Paying after Graduation
An empirical assessment of Loans with Income-Forgiveness and Human Capital Contracts

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Discussion Paper 2005-3

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January 2005

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Abstract:

There are many arguments supporting greater private contribution to higher education costs, particularly in Europe. But this case largely rests on the capability to offer deferred, income-contingent payments and to pool the cost of income contingency among all graduates. The two first features are critical to efficiency – students and lenders should not be deterred by excessive risk – and justice – contributions should be tailored to *ex post* ability to pay. While cost pooling is essential to avoid public debt classification of student contracts. Examples of instruments satisfying these criteria are loans with income-forgiveness and human capital contracts. The central aim of this paper is to produce realistic estimates of how graduates' lifetime earnings are likely to be affected by the generalisation of these instruments. Using data on Belgian wages, we compute estimates of contributions that these instruments could impose on graduates. We also evaluate their effect on population-wide distribution of lifetime net wages, using higher income tax as a benchmark. The paper further considers the risk of adverse selection inherent to cost pooling. It shows that investing less on students opting for less profitable programs is a simple way to mitigate its severity.

JEL classification: I28 (Education: Government Policy). H520 (National Government Expenditures and Education).

Key works: Higher Education Finance, loans with income-forgiveness, cost of insurance, risk pooling

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We would like to thank L. Jacquet and M. Spritsma for their helpful comments and suggestions on preliminary versions of this text. All remaining errors and omissions are ours. We benefited from the financial support of the ARC convention 02/07-274.

Introduction

Accumulation of human capital is crucial to economic prosperity. Although this idea is fairly old it is currently gaining a lot more of attention among economists and decision-makers. Mass (and quality) higher education seems justified for several reasons in order to favour economic growth. One of them being the current speed of technological change that makes high-skilled individuals more important than ever.

Why should individuals pay more?

In most European countries, public financing has been considered as the traditional approach for supporting higher education. Even if tuition fees have been introduced in various countries, they only contribute for a small amount in addition to resources provided by governments. The average subsidy rate for higher education[1] in European countries ranges from 76% to 99% (Debande, 2003). In most cases the subsidy rate is above 90%.

The potential pressure for reforming the existing funding of higher education across the EU is partially related to *increased budgetary pressure,* in a context where higher education is becoming a mass industry -- reflecting the willingness to increase the average stock of human capital to cope with the demand for a skilled workforce -- and where governments must cope with booming pension and health costs, but also to increased social demand for higher education stemming from individuals or public policy orientation[2].

[1] Defined as the share of direct public expenditure in educational institutions and total public subsidies to households and other private entities in total sources of funds for higher education.
[2] As exemplified by the objectives defined by the European Union in the framework of the Lisbon process.

The amount of public funding for higher education affordable by EU countries has also to integrate the increased *mobility trends* of students (Teichler & Jahr, 2001). As EU students are entitled to the same treatment in terms of access to higher education as nationals, countries which are net hosts of EU or foreign students subsidize the net sending countries. This generates a free-riding problems, with the resulting potential risk of underinvestment by some governments.

But there are more *philosophical reasons* for increasing individual participation in addition to current levels of public funding. One of them is the 'benefit' principle: the person who benefits should pay. There is indeed plenty of empirical research to suggest that the private benefits (higher wages, lower risk of unemployment...) from education are large (Johnes, 1993 ; Karasiotou, 2004), and probably on the rise due to a rising demand for skills cause by skill-biased technological progress (Kremer, 1994). Additional private benefits are derived from better health or personal satisfaction for those gaining higher education qualifications. As a consequence, higher education could not be considered as a pure public good. Since higher education generates social benefits (eg, the positive impact on the rate of technological innovation), taxpayers still have to contribute to the financing of higher education, but an appropriate mix between private contribution and public funding has to be found.

Why deferred and income-contingent payments?

The simplest way to increase private contribution is to increase fees that students or their families are asked to pay. But the consensus among economists is that higher fees would be both inefficient and inequitable. Consequently they generally favour a system where higher education is free at the point of use and payment is deferred (Barr, 2001).

A first argument supporting deferred payment is the idea of unequally distributed *liquidity constraints*. Attending higher education represents an investment generating benefits in the form of higher earnings materializing some time after the costs of being educated are incurred. The latter can be high as they include i) fees ii) cost of living and – most importantly – opportunity costs ie, forgone earnings if full-time attendance if required. The presence of a liquidity constraint for students due to the lack of sufficient income or capital market failures when deciding on participation to higher education has three major effects: i) a loss of talent since high ability low income students do not apply ii) a loss of opportunity to individuals and iii) a strengthening of the link between family background and a person's lifetime income.

But the case for deferred payments also rests on more *ethical grounds*. Reference is frequently made to ability to pay in discussions about higher education finance. Private contribution to education costs should be function of a student's ability to pay. In other words, payment should be income-contingent. The difficulty with this principle is that students' ability to pay is not known, as it primarily depends on their future wages or earnings[3]. Consequently, the only way to enforce the ability to pay principle (in combination with the benefit principle) is to defer its implementation at a time when the resulting income of the student will be verifiable. This is precisely what income-contingent education finance is about. Graduates with lower lifetime earnings pay less, or do not pay at all, while those with higher earnings pay more, but still in proportion commensurate to the initial cost of their investment in higher education.

Income-contingency also echoes *information* and *uncertainty problems* that need to be properly addressed. Students face higher risks in borrowing to finance human capital than – for example – an average individual borrowing to buy a house due to the lack of collateral. As stated by Barr (2001), a person who buys a house knows what he is buying. The house is unlikely to fall down, the real value of the house will generally increase and – most importantly -- if earnings fall, making repayments burdensome, she can sell the house. In other words, the house generally act as collateral for the loan, meaning that loans can be obtained on good terms from the bank. In addition, future students – particularly those from low socio-economic background, whose parents did not attend higher education – are not necessary fully aware of

[3] In most discussions about higher education finance, ability to pay *de facto* refers to the wealth of a student's relatives (parents,...); not that of the student. Although the former is frequently used as a proxy when establishing fees or grants, we believe it is poised with philosophical as well as practical difficulties. When it comes to young adults -- what higher education students are -- it is becoming problematic to assume they enjoy the benefit of their families' wealth. Should we still assume that most students are still fully supported by their families? Or should we adopt the more realistic view that they must be considered as independent ?

the magnitude of the return on human capital investment. Even well-informed students face risk: though average private rate of return to investment is fairly high, there is considerable variance about that average. In addition, more flexible labour markets and less stable households (divorces, separations, relocations...) might cause larger fluctuations in short-term levels of earnings. Finally, someone who has borrowed to pay for a qualification and faces lower earnings does not have the option to sell his degree[4], further increasing the exposure to risk and the propensity of private investors to deny access to capital or charge high risk premia.

Risk shifting or risk pooling?

It is important, especially for students from disadvantaged background to have some insurance against the lost of earnings. The case for income contingency is also supported by basic human capital theory as well as justice principle (ability to pay). We will see that income contingency can be implemented in different ways. In all cases however, income-contingency operates as an insurance against loss of earnings. And an insurance comes at a cost than need should be shared between the graduates (cost pooling) or transferred to taxpayers (cost shifting).

Cost *pooling* consists of a system where the cost of default, or low contribution due to no-or-low earning spells, is shared among graduates. But the higher cost of providing income-contingency to categories like women or less profitable fields of study could be shifted to the taxpayer via subsidies to individuals (borrowers) or inverstors (lenders). Students would then benefit from income-contingency without any risk premium or implicit transfers, and private final lenders would enjoy a source of risk-free investment. However, Barr (2001, 2002) suggests this option might lead to public debt classification (ie, student contracts classified as public debt). Total transfer of insurance costs from lenders to the State also induces a substantial fiscal cost.

[4] Degrees without their holders are no more that printed sheets of papers.

For these reasons, we shall focus in this paper on income-contingent mechanisms with cost pooling. Consequently, we will also *a priori* considerer that *all graduates* participate in the mechanism. Indeed, in order to secure effective pooling of insurance costs, as well as resdistribution, the coverage of private finance scheme should be as large as possible. It should in fact be applicable to the full cohort of students enrolled in the higher education system.

Loans and equity-like contracts

As to private deferred payment solutions – what this paper is really about – a distinction should be introduced between loan and equity contracts (Barr, 2001, 2002 ; Greenaway & Haynes, 2003 ; Jacobs, 2002).. By definition, a loan contract is a promise to pay back a fixed amount (an instalment), as a stream of interest payment + principal payback. And combined to the idea of income-contingency, in the context of education, the loan contract becomes a student *loans with income-forgiveness* (LIF).

In the case of equity contract, the contractual arrangement corresponds to the engagement to pay a share of the profits generated, either as a dividend or/and a rise in the value of the shares. Transposed to student funding, it corresponds to the notion of *human capital contract (HCC)* in which students commit part of their future income for a predetermined period of time in exchange for capital for financing fees or subsistance costs (Palacios, 2004).

How to design income-contingency?

The idea of income-contingency is central to our argument. But it still needs to be flesh out in order to be implemented. When should graduates be exonerated from payment and benefit from the insurance mechanism inherent to income-contingency ?

Income-contingency is direct in the case of human capital contracts (HCC). As payment is defined as a percentage of earnings, decline in revenues will automatically translate into lower contribution. The extreme case being the total loss of earnings which would simply totally exempt the graduate from payment. Things are slightly less obvious with loans with income-forgiveness (LIF), but we think that human capital theory, combined to the benefit principle, provides adequate guidelines to this problem. Private contribution should somehow be proportional to the benefits derived from the kind of human capital acquired at tertiary level; not the one acquired at primary or secondary school. In the context of LIF simple way to translate this idea is to decide that higher education graduates should pay only if their annual net wage is *above* the average wage of less educated ones, typically individuals with secondary school attainment.

Human capital contracts (HCC), loans with income forgiveness (LIF) vs. income tax (IT)

The central aim this paper is to produce realistic estimates of how the implementation of these private finance instruments, at the scale of entire higher education systems, is likely to affect graduates, but also non-graduates. We believe indeed that the outcomes of private finances schemes needs to be assessed in comparison with those generated by traditional income taxation mechanisms. In technical terms, this means that we are not only interested in simulating the case of LIF and HCC but also the effects on the distribution of lifetime earnings of resorting to higher income tax (IT). Using data on Belgian wages and employment, and using simple econometrics, we compute estimates of payment flows that the three types of policies are likely to generate. More importantly, we evaluate their effect on the population-wide (graduates + non-graduates) distribution of lifetime earnings.

The main result is that income-contingency schemes seems to offer plenty of opportunity to raise significant sums from individuals, while addressing the problem of the risky nature of human capital investment, and *at a cost for graduates that remains fairly marginal* regarding their lifetime net wages:

sightly less than 2% for and investment of 5,000€[5]. The other result is that these instruments are relatively *equitable* as payments are indexed on graduates' ability to pay. Although HCC somehow dominates LIF in this respect, it turns out that both instruments display strong *vertical equity* virtues. It also clearly emerges that they are considerably more expensive for graduates that general taxation. In other words; in the Belgian context, resorting to general taxation is synonymous of considerable implicit (regressive) transfers from non-graduates to graduates. In more general terms, our results confirm the preference for greater private but deferred an income-contingent payments.

But income-contingency comes at a cost that should be shared between the graduates. Yet, *pooling* the cost of insurance could lead to adverse selection (ie, inadequate pooling of high and low risk individuals). Simple computations suggest that the insurance cost for Belgian graduates with the rosier prospects (long/university program graduates) to be pooled with graduates who face lower liftetime earnings lead to payments inflated by 16%. However we show that investing *less* money on potentially less wealthy graduates eliminates this cost. The tentative conclusion is that students attending programs leading to less paid jobs can and even should be asked to pay lower cumulated fees, and consequently borrow less money to finance their human capital.

Section 1 exposes the simple model we use to assess the outcomes of LIF, HCC but also finance by higher IT (our benchmark). Section 2 contains the analysis of Belgian wage and employment data. In particular the estimation of the level of contributions that both LIF and HCC are likely to represent, and how these compared with traditional IT. Section 3 further discusses the different ways of pooling the cost of the insurance inherent to income-contingent schemes like LIF and HCC, while addressing the danger of adverse selection. Section 4 concludes.

[5] Representing 10 to 30% of current public cost per graduate; approximately the reduction in real terms of per student public spending observed in Belgium since 1980.

1. Model

The conclusion of the introductory discussion is that in order to secure additional resources for higher education systems, deferred payment schemes are highly desirable. But the case in favour of these largely rests on the capability to simultaneously secure *income-contingency.* And we have identified loans with income-forgiveness (LIF) as well as human capital contracts (HCC) as suitable candidates. But before moving to empirical analysis and simulation (section 2) we need to develop simple models of our finance schemes (LIF and HCC) aimed at increasing resources for higher education[6]. We also need to model more traditional finance by income taxation (IT) as outcomes of LIF and HCC must be put into perspective with those generated by traditional taxation mechanisms. Modelling should also include present value of earnings by category of earners. We indeed intend to use this variable to assess the impact of a each type of education finance mechanism, particularly in terms of vertical/distributive justice.

We shall assume that human capital investment (*INV*) – no matter the exact private education finance instrument used -- comes in addition to current level of mainly public funding. It is mandatory for all students[7], takes place at the age of *18*, lasts a predetermined period *D.* Students/individuals start repaying at the age of 24 (grace period of 5 years). The reader should note that for simplicity of exposure we make a similar assumption about finance by income taxation (IT). We envisage the – highly plausible – situation where additional public resources financing a particular cohort's higher education takes the form of public debt issued when individuals are aged 18. Reimbursement of this debt, via higher taxation imposed on both graduates and non-graduates, also starts at age 24 and ends at horizon *D*[8].

[6] Some authors like Jacobs (2002) model private finance mechanisms as *substitutes* to public finance. Although very sensitive when it comes to policy-making, this distinction does not fundamentally affect the results of the modelling exercise.
[7] Coverage is 100% in order to ensure insurance cost pooling and redistribution according to ability to pay.
[8] Strictly speaking we should assume than non graduates start paying taxes before the age or 24. However this more realistic modelling option would not fundamentally change our results about what happens when these individuals do not contribute to higher education additional funding.

1.1. Present value of earnings

If $w_{a,j,k}$ represents the level of net wage of a representative individual of age *a,* higher education status *j* (ie, graduate or non-graduate), and type *k*, the present value of his lifetime wage, evaluated at age 24, is:

$$PVw_{24,j,k} = \Sigma_a [w_{a,j,k} (1+\tau)^{a-24}/(1+r)^{a-24})] \quad [1]$$

with:

- a ranging from 18 to 65;
- τ capturing the general tendency of (all wages across the economy) to grow, due for example to technological progress ;
- r representing the usual discount factor (the preference for the present as supposedly reflected by the return on risk-free long term bonds)

The notion of type of individuals (k) directly echoes the idea of a *distribution* of lifetime wages; with some types/categories of indiduals with low lifetime net net wages and others to categories who are economically more successfull. Section 2 will expose who we build our types of individuals from our data set.

It is also implicit from equation 1 that the data we will be using are *cross-sectional* and not longitudinal. Transforming these data in lifetime wage functions need to be done with some care. As suggested by Jacobs (2002), the main reason why cross-sections differ from time-series is that there is wage growth due to total factor productivity gains (technological progress).

Our basic wage data will also consist of *net wages*. This choice reflects the supposedly realistic assumption that extra private or public contribution to higher education comes in addition to current levels of taxation.

1.2. Finance Instruments

i) Human capital contracts (HCC)

The case of HCC is fairly simple to model. Characterizing this instrument of private finance amounts to finding percentage θ such that present value of lifetime payments by a typical graduate equals the value of the investment;

$$INV(1+r)^5 = \theta \Sigma_a [w_{a,g,\bullet} (1+\tau)^{a-24}/(1+r)^{a-24})] \qquad [2]$$

with

- a ranging from 24 to 24 $+D-5$; where D is the duration of the human capital contract (eg, 25 years);
- $w_{a,g,\bullet}$ is the wage/age function for arepresentative graduate ($j=g$), all types k of individuals combined

ii) Loans with income-forgiveness (LIF)

Modelling LIF is slightly more demanding. It basically consists in finding the value of the annual instalment Ω such that:

$$INV(1+r)^5 = \Omega \Sigma_a [\mu_{a,g,\bullet} /(1+r)^{a-24})] \qquad [3]$$

with :

- a ranging from 24 to $24+D-5$; where D is the duration of the LIF;
- $\mu_{a,g,\bullet} \equiv Prob(w_{a,g,\bullet} > \Theta)$ the probability of payment estimated for a representative graduate ($j=g$) of age a (all types combined); Θ being the annual net earnings threshold under which no payment

is required. It is defined here as the average wage of observed among non-graduates, not necessarily of same age as graduates, but with identical labour market experience.

In the simple model exposed above, the key parameter is the probability of payment $\mu_{a,g,\bullet}$. It captures the idea of income-contingency.

iii) Income taxation (IT)

The last instrument to be modelled it IT (public debt issuance financed by deferred higher taxation). The exercise implies finding the percentage of additional taxation η such that :

$$N\,INV\,(1+r)^5 = \eta\ [N\,\Sigma_a\,[T_{a,g,\bullet}\,/(1+r)^{a-24})] + (P-N)\,\Sigma_a\,[T_{a,ng,\bullet}\,/(1+r)^{a-24})]] \qquad [4]$$

where:

- a ranging from 24 to 24+D- 5; where D is the predefined horizon of the public debt;
- T is the expected amount of tax paid by the representative individual (graduate and non-graduate);
- N is the number of graduates in a cohort (eg, 24 age-band in our cross sectional data), P is the size of the whole population;

The reader should note that the second term of the right-hand term in equation 4 reflects the contribution of non-graduates (those who do not attend higher education). Equation 4 can be restated, after dividing both sides by N, to become:

$$INV\,(1+r)^5 = \eta\ [\Sigma_a\,[T_{a,g,\bullet}\,/(1+r)^{a-24})] + (P-N)/N.\ \Sigma_a\,[T_{a,ng,\bullet}\,/(1+r)^{a-24})]] \qquad [5]$$

where *(P-N)/N* is capturing the intensity of subsidisation of higher education costs by individuals who did not attend.

Note finally that, assuming that *T* is the result of progressive taxation of annual gross wages ie, $T=b\, gw+c\, (gw)^2$ with $c>0$, we clearly have that -- for any value of *a* -- ηT is also progressive[9].

1.3. Distribution analysis

As already stated, we intend to assess the impact of each of the three types of education finance schemes modelled above on vertical/distributive justice. This means that we need to compute the present value of the lifetime contribution for each instrument (HCC, LIF, IT) and *each type* of individual *k*.

Algebraically, assessing it means computing:

$$C\_HCC_k = \theta^* \Sigma_a [w_{a,g,k} (1+g)^{a-24}/(1+r)^{a-24})] \qquad [6]$$

$$C\_LIF_k = \Omega^* \Sigma_a [\mu_{a,g,k} /(1+r)^{a-24})] \qquad [7]$$

$$C\_IT_k = \eta^* \Sigma_a [T_{a,j,k} /(1+r)^{a-24})] \qquad [8]$$

with:

- θ^*, Ω^*, η^*, being the respective solutions to equations 2, 3, 4

[9] Using the notation *MTR* for the marginal tax rate and *ATR* for the average tax rate we have indeed:

$T(gw)$:	$\eta.T(gw)$
$ATR=b+c.gw$	$ATR=\eta(b+c.gw)$
$MTR=b+2c.gw$	$MTR=\eta(b+2c.gw)$
$MTR>ATR$ if $c>0$	$MTR>ATR$ if $c>0$
$MTR/ATR=(b+2c.gw)/(b+c.gw)$	$MTR/ATR=(b+2c.gw)/(b+c.gw)$

- a ranging from 24 to 24+ D - 5;

- $w_{a,g,k}$ in equation 6 being the expected level of net earnings for a type k graduate ($j=g$);

- $\mu_{a,g,k}$ in equation 7 being the probability that a type k graduate ($j=g$) pays her annual instalment on her loan;

- $T_{a,j,k}$ in equation 8 the expected level of taxation currently paid by a type k individual;

The final stage is fairly immediate as it involves computing present values of contributions for each type *relative* to the present value of their lifetime earnings (PVw computed by type k, see equation 1).

$$\Pi\_HCC_k = C\_HCC_k / PVw_k \quad [9]$$

$$\Pi\_LIF_k = C\_LIF_k / PVw_k \quad [10]$$

$$\Pi\_IT_k = C\_IT_k / PVw_k \quad [11]$$

2. Empirical evaluation of private finance instruments

In the simple models exposed above, the key variables and parameters are the net earnings profiles (w), taxation profiles (T).as well as probability of paying loan instalments (μ). We could immediately move to the simulation exercise using somehow arbitrary values for each of these parameters. But the result would be trivial and bring little substance to the paper. So we opted for the more appealing approach that consists of estimating the value of the profiles or parameters using real information on wages, employment rates and tax payments of both higher education graduates and non-graduates.

Our data come from a survey carried out in Belgium in 2000: the Panel Study on Belgian Households (PSBH). This is a small national survey undertaken by a consortium of universities. For a sample of about 4,722 individuals drawn randomly for the whole Belgian Population it provides data on annual net and gross earnings (and thus amount of income tax), participation to labour market, working hours and personal characteristics such as age, gender and – most importantly -- education attainment.. This data set is useful to evaluate the relationship between higher education (short or long[10] programs) and earnings or taxation at different stage of individuals' career, relative to less educated people. In the context of LIF, these data can be use to estimate the probability function capturing the risk that net annual earnings fall below a certain threshold and, consequently, exonerate individuals from paying their annual instalment.

As stated in section 2, it is important to explain how the various type (*k)* of individuals are defined here. Ideally, with time-series on wage and taxation, we would use information like decile or quintile of the distribution of lifetime values. But we only have cross-sectional data. So we opted for a set of categories available in the PSBH survey, hoping that they would somehow reflect the idea that lifetime earnings (or taxes) can vary. Hence, index *k* in this paper designates types of individuals (or cells) by combining information on gender, education (highest degree obtained by respondent), and area of residence. Education is a four-category variable : i) less than secondary ii) completed secondary iii) short higher education (3 years) and (iv) long higher education (4-5 years)[11]; while area of residence is a dummy variable equal to 1 if people live in the Brussels Metropolitan Area[12]. At the most desagregate level the number of types is thus 16. But depending on the simulation needs, these can be collapsed in more agregate categories; typically graduates and non-graduates.

Insert table 1 about here (sample characteristics here)

2.1. Earnings profiles and present value of lifetime net wages by type

Our Belgian data (PSBH) help us estimate net wage/age functions by type *k*. In turn these allow us to determine both payments and present value of lifetime net wages. Only by knowing how much students

[10] Typically organised within universities
[11] The first two categories or education form what we call the 'non-graduates' while the two other the 'graduates'.
[12] Brussels + Brabant provinces.

earn after graduation we can assess of various education finance schemes affect the distribution of lifetime wages. We need in particular to relate the payments inherent to HCC, LIF and IT to individuals' lifetime wages.

A preleminary step is to estimate the OLS coefficients of the net wage regressed on a 2nd order polynomial of experience (equation 12), separately for each category *k* and for more agregate categories (ie, all graduates and non-graduates).

$$w_{exp,j,k} = \alpha + \beta\, exp_{j,k} + \gamma\, (exp_{j,k})^2 + \varepsilon_{j,k} \qquad [12]$$

where potential work experience (*exp*) is defined as the number of years since (theoretical) graduation age (i.e; 17 for secondary school drop-outs, 19 for secondary education; 23 for higher education graduate). Note that dependent variable covers part-time workers as well as people without salaries. Strictly speaking thus, they combine wage and employment premia.

Using equation 12 OLS coefficients, we the compute expected net wage by age[13] functions ($w_{a,j,k}$) for each type *k,* but also for more agregate categories. Examples of these functions are displayed in graphs 1 & 2.

Insert graph1 (male) & graph 2 (female) about here

A third step implies computing expected tax by age functions ($T_{a,j,k}$). This is done in two stages. We first estimate the OLS coefficients of the gross wage (*gw*) regressed on a 2nd order polynomial of net wage [14] We then compute the expected gross wage using these OLS coefficients and the values generated by the net wage by age function. Expected amount of tax is simply the difference between net and gross wages ($T_{a,j,k} \equiv gw_{a,j,k} - w_{a,j,k}$).

[13] The shift from wage/experience to wage/age function is immediate. We simply use the relation between age and potential labour experience (ie, $a \equiv$ theoretical graduation age + *exp*)
[14] This is done by pooling all PSBH observations available.

We finally use the net wage/age functions to compute present value of lifetime earnings (equation 1). Following Jabocs (2002), we assume a 2 percent average growth rate of the general level of earnings (τ). Justification for this could be that technical progress generate gains in general productivity that somehow benefit all individuals[15]. We also assume a discout rate (r) of 4 percent, approximately equal to the historical return on public (risk free) european bonds. Results, displayed in tables 2 & 3 suggest sizeable differences across types k. They also clearly show that higher education graduates can expect much higher lifetime wages than non-graduates. Finally, is worth noticing that these estimates confirm the persistence of significant gender gaps.

Insert tables 2 & 3 about here

2.2. Incidence of income-contingency

Our Belgian data (PSBH) also allow us to quantify the frequency with which the income-contingency clause is likely to apply in the case of LIF. In more technical terms, simple econometrics applied to PSBH help us to quantify the probability of payment (μ in equations 3 and 7).

We define the loan payment/non-payment dummy (ie, the dependant variable of our econometric model) by comparing the realized level of net wages with the threshold level (Θ). Remember that the latter is defined as the *average net annual wages of individuals without higher education* but similar professional experience (*exp*). Each time annual net earning ($w_{exp,j,k}$) is below the no-payment threshold (Θ_{exp}) we conclude to default ($Pay=0$), and normal payment of instalment Ω otherwise ($Pay=1$). Specification used is logistic, with a 2nd order polynomial function in *exp.*

[15] In the case of Belgium, but also Netherlands (Jacobs, 2002), this might be a lower bound. Long-term statistics of hourly wage growth suggest actual rates can reach 3%.

$Prob(Pay=1,j,k) \equiv \mu_{exp,j,k} = exp(\Delta_{j,k})/[1+exp(\Delta_{j,k})]$ [13]

where $\Delta_{j,k} \equiv \rho + \varsigma\, exp_{j,k} + \sigma\, (exp_{j,k})^2$

Predicted values of probability of payment are plotted on graph 3 for both short and long higher education graduates. The highest probability of payment is observed among long programs graduates. The graph clearly suggests that the income-contingency is likely to be more important as an insurance mechanism for students who attend short programs. The same graph also indicates that risk of default is clearly diminishing (probability of paying rising) between the age of 24 and 30, particularly for students who graduate from long programs[16]. Finally, it is worth observing the almost complete reduction of the initial gap between the different categories in terms of risk of default beyond the age of 50.

2.3. Contribution according to instrument and by category of individuals

The last set of estimates to report are the most interesting ones given the topic of the paper. Using the econometric results of previous sections, we compute present value of lifetime *contributions* for each instrument (HCC, LIF, IT) -- see equations 6, 7 & 8 -- and for each of our 16 types of individuals *k*.

Computations are based on the following technical assumptions. General level of wage growth per year is 2 percent (τ=0.02). Discount rate is 4 percent (r=0.04). Investment is made at age 18 and payment starts at age 24 (5 years of grace) for a period of 20 years (total duration of contract D=25). All values are expressed in Euros at the age of 24. The amount of money invested (*INV)* at the age of 18 is 5,000 Euros[17] (ie, 6,083 Euros at the age of 24). Finally, the proportion of a cohort that is likely to graduate is set to 40 percent ($(P-N)/N$ =0.4)

The levels of contributions (in Euros at the age of 24) are reported in graph 4

[16] The reader interested by risk of default on student loans should read Vandenberghe & Debande (2004)
[17] That amount would inflate current level of resources per student by 10 to 30%.

The first result is that resorting to private finance instrument considerably increases the amount paid by higher education graduates. Under the IT regime, graduates, because they earn more and pay more taxes, contribute more than non-graduates. But a sizeable fraction of the total cost is supported by those who do not attend higher education; partially because some of them face lifetime wage prospects that are equivalent to those of graduates, but more likely due to the fact that – in the case of Belgium at least -- contributions via IT is far from negligible within the wage range in which many non-graduates fall.

The other interesting result is the comparison between the two instruments of private education finance. Due to explicit (LIF) or implicit (HCC) insurance mechanisms, both instruments ensure that those facing lower lifetime wage prospects contribute significantly less. In the case of HCC, estimated contributions range from 4,500 Euros to 8,500 Euros, the average being roughly equal to the value of the initial investment (6,083 Euros). It is worth observing however that HCC somehow dominates LIF in providing insurance during no or low-income spells, and in accounting for the level of lifetime wages to determine individual contribution.

Insert graph 3 about here

Graph 5 is based on the same simulation results as graph 4, with the importance nuance that contributions are expressed in *percentage* of total lifetime wages. The first thing to highlight is that contributions requested by HCC and LIF contracts worth 5,000 Euros represent a fairly small fraction of lifetime net wages: between 1.14 and 1.88 percent.

Via graph 5, we are also capturing the *progressiveness* of contributions asked to individuals. A flat curve directly echoes the idea of proportional contribution (constant average contribution). A declining curve suggests regressivity (declining average contribution). And a rising curve corresponds to progressivity (rising average contribution).

Using this common classification, it turns out again that HCC dominates LIF. Loans are indeed regressive as they fail to ensure that wealthier graduates contribute a higher percentage of their lifetime net wages. Quite logically, HCC are synonymous with proportional contribution. The only mechanisms that appears progressive is IT. Yet, it is essentially the case at the bottom (left hand side) of the wages distribution. And the big differences concern types of individuals who do not attend higher education. The reader should also remember that IT violates the benefit principle.

Insert graph 4 about here

3. Risk pooling and adverse selection

As stated in section 2, it is important especially for students from disadvantaged background to have some insurance in case of lost/decline of wages. The case for income contingency is also supported by basic human capital theory as well as justice principle (ability to pay). As seen above, income contingency can be implemented via LIF or HCC. In both case, graduates enjoy insurance against loss of wages

In our simulations the cost of default (LIF), or low contribution due to no-or-low earning spells (HCC), are shared among graduates[18]. When we estimated the value of instalment (Ω in equation 3) in section 2, we implicitly included a premium to cover the average risk of default (1- μ) among all graduates. Similarly, when we computed the percentage or future wages requested by the HCC investor (θ in equation 2), we pooled graduates with relatively low (eg, women) and high (eg, men) lifetime wages.

Simple computations reported in table 4 suggest that, in the case of HCC, the cost for long programs Belgian graduates to be pooled with short programs individuals represents a 16% increase in the

[18] Remember that cost shifting towards the taxpayer would probably mean that student contract are assimilated to public debt.

percentage points of wages (θ) the lender is likely to demand. In other words, cost pooling implies within a cohort of graduate, redistribution from those with high lifetime wages to those with lower wages.

Insert table 4 about here

This principle of pooling was used for the Tuition Postponement Option at Yale University – an LIF programs -- in the early 1970's, and was not very successful. Its main disadvantage is to put the borrowers at some risk, depending on the probable future wages capacity of the borrowing class, and more particularly on how many potential high earners choose to exit the income contingent repayment scheme for fear of getting into a cohort with too many potential low earners. This is an illustration of the typical *adverse selection* problem.

To mitigate its severeity, the coverage of private finance scheme should be as large as possible (ie, applicable to the full cohort of students enrolled in the higher education system) as we have assumed throughout this paper. But even in this more favourable context, we should fear adverse selection. Estimates in table 4 immediately reveal that an HCC scheme implemented with long-program-only graduates[19] is less expensive than a scheme also including short program graduates. This potential reduction of cost could be sufficient to trigger off secession.

However, *investing less money on short programs students* should reduce the seriousness of this problem. Indeed short programs students can (and even *should*, given the ability to pay principle) be asked to pay *lower cumulated fees,* and consequently borrow less money to finance their study program. Algebraically, in the case of an HCC, this means imposing that investment (*INV*) by short program students represents only a fraction $0<\lambda<1$ of their peers. And to avoid adverse selection, this fraction λ should be such that pooled contribution (θ^p) is equal to the one faced by long programs graduates in a non-pooling context

[19]Mainly university programs

($\theta_{Grad.\ long}$). Referring to equation 2 we seed that θ is striclty proprotional to *INV* . We can thus identity λ by solving:

$$\theta^{p} \equiv \pi\, \lambda\, \theta_{Grad.\ long} + (1-\pi)\theta_{Grad.\ short} = \theta_{Grad.\ long} \qquad [14]$$

with:

$0 < \lambda < 1$

π being the proportion of long program graduates in the total population of graduates;

or equivalently, assuming $\pi = 1/2$:

$$\lambda = 2 - \theta_{Grad.\ short}/\theta_{Grad.\ long} \qquad [13]$$

Results in table 4 suggest that the typical HCC investment on a student attending a short program should be equal to 68% of that of a long program student. This reduction factor might appear important. In practice, it is inferior to what we would expect in the Belgium system with *uniform annual fees* across higher education institutions but *varying lengths of programs.* Considering that short programs last 3 years, while it takes 5 years to complete the long ones, we should end up with a loan size ratio of 3/5 (ie, 60%). In other words, pooling short and long programs, with uniform annual fees (eg, 1,000 Euros), would mechanically lead to the kind of investment size adjustment needed to avoid serious adverse selection problems.

4. Conclusion

The main result of this paper is that instruments of private finance, combining deferred and income-contingency payment, offer plenty of opportunity to raise significant sums to finance higher education, while addressing the problem of the risky nature of human capital investment. Their cost, given and investment of 5,000 Euros, remains fairly marginal: a bit less than 2% of current lifetime net wages.

Both LIF and HCC display strong vertical *equity* virtues, as payments are indexed on graduates' ability to pay. It also clearly emerges that they are considerably more expensive for graduates that traditional finance by higher income taxation (IT). In the Belgian context, resorting to income taxation is synonymous of considerable implicit (regressive) transfers from non-graduates to graduates. In more general terms, our results confirm the preference for greater private but deferred payment schemes. A student's current ability to pay is, by definition, unknown as it primarily depends on future wages. Consequently, the only way to adequately enforce the ability to pay principle at the level of the individual is to deferred its implementation at a time when the resulting income of the student will be verifiable.

As to indexing payments on ability to pay (ie, vertical equity), our results show that HCC marginally domimates LIF. This is no real surprise as, by definition, an HCC requires from the borrowers sums that are strictly proportional to wages. With LIF, by constrast, reference to ability to pay is much less accurate. On an annual basis, indexation simply consists of exhonerating individuals who fall below a predefined income threshold: no reference is made to the earning differences below or above that threshold. This said, better reference to ability to pay in the case of HCC does not necessarily mean that the stream of payment from the graduates is strictly proportional to the human capital wage premium. In fact, with HCC, there is no cap on total payments. And some observers (Barr, 2001) express concern about this. A good way to figure out the nature of the problem is to consider the amount of money Mick Jaeger would have paid over his career, compared to his cohort fellows, if private contribution to human capital costs was based on the HCC concept. Other analysts (Palacios, 2004) tend to consider that the absence of cap with HCC is a plus. But they refer to the supply side. Risk-averse investors might indeed particularly appreciate that when a student is very successfull economically, they receive a sum greater than the amount invested. This is a clear and strong way to compensate for the downside that less successfull students represent

Both LIF and HCC are income-contingent. In other words, they contain an insurance mechanism. The point is that insuring students against the risk of low wages after graduation comes at cost. Who should pay for it? Options available are essentially twofold. First, cost shifting. In that case, the cost of defaulting is borne by the taxpayer. But a total transfer of risk from lenders to the public sector induces a substantial fiscal cost. It would also probably lead public sector watchdogs to consider student contracts as public debt, adding to the strain public finances currently face.

This leaves us with the pooling option that we retained throughout this paper, where payments contain a premium to cover the average cost of default among the cohort. The main advantage of pooling is that is redistributive. Its drawback is its exposure to adverse selection, as potential high earners might push for exiting the scheme for fear of getting into a cohort with too many low earners. To mitigate this effect, the coverage of the student private finance scheme should be as large as possible (ie, applicable to the full cohort of students enrolled in the higher education system) as we assume in most of our simulations. *De facto* this would confer the private scheme a status almost equivalent to that of a State institution. It would also make transfers between categories of graduates less traceable or visible.

But even in this more favourable context, adverse selection might compromise the scheme's long run sustainabilitiy. Our last set of computations suggest indeed that high earners graduates (from long, university programs) would face and HCC price tag inflated by 16% if pooled with low earners (short, non-university programs graduates). However we also show that investing *less* money on students opting for less profitable programs potentially eliminates this cost. The tentative conclusion is that students opting for programs offering lower wage prospects[20] can and even should be asked to pay lower cumulated fees, and consequently borrow less money to finance their human capital.

[20]We refer to short vs. long higher education programs in this paper, but the case should also be made for the fields of study (law or engineering vs. sociology...)

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Tables and Graphs

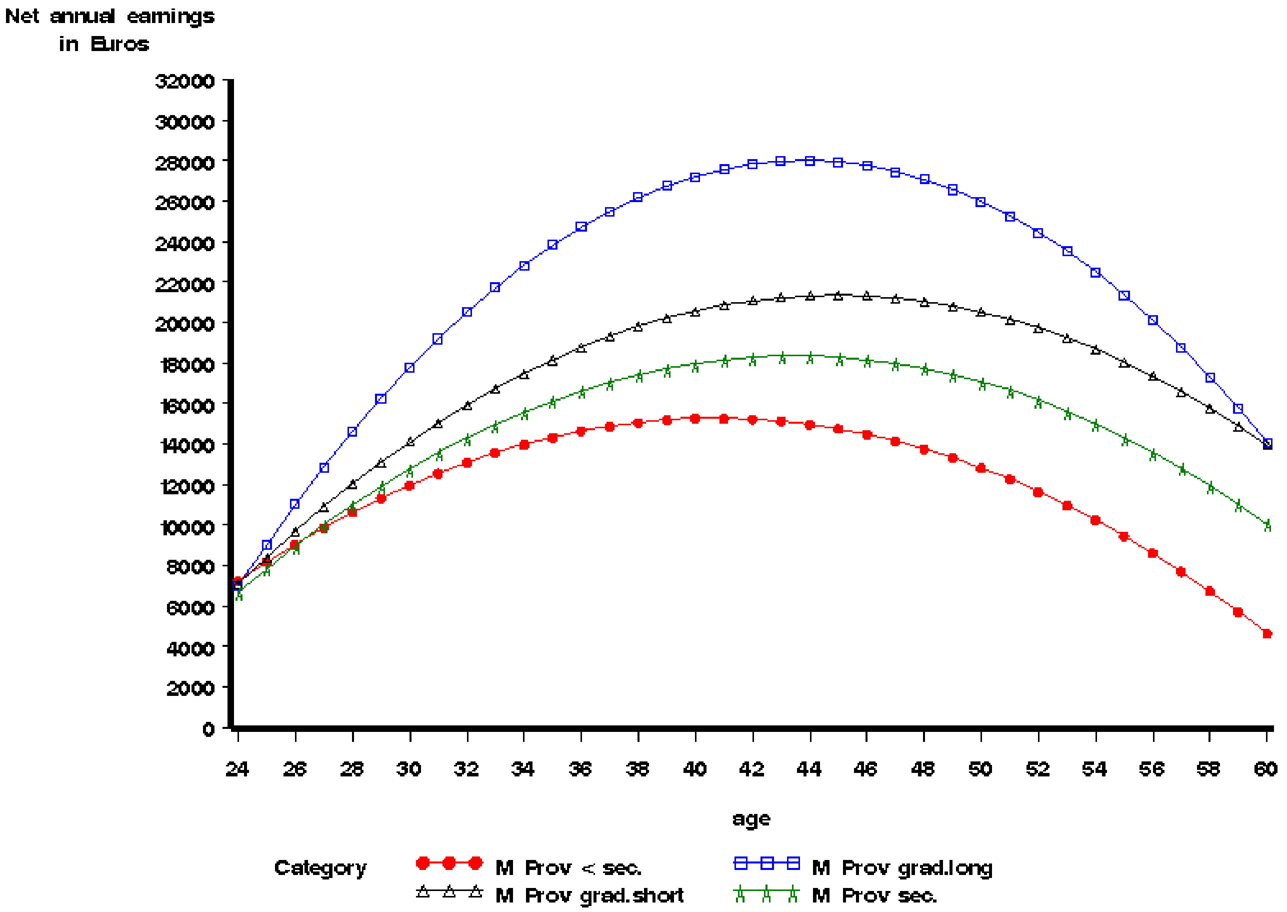
Table 1 – Sample statistics. Sample size (*row %)* and breakdown by education level, gender and geographical area

		Highest degree obtained				
Female	Brussels metropolitan	Less than secondary	Secondary	Higher education (short program*)	Higher Education (long program**)	Total
0	0	623	616	302	302	1,843
		0,34	*0,33*	*0,16*	*0,16*	*1,00*
	1	116	119	73	117	425
		0,27	*0,28*	*0,17*	*0,28*	*1,00*
1	0	638	692	431	221	1,982
		0,32	*0,35*	*0,22*	*0,11*	*1,00*
	1	109	154	113	96	472
		0,23	*0,33*	*0,24*	*0,20*	*1,00*
Total		1,486	1,581	919	736	4,722

* non-university

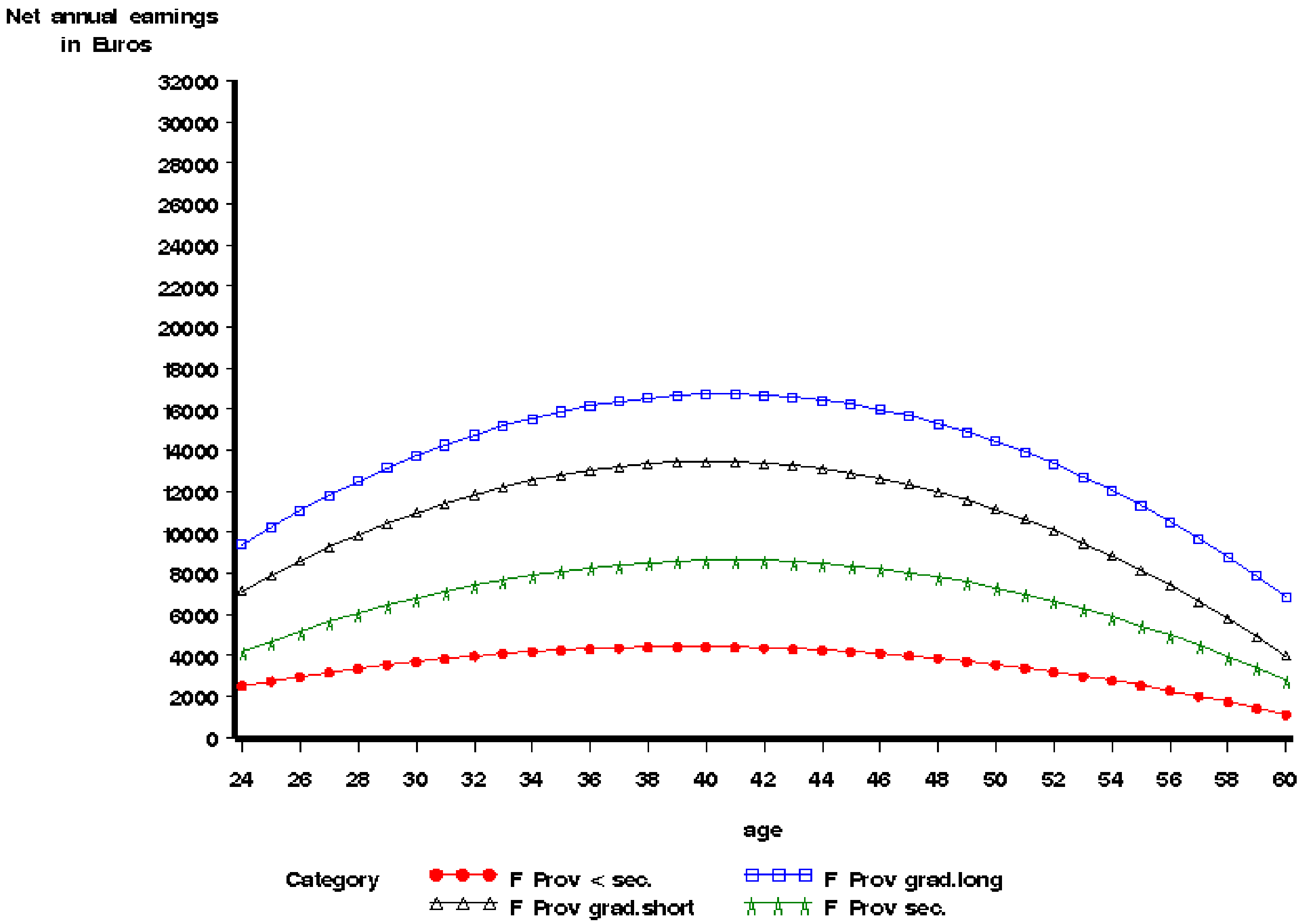
** university

Graph 1 – Annual net wages functions. Breakdown by degree. Males living outside Brussels Metropolitan Area (province)



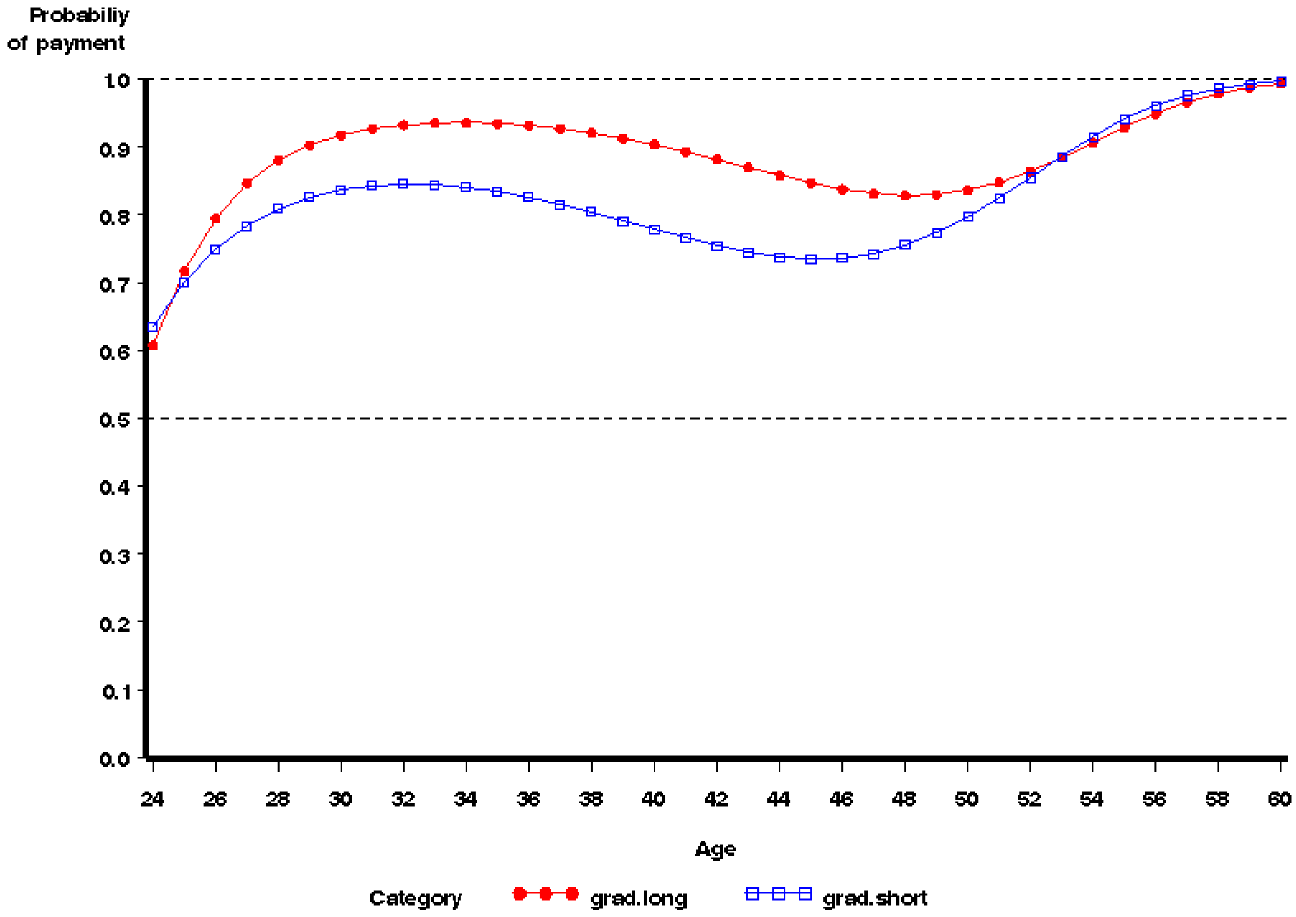
Source: PSBH00

Graph 2 – Annual net wage functions. Breakdown by degree. Females living outside Brussels Metropolitan Area (province)



Source: PSBH00

Graph 3 – Probability that higher education graduates pay their income-contingent instalment according to age



Source: PSBH00

Table 2 – Present value of lifetime (24-65) net wages estimated at the age of 24, in Euros. Breakdown by education level, gender and geographical area

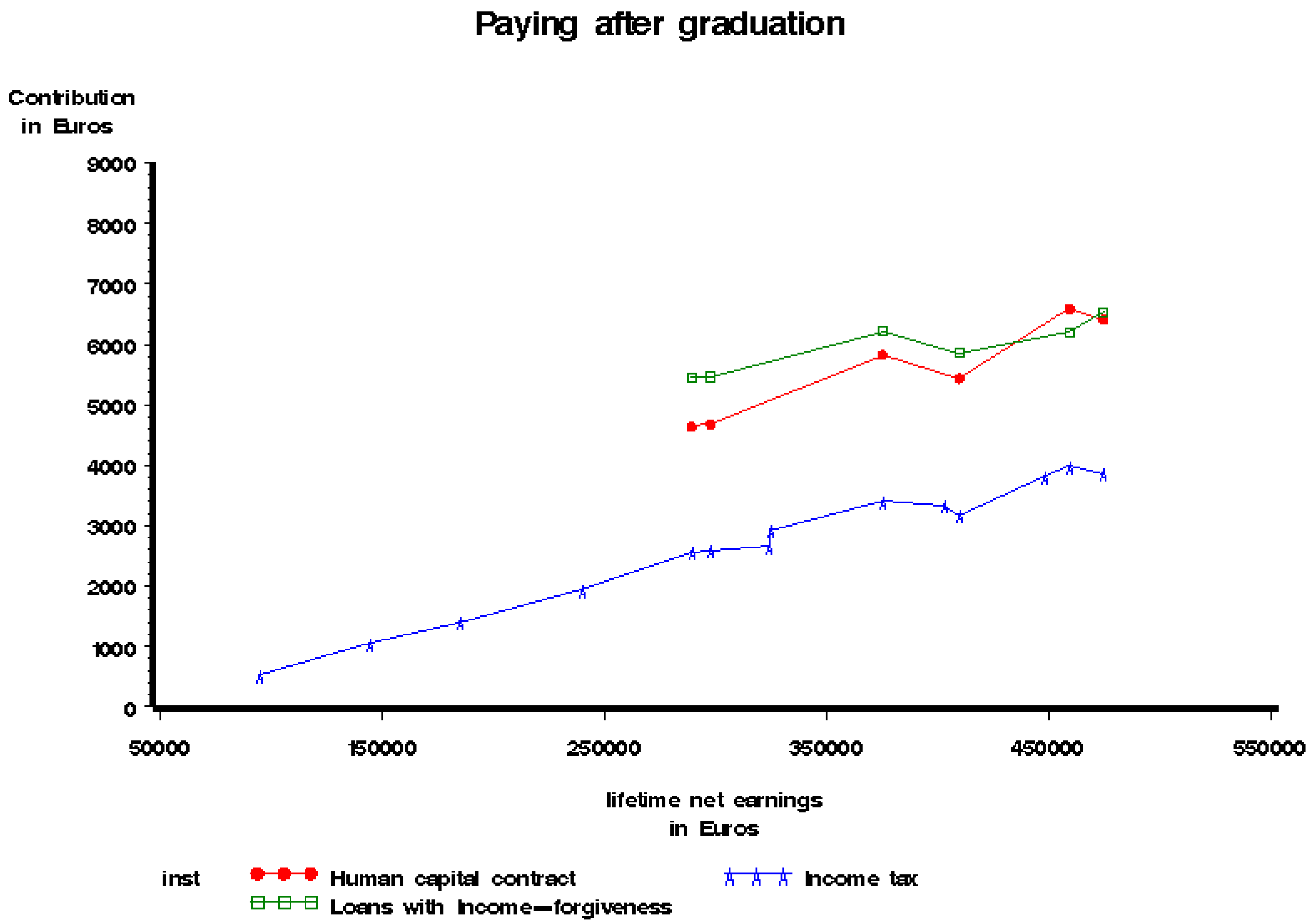
		Highest degree obtained			
Female	Brussels Metropolitan	Less than secondary	Secondary	Higher education (short program)	Higher Education (long program)
1	1	144,388	239,865	298,173	409,860
	0	94,683	184,661	289,450	375,396
0	1	324,214	448,577	459,505	581,567
	0	324,715	402,960	474,944	**584,871**

Assumptions: g=0.02, r=0.04

Table 3 – Relative present value of lifetime (24-65) net wages estimated at the age of 24. Breakdown by education level, gender and geographical area (1= category with maximal lifetime net earnings)

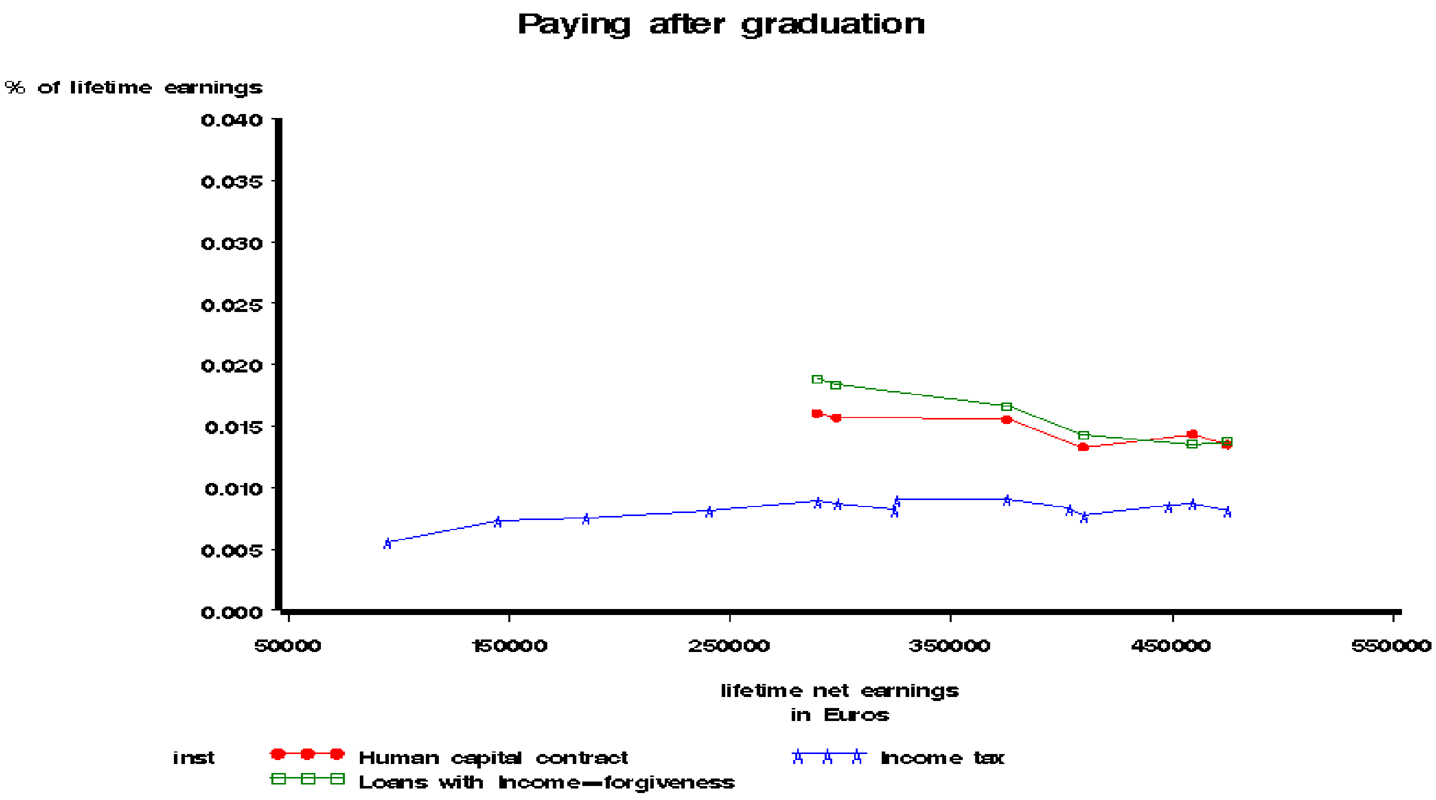
		Highest degree obtained			
Female	Brussels Metropolitan	Less than secondary	Secondary	Higher education (short program)	Higher Education (long program)
1	1	0.25	0.41	0.51	0.70
	0	0.16	0.32	0.49	0.64
0	1	0.55	0.77	0.79	0.99
	0	0.56	0.69	0.81	**1.00**

Graph 4 -- Present value of contribution by individuals according to instrument of higher education finance.



Source: PSBH00

Graph 5 - Present value of contribution by individuals **in percentage** of lifetime wages (24-65) according to instrument of higher education finance.



Source: PSBH00

Table 4 – Human capital contracts (HCC). Percentage of earnings committed depending on degree of pooling among graduates

Category (k)		Percentage of earnings committed (θ)	Cost of pooling
All graduates pooled	a	2.34%	
Graduate long programs	b	2.02%	a/b=1.16
Graduates short programs	c	2.66%	
Adjutment factor to avoid adverse selection:		$\lambda = 2 - \theta_{Grad.\ short}/\theta_{Grad.\ long} = 2 - 2.66/2.02 = 0.68$	

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ISSN 1379-244X D/2005/3082/003