 2
The distribution of higher education degree by industrial sector

<table>
<thead>
<tr>
<th>Degree</th>
<th>Manufacture and construction</th>
<th>Energy</th>
<th>Finance</th>
<th>Firm services</th>
<th>Consumer services</th>
<th>Administration</th>
<th>Other sectors</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>no tertiary degree</td>
<td>23%</td>
<td>0%</td>
<td>2%</td>
<td>14%</td>
<td>15%</td>
<td>20%</td>
<td>26%</td>
<td>100%</td>
</tr>
<tr>
<td>two-year degrees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University (a)</td>
<td>4%</td>
<td>0%</td>
<td>3%</td>
<td>7%</td>
<td>7%</td>
<td>69%</td>
<td>9%</td>
<td>100%</td>
</tr>
<tr>
<td>Schools (b)</td>
<td>20%</td>
<td>1%</td>
<td>10%</td>
<td>21%</td>
<td>7%</td>
<td>15%</td>
<td>26%</td>
<td>100%</td>
</tr>
<tr>
<td>three-year degrees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University (c)</td>
<td>8%</td>
<td>0%</td>
<td>4%</td>
<td>11%</td>
<td>7%</td>
<td>58%</td>
<td>12%</td>
<td>100%</td>
</tr>
<tr>
<td>Schools (d)</td>
<td>13%</td>
<td>0%</td>
<td>7%</td>
<td>45%</td>
<td>12%</td>
<td>11%</td>
<td>12%</td>
<td>100%</td>
</tr>
<tr>
<td>four-year degrees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Université (e)</td>
<td>9%</td>
<td>1%</td>
<td>8%</td>
<td>21%</td>
<td>6%</td>
<td>43%</td>
<td>12%</td>
<td>100%</td>
</tr>
<tr>
<td>five-year degrees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University (f)</td>
<td>12%</td>
<td>0%</td>
<td>9%</td>
<td>30%</td>
<td>5%</td>
<td>36%</td>
<td>9%</td>
<td>100%</td>
</tr>
<tr>
<td>Business schools</td>
<td>22%</td>
<td>0%</td>
<td>17%</td>
<td>34%</td>
<td>7%</td>
<td>2%</td>
<td>19%</td>
<td>100%</td>
</tr>
<tr>
<td>Engineering schools</td>
<td>37%</td>
<td>2%</td>
<td>4%</td>
<td>35%</td>
<td>2%</td>
<td>11%</td>
<td>8%</td>
<td>100%</td>
</tr>
<tr>
<td>more than five-year degrees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University (g)</td>
<td>8%</td>
<td>0%</td>
<td>1%</td>
<td>17%</td>
<td>1%</td>
<td>52%</td>
<td>20%</td>
<td>100%</td>
</tr>
<tr>
<td>All the generation</td>
<td>20%</td>
<td>1%</td>
<td>3%</td>
<td>16%</td>
<td>12%</td>
<td>52%</td>
<td>20%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Note: individuals aged 16-30 and in employment. (a) include ‘Deug’ and ‘paramedical degrees’, (b) include ‘BTS’, ‘higher technician’ and ‘DUT/Deust’, (c) include ‘licence’, (e) include ‘maîtrise’, (f) include ‘DEA, DESS’, (g) include doctorates.

Our estimation does not take into account the possibility of a multi-sector career. In our simulation, the industrial sector is conserved by the individual his entire life which means that it is more close to a degree speciality rather than an industrial sector related to a given job. As far as we are concerned with administration sector—see infra—, this is a minor problem; because in France the public employment status—the fonctionnaire status and its related rights in terms of job security, retirement entitlement, etc.—is legally constructed to remain apart from other industrial sectors.
The simulation process

The simulation process aims at produce a stylized representation of the diversity of careers for the generation 1970. We impose the simulation to respect (i) the mean pattern of activity and employment of a whole generation during its life course, (ii) the relative individual risks of transitions from a situation to another considering individual characteristics—diploma, gender, previous positions on the labour market, etc.—, (iii) for the employment position, the differences in wages in terms of diploma, diploma specified years of experience and industrial sector.

The pattern of activity and employment across life course used for the simulation is a stylized chronogram, estimated from the FLFS 1968-2005. This chronogram is differentiated by gender in order to capture the specificity of careers and the interaction between labour market position and family sphere over the life course. It links each age of the generation 1970 with an aggregated labour force participation rate and a unemployment rate. These gender profiles by age of labour force participation’s rates and unemployment rates are estimated with all the observed life course segments of the different cohorts which compose the FLFS 1968-2005. They can be interpreted as mean cohort pattern for France during the 1968-2005 periods—for details, see annex. Noteworthy, age 60 is the legal minimum age to retirement during the period which is used as reference for the estimations (1983-2005). From a forecasting point of view, the ongoing reform of the French retirement system may impact this pattern for the generation 1970.

The mean pattern of labour force participation is an inversed U-shaped curve. The age of high activity is the 28-50 period. On the contrary, the unemployment rate is U shaped: it tends to decrease over the life course, with a period of sharp decrease at the beginning of the life course and a slight increase with age for male until age 60. Noteworthy, the labour force participation curves for males and for females intersect: the activity rate of women is higher than the men’s one after age 55. This pattern of activity is well identified for France—see for instance Coeffic (2003). It is linked to the number of employment years necessary to be entitled to a full retirement pension: it is more difficult for women to be entitled to it without working more than age 60 because of interrupted careers mainly for childcare.

The individuals who compose the cohort 1970 may change their position over their life course. In this regard, it is important to simulate the transitions between inactivity,
employment and unemployment. The probability of being at a given age in a given position is generally considered as linked to socio-demographic variables: the most educated are generally more protected from unemployment; the women who stand out the labour force for childcare reasons are less likely to re-enter the labour force, etc. To simulate the hierarchy of probability transition given individual socio-demographic characteristics, we estimated some transition models on the FLFS 2003-2005. The specification of the models is detailed in annex.

During the simulation, the individual probability of being in a given position at a given age is compared to an individual random variable. This process leads to order the individuals. The individual position at a given age in the simulation is finally determined by an alignment process which respects the macro-targets defined in the chronogram. Finally this simulation reproduces the labour force participation and the unemployment rate by gender at a macro-level and it reproduces also the differences in individual probability depending on diploma, past positions, etc.

For the individual in an employment position, the wage is then simulated. The earning equation is estimated on the FLFS 2003-2005. The specification of the model is detailed in annex; we retain a diploma effect and a diploma specified experience effect in order to differentiate the wage career by diploma. Moreover, we retain an effect of the industrial sector differentiated by diploma. It is important to note here that to capture the career effect for women in the estimation; we control the wage by a dummy variable for gender, in order to capture other wage determinant ceteris paribus. However, this very effect is not included in the simulation. We assume that the chronograms differentiated by gender correspond mainly to the differences observed between men and women’s wages: the gender effect estimated is assumed to reflect differences in career between men and women which are not directly observable in the cross-section data. This means that there is no ‘pure discrimination’ in our simulation and that the gender differences are entirely explained by education and labour market participation pattern.

Given the individual past trajectory and his current position, the transfers are then computed. To take into account the interactions between labour market and social policy, the microsimulation takes into account the main features of the French socio-fiscal regime stemming directly or indirectly from labour: the unemployment benefit, the retirement pensions and the income tax.
According to French social legislation, the calculation of workers’ rights to unemployment benefits is linked to gross wages (salaire brut), which are not available in the FLFS. We assume that the gross wages are a fixed share (120%) of net wages, which are available in the FLFS. The regular unemployment benefit is simulated: the Allocation d’aide au retour à l’emploi (ARE). The entitlement and the amount of that benefit is legally linked to past wages and employment duration. In our simulation the amount of the allowance is calculated on the legal basis for the individuals who become unemployed.

The three main parts of the pension system are simulated. The basic pension is calculated based on the 25 best years, which are simulated. The differing complementary pensions are also calculated. White-collar professionals (cadres) have a specific scheme. We assume that those with a five-year higher education degree or more are cadres. The complementary pensions are based on payroll taxes actually paid over the career. They are computed with the same hypothesis than for unemployment benefit: we assume that the gross wage is a fixed part of net wage. The civil servants’ regime is also simulated; it concerns those who have worked more than 41 years in the public sector; their pension is a fixed share of their last wage. Noteworthy, in our simulation, we considered that the age for retirement is 65—as scheduled for the individuals born in 1970 since the 2003’s pension reform. We assume that there is no adjustment of labour market individual participation behaviour linked with this reform, mainly because we are not able to evaluate it without introducing other assumptions. As a consequence, in our simulation, the individual income may be under-estimated during the period between age 50 and age 65, if the employment rate of the individual born in 1970 remains high at these ages.

The French income tax is based not on individuals but on a particular definition of a household. Theoretically, the tax depends on the number of people (including children) in this ‘fiscal household’. In our simulation, we assume that the individual is single. This means that the income tax is underestimated as far as they do not take into account the wage cut (dépense fiscale) for family conditions (capacité contributive): this should be interpreted as the income tax stemming from the direct and indirect individual wages.
Computing individual returns to higher education

The simulation produces a stylized set of individual income streams for the generation 1970. Using a generational approach, it is then possible to compute individual rates of return. The net yearly income of an individual \(i\) at age \(a\) could then be defined as follows:

\[
Y_{i,a} = (W_{i,a} + D_{i,a} + R_{i,a} - T_{i,a})
\]

Where \(W_{i,a}\) is the yearly wage, \(D_{i,a}\) the amount of unemployment benefit, \(R_{i,a}\) the amount of retirement pension and \(T_{i,a}\) the corresponding amount of income tax.

With a complementary set of assumption, it is possible to identify \(N_{i,a}\) which is the net financial flow at age \((15+a)\) of pursuing a tertiary education. For an appraisal of the net impact of higher education, we assume that the net financial flows linked to higher education are the difference between individual net income \((Y_{i,a})\) and the expected income for people of the same age without a tertiary degree.

\[
N_{i,a} = Y_{i,a} - O_{i,a} - \overline{G}_{d0,a}
\]

\(\overline{G}_{d0,a}\) is the income flow mean at the age \((15 + a)\) of the individuals who do not have a higher education degree. The opportunity \((O_{dx,a,j})\) costs of an individual \(i\), with a \(dx\) diploma level are calculated as follows:

\[
O_{dx,a,j} = \max \{\overline{G}_{d0,a}, \overline{G}_{d1,a}, \ldots, \overline{G}_{dx,a}\} \quad \text{if} \quad A_i < a
\]

\[
O_{dx,a,j} = 0 \quad \text{if} \quad A_i \geq a
\]

Where \(A_i\) is the age an individual \(i\) joins the labour force, and \(\overline{G}_{dx,a}\) the mean of the gains at age \((15+a)\) of the individuals with the \(dx\) higher education level who are in the labour force.

To take into account the mortality rate over the life course, the net financial flow is weighted by the individual survival probability until age 100, depending on diploma level—this corresponds to 84 units of time. This estimation of survival function is based on the mortality tables by social class, available in Robert-Bobée and Monteil (2005) and the mortality forecast of Vaslin and Meslé (2001). The methodology which has a very small impact on the result is not reproduced here—they are available from the author; see also Courtioux and Houeto (2010).

Finally, to calculate the internal rate of return at sixteen \((r_i)\), we need all the financial flows linked to an investment: the internal rate of return is the discount rate that
makes the sum of these financial flows equal to zero. This condition can be written as follows:

\[ \sum_{a=1}^{a=N} N_{ia} (1 + r)^{-a} = 0 \]

4. Results

Our results show a great dispersion of higher education returns. The median rate of return is at 10.6% whereas the first quartile is at 6.7% and the upper quartile at 16.3%. As a benchmark, the OECD indicator is between 12.2% and 8.4%—see respectively OECD (2003, 2008).

When one considers the number of years of schooling in higher education, the results seems counter intuitive: the median return to higher education does not increase with years of schooling; it rather follows a U-shaped curve—see diagram 1. Between the two-year and three-year degrees, the median return decrease from nearly 12% to 9%; it then increases from 9% to 12% between the four-year and the five year degrees. This U-shaped curve is consistent with the evidence of increasing income with the level of education: the two-year degrees and the five-year degree have almost the same median return but the level of investment is not the same. The five-year degrees invest three more years in terms of opportunity cost; this impacts the level of future incomes. However from a financial perspective the return rate is the same.

The main explanation of the U-shaped curve of returns is that there is a polarization of the schools — versus University—curricula at the two-year and the five-year levels. The two-year level is characterized by an important proportion of tertiary schools (80%) with a high median return of 12%, whereas the traditional University two-year degree (Deug) has a mean return of 7.8%. The five-year level is composed of an important part of elite schools (grandes écoles): 15% of business school degrees and 33% of engineer degrees which have a median return of 15% whereas the University degrees have a return at 10%.

In this view, the traditional economic approach of education return by schooling year could be misleading because of heterogeneity. These results are consistent with the traditional statistical recommendation of controlling for heterogeneity when estimating mean return of schooling years not biased—see for instance Heckman et alii (2006).
Consequently, when one focuses on the University curriculum, the returns per year of schooling are more homogenous. It better illustrates the risks of valuation over a career of education investment. Then the diagram 2 shows a more intuitive result than the diagram 1: the median rate of return increases with years of schooling. To obtain this, we have to exclude the paramedical degree from the calculation: if they are include, because of their relatively high returns, we obtain again a U-shaped curve. Noteworthy, excluding paramedical degree from this computation makes sense, because their two-year degree is an end in itself: consequently the very choice of continuing studying one more year is not set as a consistent choice possibility. Noteworthy also, our distribution analysis shows that the risks on the return tend to decrease with year of schooling: the returns tend to be more polarized around the median.

However, an interpretation of the results in terms of monetary incentives remains problematic: for instance the 75th and the 90th percentiles decrease between the two-year and the three-year degrees. This means that the increasing returns with the schooling year is not homogenous when ones consider a risk perspective. As an illustration for a two-year degree, one more year of education increases the median rate by 0.2 percentage point; but with a two years degree one has 49% of chance that the return is already 0.2 percentage point higher than the median rate.

A more comprehensive approach which investigates the links between the distribution of return and the industrial sector could be more fruitful in a social risk
management perspective. It could put some light on the role of industrial sector in the construction of the risk of higher education valuation.

Diagram 2
Distribution of Returns to University degrees

In the French case, we show in section 1, that the dualisation of higher education system leads to an overrepresentation of University degrees in the public administration sector. To identify the impact of this sector on the risk of the valuation of a career, we compute the difference between the return for all the individuals and the returns for all the individuals except those of the administration sector for different points of the distribution—the 10th percentile, the median and the 90th percentile. The results are presented in table 3.

The table 3 shows that the impact of the administration sector on the risk of valuation depends on the diploma and the point of the distribution considered. The impact of administration sector on the median rate of return is positive but rather small for most of the degrees: the highest value is for engineering schools with an increase of 0.5 percentage points. However, there is a negative value for the two-year University degrees. This negative value is only due to the paramedical degrees: the impact of administration sector on median return for other University two-year degrees is positive with 0.1 percentage point. This result is not surprising when it is linked to the evidence of nurse shortage in the French health system: in the public sector career’s opportunity is difficult regarding the perspective of controlling the development of health system spending.
Noteworthy, the relative value of the public sector impact on the median return is the highest for University degrees: for five-year University degrees it represents 6% of the median return whereas for engineering schools, this proportion is of 3%. This means that the impact of the administration sector which is mainly composed of public employment is more important for the valuation of higher education for University degrees than for the schools system degrees.

Table 3
The impact of administration sector on the return to higher education (in percentage points)

<table>
<thead>
<tr>
<th>Source</th>
<th>P10 impact</th>
<th>median impact</th>
<th>P90 impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>two-year degrees</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University (a)</td>
<td>4%</td>
<td>0.2</td>
<td>12%</td>
</tr>
<tr>
<td>Schools (b)</td>
<td>2%</td>
<td>-1.2</td>
<td>10%</td>
</tr>
<tr>
<td>three-year degrees</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University (c)</td>
<td>2%</td>
<td>1.1</td>
<td>9%</td>
</tr>
<tr>
<td>Schools (d)</td>
<td>1%</td>
<td>0.5</td>
<td>8%</td>
</tr>
<tr>
<td>four-year degrees</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Université (e)</td>
<td>3%</td>
<td>0.3</td>
<td>9%</td>
</tr>
<tr>
<td>five-year degrees</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University (f)</td>
<td>5%</td>
<td>0.7</td>
<td>12%</td>
</tr>
<tr>
<td>Business schools</td>
<td>4%</td>
<td>0.4</td>
<td>7%</td>
</tr>
<tr>
<td>Engineering schools</td>
<td>8%</td>
<td>0.0</td>
<td>15%</td>
</tr>
</tbody>
</table>

Note: individuals aged 16-30 and in employment. (a) include ‘Deug’ and ‘paramedical degrees’, (b) include ‘BTS’, ‘higher technician’ and ‘DUT/Deust’, (c) include ‘licence’, (e) include ‘maîtrise’, (f) include ‘DEA, DESS, (g) include doctorates.

When one considers the risk of weak valorisation of tertiary degree, the impact of administration sector is more important. For instance the impact of administration sector on the 10th percentile of return is of 63% for three-year University degrees, 11% for the four and the five–year University degrees, whereas it is of 7% for engineering school and of 2% for other schools. From an incentive point of view, the risk of weak valorisation of one’s career, when one enters University is importantly covered by the possibility of pursuing administrations careers if one fails to pursue one’s curriculum until the highest level.
When one considers the risk of high valorisation of tertiary degree, the impact of administration sector is also important for University degrees. For instance, for University degrees—whatever the level is—, the relative impact of administration sector on the 90th percentile of return is equivalent to the relative impact on the median. This means that the administration sector is an important guaranty for the valorisation of career, even good careers.

On the contrary, for the business schools, the administration sector has no relative impact, mainly because this sector traditionally does not hire this type of degree. For engineering school the relative impact tends to decrease with the level of valuation risk: for the risk of weak valorisation the impact of the administration sector is of 7%, for the risk of median valorisation 3%, and 1% for the risk of high valorisation career. This means that for this type of degree, the careers in administration have the role of a safety-net for higher education weak valorisation risk. For other tertiary school degrees, the relative impact of administration career on return is quasi-homogenous: whatever the level of risk considered it represents around 1-2% of the return.

5. Conclusion
We argue that in France the dualisation of the higher education system leads to labour market segmentation, in terms of industrial sectors: the University degrees—versus elite schools and other tertiary schools degrees—are overrepresented in the administration sector. Based on a generational dynamic microsimulation model, we estimate the impact of this segmentation on the valuation risk for higher education degrees.

We show that the relative impact on the median rate of return is positive and relatively higher for the three-year and more University degrees than for the school system degrees. When one considers the risk of weak valorisation, this differentiation is reinforced particularly for the three-year University degrees. In an institutionalist perspective as developed for instance by the VoC or the TLM approach, it is possible to argue that one of the functions of the administration sector and more generally public employment in the French national regime is that it is a kind of guaranty of valuation for individual who invest in a curriculum where the public spending—notably in pedagogy terms—are relatively low, as it is the case for University—versus school system. The existence of such careers in administration is then a part of the
incentives to pursue tertiary studies. In this view, considering simultaneously labour market and education system, a reform aiming at reducing public employment—in order to reduce public deficit for instance—has an impact on the incentive scheme to pursue higher education. If we assume that individual public subsidies on education is also a part of the incentives to pursue a tertiary curriculum, it means that downsizing public employment needs to be balanced by an increase in the education spending for the more impacted degrees.

Of course these results have to be completed: it could be interesting to test if these results still hold when one takes into account the transitions between industrial sector over a career, or the heterogeneity of part-time employment between tertiary degrees and industrial sector, or the specificity of women’s career. All this aspects could be investigated with a more complete—and more complex—microsimulation modelling perspective. However, more generally, our results confirm that policy recommendations on incentive to enter a tertiary curriculum based on an indicator of mean return to education miss an important point: they have to be linked in a more comprehensive approach to higher education public spending and career perspective.

Acknowledgements
A previous version of this paper was presented at the International Working Party on Labour Market Segmentation (2010, Valencia, Spain) and at the first conference of the Association Française d’Economie Politique (2010, Lille, France). The estimates used for microsimulation in this paper are done on three sets of data: the French Labour Force Survey for 2003-2005, which is available online (http://www.insee.fr), the French Labour Force Survey 1968-2002, which is available for researchers from the Quetelet Centre (http://www.centre.quetelet.cnrs.fr/), and the mortality rates and their forecast based on Vallin and Meslé (2001) and Robert-Bobée and Monteil (2005). The model used for the simulations is developed at EDHEC’s Economics Research Centre; the author thanks Dede Houeto and Stéphane Gregoir who contribute to develop the model. The author would also like to thanks Bernard Gazier for his comments on a previous version of the paper.

References
Amable B. (2003), The Diversity of Modern capitalism, Oxford University Press.


Annex

The chronogram imposed to the cohort 1970

For our simulation, we model the labour force participation rate and the unemployment rate over the life course for a given generation. The French Labour Force Survey 1968-2005 is used to construct segments of labour participation rate and unemployment rate by age and generation. For instance, data available for the generation born in 1950 cover the ages 18 to 55 which constitutes a segment of life, the generation born in 1960 from the age 16 to 45—this constitutes another segment—, the generation born in 1970 from 16 to 35, etc. The model is estimated separately for men and women; it includes several specifications for age, the current unemployment rate for a generation at a given age and some generation dummies. The equations estimated are specified as follow:

\[
\log\left(\frac{P_{g,t}}{1-P_{g,t}}\right) = \alpha + \beta(t-g) + \chi(t-g)^2 + \delta(t-g)^3 + \phi(t-g)^4 + U_t + D_g
\]

where \(P_{g,t}\) is the participation rate of the generation \(g\) for the year \(t\), \(U\) the unemployment rate and \(D\) a generation dummy.

\[
\log\left(\frac{U_{g,t}}{1-U_{g,t}}\right) = \alpha + \beta(t-g) + \chi(t-g)^2 + \delta(t-g)^3 + U_t + D_g
\]

where \(U_{g,t}\) is the unemployment rate of the generation \(g\) for the year \(t\), \(U\) the unemployment rate and \(D\) a generation dummy. The main results of the estimations are presented in table A1. For the simulation, we assume that the current employment rate during the period is fixed (8%).

Table A1.
Estimation of labour force participation and unemployment rate models

<table>
<thead>
<tr>
<th>Source: Labour Force Survey 1968-2005 (Insee)— author’s calculation.</th>
<th>Note: taking 1970 for reference, this model is estimated with dummies for each generation; they are not reproduced here; (*) for 1% level of significance.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logistic transformation of labour force participation rate</td>
<td>Logistic transformation of unemployment rate</td>
</tr>
<tr>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Intercept</td>
<td>-21.25 *</td>
</tr>
<tr>
<td>Age</td>
<td>1.75 *</td>
</tr>
<tr>
<td>Age</td>
<td>-0.04 *</td>
</tr>
<tr>
<td>Age</td>
<td>0.00042 *</td>
</tr>
<tr>
<td>Age</td>
<td>-0.000002 *</td>
</tr>
<tr>
<td>Current unemployment rate</td>
<td>-3.44 *</td>
</tr>
<tr>
<td>R-Square</td>
<td>0.97</td>
</tr>
</tbody>
</table>

The individual transitions probability

In the microsimulation model, the transitions between inactivity, employment and unemployment are modelled. More precisely, five states are modelled: inactivity, self-employment, employment in public
sector, employment in private sector and unemployment. The public sector variable is correlated but not redundant with the administration sector variable commented in the main part of the article. This distinction of position on the labour market independently of the industrial sector is justified by the specificities of the French institutional context: in a career perspective this variable is a way to apprehend the career of fonctionnaires (permanent civil servants) who have a legal status characterized by employment guaranty and special retirement system—this particular retirement system is simulated in our model.

We are then interested in the modelling of the following conditional transition probability: $P(a_{it} = 1)$ where $a_{it}$ is the probability of being in activity at the $t$ period, $P(s_{it} = 1/a_{it} = 1)$ where $s_{it}$ is the probability of being self-employed at the $t$ period, $P(p_{it} = 1/a_{it} = 1, s_{it} = 0)$ where $p_{it}$ is the probability of being employed in the public sector at the $t$ period, $P(e_{it} = 1/a_{it} = 1, s_{it} = 0, p_{it} = 0)$ where $e_{it}$ is the probability of being employed in the private sector at the $t$ period.

The individual probability of transition is calculated using binomial logit models, which are estimated on the French Labour Force Survey 2003-2007. The variables used in the model include the former position—which explains an important part of the transition probability, see table A2.—, some variables describing the socio-economic status, and diploma. The equation estimated is the following:

$Y_{it} = \alpha + \beta Y_{i,(t-1)} + \delta S_{it} + \varphi D_{it}$

where $Y_i$ is the transition estimated, $S$ a matrix of socio-economic variables and $D$ the diploma. The results are presented in table A2. It should be noted that the variables used in the estimation of the various equations needed to model individual transitions are not all included in the equations used to simulate the individual trajectory. The socio-economic variables concerning the family’s position—number of children if female, young children if woman—are included in the estimations to capture their impact on individual transitions on the labour market. They are not however included in the microsimulation of individual transitions: since our analysis is restricted to single individuals, the use of these variables is not needed.
Table A2
Estimation of transition models (binomial logits)

<table>
<thead>
<tr>
<th></th>
<th>Transition to activity</th>
<th>Transition to self-employment</th>
<th>Transition to employment (public sector)</th>
<th>Transition to employment (private sector)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.261 *</td>
<td>2.196 *</td>
<td>1.434 *</td>
<td>2.108 *</td>
</tr>
<tr>
<td>Former position</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inactive</td>
<td>ref</td>
<td>-5.438 *</td>
<td>-5.326 *</td>
<td>-1.834 *</td>
</tr>
<tr>
<td>Unemployment</td>
<td>2.489 *</td>
<td>-6.610 *</td>
<td>-6.341 *</td>
<td>-3.091 *</td>
</tr>
<tr>
<td>Self-Employment</td>
<td>5.057 *</td>
<td>ref</td>
<td>-5.555 *</td>
<td>-1.834 *</td>
</tr>
<tr>
<td>Employment (public sector)</td>
<td>4.166 *</td>
<td>-10.020 *</td>
<td>ref</td>
<td>-1.874 *</td>
</tr>
<tr>
<td>Employment (private sector)</td>
<td>3.794 *</td>
<td>-8.122 *</td>
<td>-6.326 *</td>
<td>ref</td>
</tr>
<tr>
<td>Socio-economic status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>-0.230 *</td>
<td>-0.601 *</td>
<td>0.548 *</td>
<td>-0.072 *</td>
</tr>
<tr>
<td>Number of Children (if female)</td>
<td>-0.089 *</td>
<td>0.066 *</td>
<td>0.008 *</td>
<td>-0.091 *</td>
</tr>
<tr>
<td>Young Children (if female)</td>
<td>-1.579 *</td>
<td>0.126 *</td>
<td>0.143 *</td>
<td>0.101 *</td>
</tr>
<tr>
<td>Age 55 and more</td>
<td>-1.491 *</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age 60 and more</td>
<td>-1.373 *</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age 65 and more</td>
<td>-0.352 *</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years of experience</td>
<td>-0.018 *</td>
<td>-0.040 *</td>
<td>0.067 *</td>
<td>0.045 *</td>
</tr>
<tr>
<td>Years of experience (square)</td>
<td>-0.000035</td>
<td>-0.001 *</td>
<td>-0.001 *</td>
<td></td>
</tr>
<tr>
<td>Out of the Labour force duration (in years)</td>
<td>-0.365 *</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long term unemployment</td>
<td>-13.459 **</td>
<td>-16.551 *</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Diploma

No Higher Education Diploma

- CAP/BEP
  - 0.354 *
  - -0.054 *
  - 0.553 *
  - 0.300 *
- Bac Général
  - 0.262 *
  - 0.359 *
  - 0.500 *
  - 0.337 *
- Bac Professionnel
  - 0.914 *
  - 0.295 *
  - 0.083 *
  - 0.653 *
- Bac Technique
  - 0.495 *
  - 0.056 *
  - 0.593 *
  - 0.451 *
- Capacité en Droit (1)
  - 0.934 *
  - 0.163 **
  - -0.841 *
  - -0.396 *

Two-year degree

- DEUG (University)
  - 0.078 *
  - 1.036 *
  - 0.470 *
  - 0.124 *
- DUT/DEUST (University)
  - 0.772 *
  - -0.285 *
  - 0.275 *
  - 0.848 *
- BTS
  - 0.617 *
  - 0.471 *
  - 0.008 ns
  - 0.681 *
- Other Higher Technician Diploma
  - 0.068 *
  - 0.691 *
  - 0.110 *
  - -0.042 *
- Paramedical Diploma
  - 0.376 *
  - 2.421 *
  - 3.606 *
  - 1.121 *

Three-year degree

- Licence (University)
  - 0.139 *
  - 0.576 *
  - 1.212 *
  - 0.272 *
- Others three-year degree
  - 0.739 *
  - 0.905 *
  - 0.302 *
  - 0.613 *

Four-year degree

- Maîtrise (University)
  - 0.314 *
  - 0.637 *
  - 0.844 *
  - 0.202 *

Five-year degree

- DEA (University)
  - 0.511 *
  - 0.242 *
  - 0.826 *
  - 0.190 *
- DESS (University)
  - 0.859 *
  - -0.112 *
  - 0.429 *
  - 0.391 *
- Business Schools
  - 1.164 *
  - 0.464 *
  - -0.626 *
  - 0.529 *
- Engineering Schools
  - 0.827 *
  - 0.671 *
  - 0.151 *
  - 0.634 *

Degree of more than five years

- PhD (Medical Degree excluded)
  - 0.935 *
  - 0.344 *
  - 1.362 *
  - 0.422 *
- PhD (Medical Degree)
  - 0.694 *
  - 0.796 *
  - 3.223 *
  - 1.205 *

Sommer’s D

- 0.955
- 0.958
- 0.911
- 0.72
P. Conc.

- 97.7
- 97.6
- 95.2
- 85.6
P. Disc.

- 2.2
- 1.9
- 4.2
- 13.5
P. Tied

- 0.1
- 0.5
- 0.6
- 0.9

Note: (*) for 1% and (**) for 5% level of significance. (1) Capacité en droit is a university law degree which does not imply earlier success on the Bac; it concerns almost 0.7% of the 1970 generation.

The estimation of a wage equation

To model wages, we estimate separately Mincer’s earnings equations by diplomas specified as follows:

\[ \log(w_{i,d}) = \alpha_d + \beta_d \varepsilon_{i,d} + \delta_d \varepsilon_{i,d}^2 + \varphi_d X_{i,d} + \varepsilon_{i,d} \]
Where $w_{i,d}$ is the hourly wage—as available in the FLFS 2003-2005—of the individual $i$ with a diploma $d$, $e_{i,d}$ the number of years of experience, and $X$ a matrix of variables which characterizes the individual—gender and the young unemployment rate at the beginning of its career—and the job—civil servant, economic sector, etc.

This model aims at capturing differentiated wage profiles over the career as a function of the diplomas obtained; the traditional experience effect is then estimated by diploma—see table A3 for detailed estimates. The model includes additional variables to estimate the ‘real specific’ effect of diploma on earnings over the career:

- To capture a potential generation effect in the estimation of the Mincer equation we control the estimation by the unemployment rate among young people—under 25 years—at the labour force entering age. To simulate wages we assume that this rate is constant over the period we simulate (8%).
- To capture the career effect for women in the estimation, we control the wage equation by a dummy for sex. However this effect is not included in the simulations. We assume that the gender differences in the generation aggregate rate of labour force participation and unemployment rate that are introduced in the microsimulation already simulate the specificity of women’s careers in our model.
- To capture the specificity of civil servants’ wage careers, a dummy for employment (or not) in the public sector is included in the estimation.
- To capture sector wage specificities, a set of dummies is introduced in the estimation. For the wage simulation, we assume that an individual makes her whole career in the same sector. This sector is imputed randomly based on the observed repartition in the FLFS 2003-2005 of the different diplomas in the different economic sectors.
- The working time is introduced as a control in the estimation. For the simulations, we assume that all jobs are full-time jobs and we arbitrarily set the working time at 150 hours per month.

Because of the small number of observations for some diplomas, we pool some diplomas for the estimations. In case of pooled estimations, we identify the specific effect of a given diploma by a dummy. We use a particular methodology to decide which diplomas have to be pooled. The pooling is based on the proximity of diplomas regarding their situation in the labour market. In order to identify the proximity of diplomas we use a data analysis whose results are available on request. When the results of the data analysis are not sufficient, the pooling is based on the proximity of diplomas considering their higher education level. Finally, eight earning equations are estimated with six equations concerning higher education diplomas. The results of the estimates are shown in table A3.
Table A3
Estimation of earning equations by diploma

| Note | (*) for 1% and (**) for 5% level of significance; (ns) for no significance. (1) The intercept presented here is not used in this form in the simulations, see table 2.1; (2) Capacité en droit is a university law degree which does not imply passage of the Bac; it concerns almost 0.7% of the 1970 generation. |

The individual residuals corresponding to the estimates are stocked and used during the simulation following a bootstrap statistical procedure. Based on a random process, the microsimulation gives each simulated individual an observed residual depending on his diploma. During the dynamic simulation process, the residual is conserved until the individual leaves employment; when he finds a new job, a new residual is then randomly matched. Unfortunately, data on self-employment earnings are not available in the FLFS. In the simulation we decided to impute wages as a proxy of self-employment earnings.