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**MODELLING INCOME CONTINGENT LOANS FOR HIGHER
EDUCATION STUDENT FINANCING IN BRAZIL**

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PAULO AUGUSTO MEYER MATTOS NASCIMENTO

**MODELLING INCOME CONTINGENT LOANS FOR
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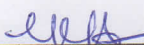


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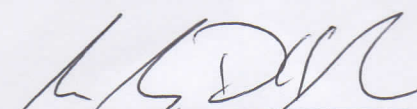


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DECLARATION OF ORIGINALITY

I declare that this thesis is an original work and is an account of research carried out by myself while enrolled as a Doctorate candidate at the Federal University of Bahia (UFBA). This thesis does not contain material that has been accepted for the award of any other degree or diploma in any University, nor material published or written by another person, except where due reference is made.

Salvador, Bahia, Brazil, 31th July 2018.



PAULO AUGUSTO MEYER MATTOS NASCIMENTO

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* The term *Sandwich Doctorate* has become usual in Brazil to refer to a specific type of selective scholarship schemes for Doctorate candidates. The schemes usually finance a period of one or two semesters as a Visitor Graduate Student (or equivalent) in a university other than the university where the recipient is registered as a Doctorate candidate. Two government agencies operate *Sandwich Doctorate* scholarship schemes at the federal level of government in Brazil: The Coordination for the Improvement of Higher Education Personnel (CAPES) and The National Council for Scientific and Technological Development (CNPq). Similar schemes are operated by other agencies at state-level governments.

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RESUMO

Empréstimos com amortizações contingentes à renda futura (ECRs) são um tipo de empréstimo que funciona para o devedor como uma espécie de seguro contra baixa renda, já que as amortizações variam de acordo com as flutuações na renda. Com uma implementação apropriada, a contingência à renda pode aproveitar ao máximo as eficiências transacionais envolvidas no monopólio governamental na tributação da renda pessoal e assim implementar amplos sistemas de empréstimos para financiar uma variedade de necessidades individuais. Esta tese discute as potencialidades de um amplo sistema de ECR para financiar formação superior no Brasil e simula hipotéticas configurações alternativas que tal sistema poderia assumir. As simulações usam um painel de indivíduos com nível superior presentes nos anos de 2014 e de 2015 da Pesquisa Nacional por Amostra de Domicílios Contínua (PNAD Contínua) e aplicam uma abordagem simplificada de funções de cópula para levar em conta a mobilidade na distribuição dos rendimentos desses indivíduos. Os padrões de amortização são então simulados para hipotéticos programas de financiamento a termo e contingentes à renda futura. Os resultados permitem avaliar as implicações fiscais e distributivas relacionadas às diversas características do programa de financiamento: taxas de juros, alíquotas e faixas de pagamento, sobretaxas e prêmios de risco. Os melhores modelos, em termos de acessibilidade para graduados e tamanho dos subsídios públicos, envolvem pagamentos contingentes à renda futura com sobretaxas aplicadas aos montantes emprestados, taxas de juros equivalentes à taxa básica de juros (SELIC) e cobranças feitas com alíquotas progressivas e respeitada uma faixa de isenção igual à faixa de isenção válida para fins de imposto de renda. Parte dos resultados serve também como uma avaliação *ex ante* do potencial de arrecadação do Fundo de Financiamento Estudantil (FIES) após as reformas introduzidas por lei em fins de 2017. Funções de idade-renda que levem em conta a dinâmica de renda de quem tem nível superior é a questão-chave para a pesquisa sobre o formato e o custo de programas públicos de financiamento estudantil. Assim sendo, esta tese fornece uma contribuição muito relevante para a avaliação *ex ante* das reformas recentes e das reformas pendentes – mas necessárias – do financiamento de estudantes do ensino superior brasileiro. Trata-se de tema de grande relevância dada a expansão que ainda se faz necessária do ensino superior no Brasil, especialmente ao se considerar as restrições adicionais impostas aos orçamentos públicos pela chamada emenda constitucional do teto de gastos, aprovada em fins de 2016.

Palavras-chave: Financiamento estudantil. Empréstimos para estudantes de ensino superior. Subsídios públicos. Encargos de reembolso. Empréstimos a termo. Empréstimos com amortizações contingentes à renda futura (ECRs). Brasil.

ABSTRACT

Income contingent loans (ICLs) are a loan type insuring debtor against both temporary and lifetime low income, as amortisations vary in accord with fluctuations in income. With an appropriate implementation, income-contingency can make the most of the transactional efficiencies involved in the government monopoly in taxing personal income to implement wide loan systems to finance a variety of individuals' needs. This thesis discusses the potentials for a broad ICL system to finance higher education studies in Brazil and simulates how such a system might look like. Simulations apply a simplified copula approach to account for mobility in the graduates' earnings distribution. Repayment patterns are then simulated for time-based and income-contingent loan designs. The results enable the assessment of the fiscal and distributional implications related to various loan features: interest rates, repayment rates and thresholds, surcharges and cohort risk premiums. The best designs, in terms of affordability for graduates and size of taxpayer subsidies, involve income-contingency with surcharges on initial borrowings, interest rates at the government's cost of borrowing upon graduation and above an initial threshold, and progressive repayment rates aligned with thresholds valid for taxing personal income. The results also provide an assessment of the potentials of recent reforms introducing income-contingency to the Student Financing Fund (FIES), the large scheme financing fees in private institutions as well as in a reduced number of public higher education institutions that are permitted to charge fees in Brazil. Appropriate models of earnings dynamics are the key issue for research on the application and costing of higher education student financing schemes, so this thesis provides a very relevant contribution to *ex ante* evaluation of the pending but necessary reforms to finance further higher education expansion in Brazil, especially considering the additional constraints imposed on the government's budget by the so-called spending freeze amendment.

Keywords: Higher education student financing. Student loans. Taxpayer subsidies. Repayment burdens. Time-based repayment loans. Income contingent loans. Brazil.

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LIST OF ABBREVIATIONS AND ACRONYMS

ANU	Australian National University
BCB	Central Bank of Brazil
BHPS	British Household Panel Survey
BRL	Brazilian Reais
CAPES	Coordination for the Improvement of Higher Education Personnel
CDF	Cumulative distribution function
CNPq	National Council for Scientific and Technological Development
CODACE	Brazilian Business Cycle Dating Committee
CQR	Conditional quantile regressions
CPI	Consumer Price Index
CPS	Current Population Survey (United States of America – US)
Continuous PNAD	Continuous Annual Household Sample Survey
CREDOC	Educational Credit Programme
EIB	European Investment Bank
E-social	Digital Bookkeeping of Tax, Social Security and Labour Obligations
FCB	Federal Constitution of Brazil
FGEDUC	Guarantee Fund of Educational Credit Operations
FIES	Student Financing Fund
FIES Committee	Student Financing Fund Managing Committee
FNDE	National Fund for Educational Development

FRS	Federal Revenue System
GDP	Gross Domestic Product
HCC	Human capital contracts
HCO	Human capital options
HECS	Higher Education Contribution Scheme
HE	Higher education
HEIs	Higher education institutions
HELP	Higher Education Loan Programme
IBGE	Brazilian Institute of Geography and Statistics
ICL	Income contingent loans
ILO	International Labour Organisation
INEP	National Institute for Educational Studies and Research "Anísio Teixeira"
IPCA	Extended Consumer Price Index
IPEA	Institute for Applied Economic Research
ISA	Income-share agreements
ISCED 2011	International Standard Classification of Education
LSE	London School of Economics and Political Science
MLE	Maximum Likelihood Estimate
NEP	National Education Plan
NLSY79	National Longitudinal Survey of Youth 1979
NLSY97	National Longitudinal Survey of Youth 1997
NPV	Net present value

OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary least squares
p.a.	per annum
PCR	Income Commitment Plan
PISA	Programme for International Student Assessment
PNAD	Annual Household Sample Survey
PNAES	National Programme of Student Assistance
p.p.	percentage points
PRONATEC	National Programme of Access to Technical Education and Employment
PROUNI	University for All Programme
PPPs	Purchasing Power Parities
QMLE	Quasi-maximum likelihood estimate
RAIS	Annual Social Information Report
RBs	Repayment burdens
RBEM	Repayment burden empirical method
R&D	Research & development activities
REUNI	Programme to Support the Restructuring and Expansion Plan of Federal Universities
RIF	Re-centred influence functions
RSE	ANU Research School of Economics
SELIC	Special Settlement and Custody System (Brazil's base interest rate)
SFH	Housing Finance System
TBRLs	Time-based repayment loans

TPO	Yale's Tuition Postponement Option scheme
UCB	Catholic University of Brasília
UCL	University College London
UFBA	Federal University of Bahia
UNSC	United Nations Statistics Commission
UQR	Unconditional quantile regressions
US	United States of America
USD	US Dollars
VET	Vocation education and training

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1 INTRODUCTION, JUSTIFICATION AND OBJECTIVE OF THE THESIS

The contemporary debate on higher education student financing faces two key problems: i) finding fiscally responsible ways of making more resources available for public institutions, including a greater contribution of the student body towards the cost of their studies, but without erecting greater barriers to access; and ii) designing national student financial aid systems that focus on objectives of fairness, while limiting the contribution to be made by public subsidies. These issues have been increasingly discussed in Brazil. The current scenario of fiscal restriction and deterioration of economic indicators continually widens the space for the re-examination of policies such as the Student Financing Fund (FIES) and the National Programme of Access to Technical Education and Employment (PRONATEC), as well as the free-of-charge delivery of programmes offered by public higher education institutions (HEIs).

The international literature suggests income contingent loans (ICLs) as the most effective and just manner of confronting these questions (BARR, 1993, 2014; CHAPMAN, 1997, 2006a; CHAPMAN; LOUNKAEW, 2016; DIRIS; OOGHE, 2018; STIGLITZ, 2016). This is a form of loan with repayments linked to the individual's income and is charged using the same mechanisms to collect taxes and/or social security contributions, with successful results as an educational credit policy in some countries. It works as an insurance against economic contingencies throughout life: the final deadline for debt settlement can be extended for decades and the amortisations vary in accord with fluctuations in income. In some cases, provision is made for forgiveness of the remaining debt after n years have elapsed, or in case of retirement or death – although this attribute is not necessarily present in ICLs. Such characteristics tend to make this a potentially more efficient and fairer model than conventional financing schemes.

Part of the literature also discusses income-contingent financing mechanisms based on taxation (the graduate tax – GLENNERSTER; MERRET; WILSON, 1968) or on equity-like instruments (human capital contracts and options – PALACIOS, 2007) that enable the individual to postpone the payment of the costs of their education. Policy analysis often highlight the advantages of income-contingent financing instruments in providing insurance for beneficiaries while keeping public subsidies under a manageable level. These instruments emerge as a superior mechanism to conventional loans and tax-financed subsidies (BARR,

2001a; CHAPMAN; HIGGINS; STIGLITZ, 2014; DIRIS; OOGHE, 2018; STIGLITZ; GUZMAN, 2016). However, the concepts behind ICL models, graduate taxes and human capital contracts and options are not new.

1.1 A BRIEF HISTORY OF INCOME-CONTINGENT FINANCING

The idea of postponing payments for post-secondary degrees until after their completion has been discussed in economic literature since at least the 1950s. Friedman (1955) wrote about *a posteriori* charges for the costs of post-secondary education: in order to avoid low investment in human capital due to financial and credit constraints, the government or firms need to finance post-secondary studies. Investing in human resources, however, involves considerably greater risk than investing in physical capital, and the individuals embodying the investment often have no collateral to offer other than their future earnings. Hence, there should be a condition that the direct beneficiaries, after they become graduates and are active in the labour market, repay the investment made in their training by allocating part of their future income to their funders. This would correspond to the device, typically adopted for other risky investments, of using equity investment plus limited liability on the part of shareholders (FRIEDMAN, 1955).

While in both Europe and the United States of America (US) a debate took place over how best to implement a graduate tax to tackle the issues raised by Friedman (1955), the first governmental initiatives of educational credit began to take shape in Latin America. They were based on the same principle of making the professional of the future pay for the training of the student of today. It was precisely in 1950 that the first national agency specialising in educational credit emerged in Colombia, conceived by Gabriel Betancourt Mejía (BETANCUR-MEJÍA, 1992). The idea spread rapidly across the continent and similar governmental organisations were set up in various countries (TÉLLEZ-FUENTES, 2009).

In the 1970s, James Tobin combined the two ideas and put into practice the first ICL scheme at Yale University, in the US, where Tobin was a professor. The ICL at Yale was seen as an innovative way of financing higher education (HE) degrees but was soon discontinued due to the difficulties the university had in accurately measuring the income of its graduates and effectively collecting the due instalments (PALACIOS, 2007).

In 1989, one of Tobin's former students designed and helped the Australian government implement the first ICL to be collected by a national income tax collection system (MOSS,

2012). The Australian system has been relatively successful, still endures after 30 years and has inspired the implementation of analogous arrangements in other parts of the world. At present, large national ICL schemes are being operated in New Zealand, the United Kingdom and Hungary. A growing number of countries, including Chile, Colombia, the US and Ireland, have discussed alternatives based on large-scale ICLs to reshape their student financing systems. More recently, new interpretations of Friedman's work have led to alternative formulations of the ICL, using equity-like financial instruments (PALACIOS, 2007), alternatives which have already been offered to students in some countries through private financial institutions (BORNSTEIN, 2011).

Beyond their applications in educational contexts, ICL systems reduce transaction costs, cheapening and amplifying access to credit. The guarantees arising from the involvement of the tax or social security system in the collection of income contingent payments would open ample opportunities in private credit markets. However, it is as an instrument of public policy that ICLs have their greatest potential impact. Technological advances have enabled the perfection of tax collection and income transfer systems, in a way which enables governments to constitute true infrastructures for providing credit at low cost for a variety of human needs.

Therefore, ICL arrangements have also been discussed in some countries for a variety of other purposes, from financing unemployment insurance and parental leave to solar rooftops (CHAPMAN; HIGGINS; STIGLITZ, 2014). Stiglitz (2016) celebrates the ICL as an important social innovation in response to the imperfections that emerge in the capital market as a result of transaction costs associated with problems of adverse selection and moral hazard. However, despite all the recent attention in numerous countries, this is still an open field of study.

1.2 DATA AND RESEARCH METHODS FOR DESIGNING AND ASSESSING STUDENT LOAN SYSTEMS

The bulk of the current literature is based in theory and practice regarding the applications of ICL systems (for a bird's eye view of these discussions, see the book edited by CHAPMAN; HIGGINS; STIGLITZ, 2014). As student debts have grown, causing crises in both developed and developing countries, the demand for high-quality empirical analyses has greatly increased (BETTINGER, 2015) – see, for example, empirical papers published by a special edition of the *Economics of Education Review*, to be released in 2019.

Ideally, evidence-based policies require data at the individual level, but few countries produce reliable longitudinal data on college enrolment, student borrowing and graduates' earnings that follows entire cohorts of former students over time. Dynarski (2015) uses an example to illustrate why the registration of data on earnings and borrowing on the individual level is important for student loan analysis. Consider the hypothesis of a traditional student financing scheme (without ICL) in which small loans present higher default rates than those recorded for large loans. Such a situation would be consistent with two alternative scenarios, each of which has significantly different policy implications.

In one of these scenarios, the defaulters present low income during precisely that part of their productive life in which the repayment deadlines for their student financing arrive. In this case, switching the loan type to an ICL, thereby reducing payments during periods of low income, would represent financial security for the beneficiaries. At the same time, if the income of these people rises throughout their lives, the government will be able to recover a larger proportion of the resources lent. If there are no additional subsidies implicit in the policy design, the system will be self-financing.

The other possible scenario is that the income pattern of these people would remain low throughout their lives, so that the greater part of them would not demonstrate the capacity to support even small repayments. In this case, an ICL would still be more advantageous for these people than traditional financing, but the costs for the government would be considerably elevated since a significant portion of the loans would end up being forgiven. Unless they have been adopted with the specific objective of making possible the payment of at least part of the pre-existing student debts, the high cost of making, servicing, and forgiving such loans would make grants and scholarship arrangements and/or the maintenance/expansion of totally free-of-charge public systems relatively cost-effective alternatives for the taxpayer.

Distinguishing between these two scenarios requires longitudinal data at the individual level, which provides information on income patterns and access to and conditions of credit. As Dynarski (2015) emphasises, following the same group of individuals over time is the most reliable way of capturing the income shocks against which ICL systems protect. Analyses based only on averages would soften the shocks that impact groups with specific characteristics, distorting the benefit and cost estimates for ICL introduction.

In the absence of lengthy panels, cross-sectional microdata on income, age and education have generally been the alternative sought by researchers to analyse and design student loan systems. Recent developments enable good quality dynamic analyses using sample surveys that have rotating panels with individualised data for at least two consecutive years. Essentially, what these approaches do is to project the lifetime income profile of individuals with university degrees based on one or very few data points about their income and age, in order to evaluate distributional impacts and the subsidies implicit in different alternative designs for student loan schemes.

This strand of the literature has developed considerably since Chapman and Lounkaew (2010b) used cross-sectional microdata from the US to simulate student loan repayment patterns using age-income profiles predicted by quantile regressions based on income or earnings data observed at a single moment in time. The main limitation of the method is that it disregards the fact that the individual's employment and income conditions are not static in time, which affects their ability to repay any financing they have contracted. In other words, the method places individuals in a static universe in which the position of each individual in the world of work (in or out of the labour force, employed or unemployed) never changes and there are no transitions between income quantiles throughout life (DEARDEN, in press; HIGGINS; SINNING, 2013).

A relatively simple alternative to overcome the limitations of age-income profiles obtained from cross-sectional data is to use Monte Carlo simulations to project future income, so long as there is individualised income and age data on people with university degrees collected at two or more points in time. To account for income mobility even when only short-duration rotating panels are available, Dearden (in press) has suggested the use of copula functions along with Monte Carlo simulations. The method applies a simplified copula approach and then uses Monte Carlo simulations to estimate age-income profiles based on the copula function. With these approaches, the aim is to circumvent the non-availability of longitudinal microdata, a common restriction for the research and evaluation of public policies in many countries. Robust methods are important for generating realistic earnings patterns on which it is possible to illustrate potential repayment hardship and to simulate alternative student loan designs.

1.3 THE GROWING STUDENT DEBT PROBLEM AROUND THE WORLD

Funding for HE systems comes either from private sources or governmental budgets. In both cases, however, public subsidies play a central role: taxpayer money finances the direct subsidies given to universities, as well as the subsidies associated with government-administered student loan and grant schemes. Fiscal austerity and competition over resources often impose heavy constraints on the setting up and maintenance of large public HE systems, if there is no kind of cost sharing.

In the US, student debts are already higher than credit card debt or vehicle financing (DYNARSKI, 2015; SCOTT-CLAYTON, 2018). These high debts mostly affect borrowers studying at for-profit institutions (LOONEY; YANNELIS, 2015). In response to this situation, regulations introduced in 2014 by the Obama administration established graduates' loan payment-to-earnings ratios as an eligibility requirement for for-profit colleges to access federal student aid (CELLINI; DAROLIA; TURNER, 2016). Concerns over rising student debt are not restricted to the for-profit sector. The offer of free-of-charge public HE was on the agenda of at least one candidate (Senator Bernie Sanders, whose plan influenced the policy platform of Hillary Clinton) in the US Presidential elections of 2016 (NELSON, 2016) and the state of New York began offering free tuition at public community colleges and public four-year institutions to all but its wealthiest residents in June 2017 (MURPHY; SCOTT-CLAYTON; WYNESS, 2017).

This policy debate is not confined to the US. In the United Kingdom, the abolition of tuition fees was part of the Labour Party manifesto in its 2017 General Election campaign (RILEY, 2017). The Labour government elected in New Zealand in 2017 promised to abolish tuition fees during the campaign and again when it took office (BOTHWELL, 2017). German public universities have been legally permitted to charge tuition since 2005, but all HEIs which opted to charge at the time surrendered soon afterwards to pressure from organised groups and abolished them again (BUSEMEYER; LERGETPORER; WOESSMANN, 2018). Recent riots of college students in South Africa because of the proposed rate increase of about ten percent demonstrate the dilemma about the rising cost of HE and who should pay for it (OKETCH, 2016).

Political movements of this nature tend to act like pendulums and, although they may suggest a growth trend in the offer of free-of-charge HE, in the real world the higher the public sector

subsidy for HE, the greater the pressure on the system to prevent it from growing (BARR, 1993). For this very reason, tuition fees are present in most HE systems, sometimes charged during the period of study, sometimes with payment deferred until the years after graduation. Systems that are completely free of charge tend to be under-resourced, compromising either coverage or quality – or both (BARR, 1993). The typical exceptions are Austria, Germany and the Scandinavian countries¹, mainly because of their strong welfare economies and the acceptance of relatively high levels of taxation. Yet, even in these countries student financing schemes are in demand (JOHNSTONE, 2014), because the students themselves have to deal with their daily expenses, directly or indirectly related to their studies (accommodation, food, transport, study materials, leisure etc.). Hence, student loan systems are not designed solely for cost sharing purposes; they may also target student independence, providing financial means for the students to pay for their basic living costs, and/or social inclusion. In this case, the aim of the loan is to make HE affordable for low-income families (ZIDERMAN, 2013).

HE systems in most of the countries in continental Europe rely mainly on public financing sources. Tuition fees, where they exist in continental Europe, tend to be low, whereas in the Anglo-Saxon world private financing generally bears a greater load of the budgets of the HEIs (KWIEK, 2017). In other countries (including Russia, most of the post-communist countries and most East African countries), dual HE financing systems exist: a free selective public system, for students with good performance, coexists with a larger paid public system, for those who fail to pass through the qualification filter for the free-of-charge places (JOHNSTONE, 2014). Some countries in Asia and Latin America maintain an atrophied public sector (generally elite, selective and free-of-charge) while incentivising the expansion of places at the private HEIs (often profitable and frequently subsidised by the government); in contrast, other countries in these regions follow the Anglo-Saxon tradition (JOHNSTONE, 2004).

Chile and Colombia are two examples in Latin America of the Anglo-Saxon tradition of depending mainly on private financing sources. Tuition fees paid by students are substantial sources of funding and are present in both the public and the private sectors. The governments provide study grants and substantial student loans. Like the US, student loans in these countries generally follow the conventional time-based format, and student debts are substantial for some

¹ In Austria and in the Scandinavian countries, the share of public funding is at least 90% of total expenditures on higher education. In countries where private sources of funding are substantial part of higher education financing, such as in Australia, Chile, Israel, Japan, Korea and the US, families finance about half of the higher education costs, using savings and loans (DIRIS; OOGHE, 2018).

graduates and have become a social problem. In Colombia, students have protested in the streets demanding free HE for all, inspired by the demonstrations against the student loan system which almost brought down the government of Chile in 2012 (SALMI, 2013). The Chilean government elected in 2014 promised that by 2020 free-of-charge HE would be offered in the country (BUCAREY, 2018). In January 2018, the Congress approved legislation guaranteeing the gratuity for students whose family incomes are amongst the lowest 60 per cent in the country. Some authors argue that this policy may deter low-income students if it is not followed up with a large increase in the capacity of Chilean universities (DELISLE; BERNASCONI, 2018, citing empirical evidence reported by BUCAREY, 2018).

Also situated in Latin America, countries such as Argentina, Brazil and Uruguay already have a long history of public systems which are free at the point of use.

In Uruguay, the least populous of the three nations (3.4 million inhabitants in 2016, 152.6 thousand registered in HE in 2015), 86 per cent of HE enrolment is concentrated in the public sector, of which 95 per cent is at a single institution University of the Republic (UdelaR). Uruguay finances its system principally by means of the public budget, complemented by compulsory contributions made by public sector graduates, based on the cost of their degrees (the Solidarity Fund - to learn more about this, see DONESCHI; NOVAS; VELÁZQUEZ, 2014).

Brazil and Argentina, the most populous countries and the largest economies in South America, also possess free-of-charge public HE systems, but with very different characteristics. While Brazil maintains a small, selective system, Argentina offers a system of free access for those who complete secondary education (that is, there is no selective process to filter entry; simply presenting an upper secondary school qualification of any quality is sufficient to enrol in a public HEI). The public university system represents 80 per cent of total enrolment for tertiary degrees in Argentina (BERNASCONI; CELIS, 2017). The non-selective admission system contributes to the high gross enrolment ratio in higher education observed in Argentina (similar to that of developed countries). However, free access has not been sufficient to ensure equity in the results: the Argentinian HE system is also characterised by high drop-out rates and low completion rates (FANELLI; DEANE, 2016). Meanwhile, in Brazil, the public universities are selective and represent just 24 per cent of enrolment for tertiary degrees (according to official data registered in the HE census of 2016). The other 76 per cent of enrolment is at private HEIs, and almost half of the six million enrolments recorded in 2016 in the Brazilian private HE

system were subsidised by governmental grant and student loan schemes, the most relevant being those maintained by the federal government.

1.4 KEY ISSUES IN HIGHER EDUCATION STUDENT FINANCING IN BRAZIL

Brazil is one of the largest democracies in the world and home to 208 million people. The country is a middle-income, mostly urban and Christian country, with a moderately diversified economy that maintains a HE system in which public institutions are elite, selective, and free-of-charge and most undergraduate students are enrolled at private institutions. As will be discussed in Chapter 3, the Brazilian HE system has grown substantially over the last two decades, but the debate over further expansion raises two problems: the need for additional resources for public HEIs, which are currently free of charge, and the need to make student loans sustainable in Brazil (for borrowers and for the government). Exponential growth observed between 2010 and 2014 in the FIES, the government-administered student loan scheme for students enrolled in fee-paying undergraduate programmes, compromised its fiscal sustainability. That happened due to the high default rates (approximately 50 per cent according to reports released by the government in 2017) and the significant subsidies resulting from the discrepancy between the interest rates paid on government bonds and those charged in student loans. Changes to the rules of the scheme, however, must take heed of the payment capacity of the debtors or risk turning a fiscal problem into a social one.

In parallel, lack of resources is a recurring problem reported in the public HE system. This is a more critical issue in periods of severe governmental budget constraints. Such constraints tend to be particularly critical and persistent in Brazil after the approval, at the end of 2016, of a constitutional amendment tying the growth of public spending to the official inflation rate. Without alternative financing sources, the Brazilian public HE system will fail to reach growth targets pursued by national plans. Although enrolments at public HEIs grew by 28 per cent between 2008 and 2016, they would need to grow another 76 per cent by 2024 to achieve official expansion targets established by law in 2014. This is simply not economically viable in the current climate whilst public universities in Brazil remain free-of-charge. The free college issue is thus a key debate in the HE student financing in Brazil.

Therefore, the discussion about ICLs for HE has double relevance in Brazil. On the one hand, it introduces a fair form of cost sharing at public providers, which are currently completely free

for virtually all users² – in other words, entirely financed by public resources. On the other, it reduces the fiscal burden of the FIES while keeping repayments manageable for the debtors of this federal student loan arrangement, which since 1999 has financed the payment of tuition fees in private HEIs. Additional applications (beyond the scope of this thesis discussion) could also consider ICLs to finance student living costs and vocational education, as well as to replace some of the existing non-repayable transfers, grants, subsidies and bailouts in other areas of public policy in Brazil.

1.5 OBJECTIVES OF THE THESIS

The main objective of this thesis is:

- to simulate how a broad ICL system to finance HE studies could work in Brazil and why such a system would be better than an alternative based on conventional time-based repayment loans (TBRLs) in terms of the size of taxpayer subsidies as well as in terms of affordability for borrowers.

Secondary objectives include:

- Discussing the theoretical and practical applications of income-contingent financing instruments;
- Explaining the problems concerning TBRLs;
- Underlining how ICLs overcome problems associated with TBRLs and stand as a superior alternative to remove credit constraints in HE;
- Outlining income-contingent financing as an efficient and equitable tool to tackle two major issues facing HE student financing in Brazil: the need for additional resources for public HEIs, which are currently free of charge, and the need to make student loans sustainable (for borrowers and for the government);
- Pointing out the reasons why in Brazil the full involvement of the federal revenue system (FRS) is a key element for the efficient collection of income-contingent repayments and these should be charged over all sources of assessable income.

² Tuition-fees can be charged by HEIs maintained by municipal levels of government, but these represent a tiny minority of the institutions and enrolments in the Brazilian higher education system.

1.6 OUTLINE OF THE THESIS

This thesis is organised in six chapters, the first of which is this introduction. Chapter 2 presents an extensive literature review on income-contingent financing, also discussing the role of government in student finance and student loans as a policy instrument to remove credit constraints in HE. Chapter 3 discusses HE student financing in Brazil, with emphasis on the free college debate and the ongoing reforms of the large loan scheme for students enrolled in fee-paying undergraduate programmes. Chapter 4 presents the empirical methods for assessing and designing student loan schemes. Chapter 5 simulates alternative student loan schemes for Brazil, discussing the impacts for taxpayers and borrowers of variations in various loan features: interest rates, repayment rates and thresholds, surcharges and cohort risk premiums. Chapter 6 concludes by emphasising Brazil's institutional strengths and weakness in implementing a broad and efficient ICL, and summarises a potential agenda for future research.

2 BACKGROUND ON HIGHER EDUCATION STUDENT FINANCE AND INCOME CONTINGENT LOANS

2.1 INTRODUCTION

Income contingency is a mechanism for collecting repayments, underlying income contingent loans (ICLs), which appear as its loan form, and graduate taxes and human capital contracts as equity finance tools. Payments are defined based on the debtor's earnings or income and are usually collected by the tax or social security systems, following a flexible calendar adaptable to individual income circumstances and lifetime capacity to pay. The greatest appeal of income-contingent instruments is reconciling the transaction efficiencies associated with government monopoly on tax collection with consumption smoothing and insurance for the individual (STIGLITZ, 2016). Although theoretically they can also be implemented to finance other human needs, income contingency is often studied in the economic literature as a form of educational credit policy. This occurs not only because the original idea was in fact to finance investments in human capital, but also because it is in their loan format that these instruments are spread in different parts of the world. ICLs have been particularly successful in countries that have introduced cost-sharing in public HE and have advanced tax and social security systems (CHAPMAN, 2014).

This chapter aims to present an ample literature review on income-contingent financing. It focuses on the role of government in student finance and discusses student loans as a policy instrument to remove credit constraints that may deter skilled prospective students from pursuing a tertiary degree.

2.2 THE ROLE OF GOVERNMENT IN STUDENT FINANCE

Whether educational services should be free of charge or not is a political decision. Economic reasoning does not provide a conceptual or empirical basis for resolving this issue, although arguments can be found justifying either way. Capital market failures, uncertainty about future labour outcomes, equality of access goals, information asymmetries, and the potential presence of positive externalities and spillovers are the usual key theoretical arguments for an active government role in the provision and finance of postsecondary

education. In contrast, public budget constraints, high average private rates of return, and the regressive nature of HE emphasises the need for increasing the participation of beneficiaries in the sharing of cost. These opposite points of view result in very different financing arrangements for HE across the world. Some systems are 100 per cent funded by the taxpayer, whereas most of them charge either upfront or deferred fees, generally to all but in many cases only to some of the students.

Student loans are of special relevance when tuition fees apply because these can be a financial barrier for some potential students to enrol and complete postsecondary programmes. But even when no tuition fees apply, student loans tend to be important, because there are also indirect costs involved in the decision to study. The opportunity costs can progressively restrain the time available for academic activities up to such an extent that it may cause some to drop out, making the system more expensive and often frustrating for those who drop out. The consequence is a waste of the talent and the time of those who end up dropping out, as well as of those who, despite their skills, cannot afford to enrol in a postsecondary programme at all. Financial constraints may thus arise even when no direct costs are imposed on students and may imply social costs and – when the costs of dropouts are borne by the taxpayer – fiscal costs.

2.2.1 Should postsecondary studies be subsidised?

The economic case for public subsidies for postsecondary education rests mainly on the assumption that private markets fail to provide socially optimal levels of student funding. Facing rationed and expensive credit in private markets, many people would be unable to develop their full potential, because they would be financially constrained from investing in their postsecondary schooling, unless governmental support were available.

The social loss tends to be even higher than solely the barrier of access imposed by credit constraints, if the assumption that education generates positive externalities, and spawns economic and non-economic spillovers for society, is also valid. Although Friedman (1955) argues that only general education generates significant spillovers and that postsecondary education may require government funding only to remove financial constraints under imperfect credit markets, the literature usually presupposes that all levels of education engender

positive externalities and spillovers³. Removing financial constraints is even more relevant in a country such as Brazil, where relatively few adults hold a HE degree: according to the OECD (2017), only 15 per cent of Brazilians from 25 to 64 years old have completed a tertiary degree, whereas the average for OECD countries is 37 per cent.

Notwithstanding, some authors have questioned the relevance of short run credit constraints for college attendance. Findings obtained for the US from the National Longitudinal Survey of Youth 1979 (NLSY79) and reported by Keane and Wolpin (2001), Carneiro and Heckman (2002) and Cameron and Taber (2004) do not corroborate the hypothesis that credit constraints have significantly deterred segments of the population from pursuing a tertiary degree. Carneiro and Heckman (2002), for example, estimate that no more than 8 per cent of the US population does not attend tertiary education due to short-term credit constraints. Their research suggests that long run family effects are quantitatively much more important than tuition policy or supplements to family income in the adolescent years of prospective college students.

Belley and Lochner (2007), Bailey and Dynarski (2011), and Lochner and Monge-Naranjo (2012) claim that a later cohort (the NLSY97) delivers robust evidence that credit constraint does substantially affect participation in HE in the US, especially among less able students from lower socioeconomic backgrounds. Heckman and Mosso (2014) interpret findings based on the NLSY97 cohort as a consequence of increasing income inequality, as observed in the US between 1979 and 1997. In their interpretation, what Belley and Lochner (2007), Bailey and Dynarski (2011), and Lochner and Monge-Naranjo (2012) claim as stronger evidence of credit constraints is more likely to be reflecting the effect of changes in the composition of college students during those years. A disproportionate share of the increase in family income would have driven affluent families towards higher consumption of college education, sending even their less able offspring to college.

For the wealthiest families, on one side, education would thus be also a commodity. For the poorest families, on the other side, education would rather represent an investment in human capital. Therefore, keeping their offspring studying is, for many families, a justifiable decision only if there is a good level of expectations that this decision will significantly increase the future opportunities of the child by enabling them to earn higher salaries and have a better

³ See Chapman and Lounkaew (2015b) for an attempt to provide evidence on externalities associated with higher education.

standard of living. As age increases and expectations for future returns from education fall, more and more people will tend to decline the opportunity to study and, as a matter of survival, to increase the time they spend on activities that provide some immediate financial relief to their families.

It follows from this reasoning that, under adverse conditions, many families tend to choose which children will study more and which will study less – pressuring the less skilled to enter the labour force as soon as possible, as the increasing opportunity costs involved are faced with an uncertain, and perhaps low, future return. By doing so, these families are not making a "wrong" or "cruel" decision. Rather, they are choosing the alternative that imposes less burden and sacrifice on them and their families, within the range of alternative options available to them, and in view of the prospects they can foresee with the information set they have access to and given the past experiences they recall concerning themselves and those surrounding them.

The issue is not just capacity to pay for studies. It is inferable from the arguments of Heckman and Mosso (2014) that, if the prospects of return do not compensate, those in the lower socioeconomic strata will be underrepresented in tertiary education even if there are vacancies and even if these are free or financed by abundantly available and heavily subsidised student loan schemes.

Heckman and Mosso (2014) observe that, despite disagreements about the importance of credit for access to and completion of postsecondary education, there is a fair consensus in the economic literature that ability and skills are the first-order determinants not only of the level of schooling, but also of returns from education. They also highlight that these characteristics are resultant from a process that begins in the early stages of life. This interpretation is in line with the view repeatedly reinforced in the work of James Heckman with several of his co-authors: the preponderant reasons for educational exclusion are the economic, social and cultural constraints that, throughout individuals' lives, extend cognitive and non-cognitive differences and enlarge the gap in scholastic and professional attainments.

Heckman's view implies that government efforts should be concentrated on early childhood (a relative point of agreement in mainstream contemporaneous economic literature), but it does not necessarily imply that postsecondary education should not receive government attention. Even if affecting small proportions of the population, public policy designed to remove credit

constraints in postsecondary education finance is justifiable in equity terms, as it favours low-income students the most. Beyond that, mainstream economics often attribute to postsecondary schooling (particularly tertiary education) either a skill-acquisition role or a signalling role (WEISS, 1995). The skill-acquisition role is important to enhance productivity and therefore shapes a tertiary degree as an asset worthy of investment from both society and individuals. The signalling role implies that a tertiary degree would be simply measuring performance ability (not improving skills), reinforcing the equity argument, as public subsidies would emerge in this context to avoid excluding talented credit-constrained pupils who would not be able to signal themselves in the absence of student aid initiatives.

Other conceptual frameworks seek to assess education under more comprehensive and multidimensional approaches (see, for example, ROBEYNS, 2006; SPRING, 2000; WALKER; UNTERHALTER, 2007). In search of overcoming the economist and instrumentalist bias permeating interpretations such as those of Heckman and Mosso (2014) and dominating approaches based solely on human capital theory, such as those of Friedman (1955), Schultz (1961), Becker (1964) and Arrow (1973), these frameworks often justify government funding for postsecondary schooling either as a policy that guarantees a right or as a means of empowerment. If there are segments of the population for whom credit constraints are a barrier to accessing post-secondary education, the government should provide the means so that no one is left aside for financial reasons, even if in the aggregate this issue does not appear as a first order problem. This line of interpretation coincides not only with the notion of education as a right, but also with Amartya Sen's approach to the development of human capacities as instrumental freedom and as a means of empowering people and the communities to which they belong (SEN, 2000).

In any case, the empirical evidence reported in Belley and Lochner (2007), Bailey and Dynarski (2011), and Lochner and Monge-Naranjo (2012) is backed by a growing body of new evidence based on longitudinal data, such as Caucutt and Lochner (2012), Johnson (2013) and Abbott and others (in press) to the US, and Blundell and others (2016) to the UK. Hai and Heckman (2017) maintain that short-run credit constraints are not so relevant for college access, but they acknowledge that long run constraints are important. Indeed, Hai and Heckman (2017) remark that credit constraints affect human capital accumulation and inequality only if these constraints persist over the individual's life cycle. In their own dynamic model, they find

substantial evidence of long-run credit constraints when following the NLSY97 cohort from 1997 to 2013.

In sum, public subsidies towards postsecondary schooling are justifiable if one or more of the following hypotheses are assumed:

- (i) private markets fail to provide socially optimal levels of student funding, leading to financial and borrowing constraints that deter some segments of the population to enrol in and complete postsecondary studies;
- (ii) positive externalities as well as economic and non-economic spillovers are likely to take place;
- (iii) postsecondary education fosters human development and freedom, as it empowers individuals and their communities;
- (iv) all levels of education are human or individual rights.

The more a society agrees with at least some of these four conjectures, the higher the cost share that will be borne by the taxpayer.

2.2.2 Why share with those who study the costs of their education?

Justifying the need for public spending in postsecondary education does not necessarily mean relying exclusively on government budgets to bear the costs. Even when assuming the existence of spillovers and credit constraints in this market or taking universal access as a societal goal, worldwide evidence on the high financial returns from HE studies provides strong support for cost sharing, at least for the most popular postsecondary study route: tertiary degrees. Psacharopoulos and Patrinos (2004) report evidence on private returns from HE in a wide range of countries. Specific studies with Brazilian data suggest that average returns are particularly high in Brazil, around 25 per cent (BARBOSA FILHO; VELOSO, 2015; CARNOY *et al.*, 2013). As another piece of evidence, the OECD annually releases data on the wage premiums for HE and Brazil has routinely been at the top of the list (see indicators from Education at a Glance). Cost sharing is also justifiable by equity arguments: “free” HE is something of a neologism for a 100 per cent tax-funded, under-resourced HE system – and a regressive way to redistribute wealth. University fees help to reduce the burden on taxpayers, who are distributed across all strata of the socioeconomic pyramid, and many of whom do not even have a college degree, while increasing the cost-share of HEI graduates, direct

beneficiaries of training that usually leads to high returns. Finally, fiscal austerity constraints reinforce the need to balance affordability for students with taxpayer subsidies (BARR, 2014).

In view of these arguments, costs of HE are increasingly conceived as a joint responsibility of both direct beneficiaries (students) and taxpayers⁴ (BARR, 2001b; CHAPMAN, 2006b; JOHNSTONE, 2004). However, direct beneficiaries should bear their cost share when it becomes affordable to them – as graduates, not as students (BETANCUR-MEJÍA, 1992). Given that future earnings of graduates are the only large-scale equitable source of private finance (BARR, 2014), student loans play an essential role in HE student financing. However, they tend to be rationed if their provision is left to be determined solely by market forces. There are two main reasons for that. First, uncertainties and risk concerning future economic returns from HE may lead to suboptimal borrowing amongst some segments of the population. Second, transaction inefficiencies related to adverse selection and moral hazard, as well as the lack of collateral, may lead to suboptimal lending. These capital market failures justify public policy interventions focused on making deferred payments viable for credit-constrained students (CHAPMAN, 2014).

2.3 STUDENT LOANS AS A POLICY INSTRUMENT TO ENSURE ACCESS FOR THE FINANCIALLY-CONSTRAINED

Student loans were first discussed as a public policy in the work of Betancur-Mejía (1944). Although initially raised as a way to fairly introduce or enlarge cost sharing in HE, government-sponsored student loans can target a myriad of different objectives, summarised by Ziderman (2013) in three categories: cost sharing, social target and student independence. Thus, student loans present features of cost sharing and/or social target policy when tuition fees apply, focusing on student independence and again on social targets when tuition fees do not apply.

Regardless of the political motivation underlying student loan policies, and so long as it supplements rather than supplants HE revenues from taxpayers, additional revenue from borrowing gives students the opportunity to invest in their own schooling, supposedly at lower costs to taxpayers than outright grants. It also provides institutions with revenue that otherwise would not be forthcoming from governments. These features have the potential to enhance institutional quality and capacity of provision as well as to improve educational choices, access

⁴ Johnstone (2004) also mentions parents and individual or institutional donors as additional parties bearing the costs of higher education.

and living standards for students⁵. On condition that the government achieves relative success in recovering loan disbursements, that is a good policy also under the taxpayer's point of view, as it potentially reduces pressure on additional resourcing from public budgets (JOHNSTONE, 2016; JOHNSTONE; MARCUCCI, 2010).

2.3.1 The types of government-administered student loan schemes

Most student loan schemes currently in operation in the world are fraught with sizeable built-in government subsidies (SHEN; ZIDERMAN, 2009), usually taking the forms of interest-rate subsidies and the guarantee to cover the costs of non-repayment (CHAPMAN; LOUNKAEW, 2016). Two are the generic types of these arrangements: time-based and income-contingent loans.

2.3.1.1 The conventional time-based repayment loans (TBRLs)

In many countries, subsidised student loans are designed to follow a fixed-schedule loan calendar. This loan type will be referred hereafter as *time-based repayment loans (TBRLs)*. Such loans are usually contracted with banks (in some cases, government-owned banks, like in Brazil), either for tuition or for income support – or for both. In the absence of collateral, the student may be required to present other individuals willing to sign the contract as guarantors, who must be able to prove sufficient income to pay future instalments in case the student fails to do so. If default takes place anyway, the government guarantees repayment. Public sector support frequently also takes the form of waiving interest on the debt before a student graduates, and often waiving part of the interest on the repayment period, too.

Such a scheme removes the bank's need for collateral and addresses the default problem for lenders – tackling the market failure that leads to suboptimal lending. Notwithstanding, it presents at least two sets of disadvantages. First, if it is indeed a government-administered loan (as student loans often are), the TBRL fully transfers costs of unpaid debts to the taxpayer. Second, graduates are required to pay on the basis of time rather than ability to pay. Therefore, they still face the risks and consequences of default⁶, and the market failure that leads to

⁵ Murphy, Scott-Clayton and Wyness (2017) present evidence suggesting this has been indeed the case for England over the years.

⁶ In many countries, unpaid student debts may significantly jeopardise the person's credit rating.

suboptimal borrowing may not be appropriately fixed. These drawbacks are in theory better addressed by income contingent loans (ICLs).

2.3.1.2 The innovation introduced by income-contingent loans

As an alternative for TBRLs, ICLs offer an arrangement allowing consumption smoothing for the beneficiaries, while strengthening enforcement for repayment and potentially increasing long run loan disbursement recovery. In theoretical terms, the rationale is to make the most of the transactional efficiencies involved in the government monopoly on taxing personal income to implement wide loan systems based on income-contingent repayments to finance a variety of individuals' needs. Tuition fees and students' daily costs have been the two primary needs for which ICL systems have been in operation in a growing number of countries in the last three decades.

The main differences between an ICL and a TBRL are in the calculation and collection of instalments. In a well-designed ICL scheme, they occur through either one of the mechanisms by which the government collects income taxes or social security contributions, preferentially using employer withholding and tax return systems, whereby debts are repaid according to recipients' contemporaneous earnings or income. Forgiveness rules are not necessarily a key feature, but they may apply after n years, or at retirement or death. Ideally, repayment thresholds, repayment rates, surcharges and interest rates should be chosen in such a way that there is some cross-subsidy from high earners towards low earners, large cliff edges or wedges are avoided, and implicit subsidies are concentrated on people with low lifetime income (loss on other borrowers should be minimal). These characteristics outline a more equitable and efficient student funding scheme (BARR *et al.*, 2017).

2.3.2 Government subsidies in student loans

Subsidies in government-administered student loan schemes are usually justified by the presumed gap between social and private benefits entailed by HE. This ignores that the higher the expected private returns, the higher the willingness to pursue a tertiary degree. Assuming wealthy prospective students (and their families) form higher expectations on returns from schooling, subsidised loans therefore disproportionately increase the incentives for the wealthiest prospective students to enrol in tertiary degrees. This is so because they foresee a double benefit:

- i) the prospect of good salaries in the future;
- ii) the opportunity in the present to invest their own (or their families') financial resources on a profitable alternative while borrowing cheaper money or relying on public funds to pay for the degree they would have chosen to fund privately anyway in the absence of public funding or cheap credit.

Designing indiscriminate subsidies in government-administered student loan schemes may thus result in undesired crowding-out effects.⁷ Moreover, public subsidies to poorly-designed student loans do not necessarily reach the student. Loan availability is likely to expand the demand for tertiary degrees. However, students may also regard subsidised loans as an alternative to offset price increases. In this case, educational providers, by setting higher tuition fees, will appropriate most of the subsidy. The literature refers to this possibility as the *Bennet Hypothesis* – named after Willian Bennet, who highlighted this risk when acting in the US as President Ronald Reagan's Secretary of Education, during the 1980s. Some studies report evidence that the Bennet Hypothesis does currently apply in the US.⁸ Mello and Duarte (2016) found evidence of the Bennet Hypothesis in Brazil after the significant changes in the federal student loan system in 2010.

High price low quality HE provision is a potential undesirable output of the student loan policy if the incentives of the HE providers are not reasonable aligned with the policy objectives. Sharing the costs of non-repayment with HEIs is necessary to avoid the effects of the Bennet Hypothesis. In Brazil, participating HEIs are required to contribute towards a fund that covers part of the costs of non-repayment. In the US, graduates' loan payment-to-earnings ratios were established in 2014 as an eligibility requirement for for-profit colleges to access federal student aid (CELLINI; DAROLIA; TURNER, 2016). Sharing the risks of non-repayment with the HEIs is a desirable feature, to avoid over-servicing and the exploitation of information asymmetries (providers know the quality of the service much better than the student, who will not be able to assess it until experiencing it).

Besides institutional risk sharing, charging loan surcharges or interest rates above the government's cost of borrowing would introduce cost sharing in the losses from low-

⁷. See Gale (1991) for crowding out effects in federal credit schemes. Specifically for an analysis of federal student loans crowding out the private market, see Bhole (2017), whose model suggests that income-based repayment schemes allow government-administered loans to charge higher interest rates, as if insuring borrowers against low future wages.

⁸. See, for example, Goldin and Cellini (2014), and Lucca, Nadauld and Shen (2015).

income borrowers, with a desirable cap on maximum overpayment. Substantial risk premia or surcharges should also be avoided because they increase the prospect of adverse selection and may create political problems (BARR *et al.*, 2017).

Requiring institutions and the cohorts of borrowers to bear part of the risks of non-repayment is important, but it does not eliminate public subsidies. These vary significantly from scheme to scheme. A critical policy issue is how to best balance the size of implicit subsidies and repayment burdens (RBs).

2.3.3 The trade-off between implicit subsidies and repayment burdens in government-administered student loan schemes

Implicit subsidies are the difference between original loan size and actual required repayment. Shen and Ziderman (2009) call them *hidden grants*, because they are the proportion of a loan that will never be recovered (in present value terms) even if the borrower pays all the instalments on time. These subsidies relate to concessional interest rates and/or written-off conditions and can be formally defined as (adapted from CHAPMAN; LOUNKAEW, 2016):

$$s(\gamma, r, t) = 1 - \frac{\sum_{t=1}^T \left(\frac{1}{1+\gamma}\right)^t R_t(r, L, T)}{\sum_{t=1}^T \left(\frac{1}{1+\gamma}\right)^t l_t} \quad (1)$$

Consequently, the amount of the implicit subsidy depends on the following:

- The adopted discount rate, which should be, for government-administered student loan schemes, the government's real cost of borrowing $\gamma \in [0,1]$. That is the inflation-adjusted level of the yields paid by government bonds throughout the loan's utilisation and repayment periods or, in case of projecting loan's disbursements and repayments into the future, the natural rate of interest expected to prevail in the long term.
- The real rate of interest charged on the loan (r).
- The t number of periods that makes the total length of the loan (T).
- The loan disbursed in each period (l_t), the sum of which makes the total amount of borrowings (L).
- The instalments to be paid (R_t), with these being a function of r , L , and T and usually assuming the value of zero for the grace and study periods.

The most critical parameter for the calculation of implicit subsidies is the gap between the

rate of loan interest (r) and the government's cost of borrowing (γ). The total length of the contract (T) is also important, since it affects the amount of interest-rate subsidy (if that is positive) and the amount of unpaid debts (if written-off conditions apply). On the one hand, the higher the subsidy on the interest rate and the longer the length of the loan, the lesser the total loan amount recovered at the end of the repayment period (R_t) and, therefore, the higher the implicit subsidy. On the other, the shorter the length of the loan, the higher the non-repayment subsidy if written-off conditions apply. In other words, if the loan interest rate is equal to the government's cost of borrowing, then T will not affect the interest-rate subsidy, but it will affect non-repayment subsidies. Removing interest subsidies means removing *ex ante* implicit subsidies. If debt forgiveness rules apply, there will be also *ex post* implicit subsidies.

In TBRLs, interest-rate subsidy tends to be the main form of implicit subsidy and may emerge as unavoidable to make this loan type feasible, especially when chasing social targets. High interest rates in TBRLs affect the size of instalments and may induce defaulting as the rational decision of graduates facing repayment hardship, particularly if they cannot rely on external resources (e.g. help from family members) to repay their loans. RBs are thus another key element in the assessment of student loan schemes. They are defined as the proportion of income individuals must allocate to service their student loan debts. This is given by (CHAPMAN, 2014):

$$\text{repayment burden in period } t = \frac{\text{loan repayment in period } t}{\text{income in period } t} \quad (2)$$

RBs are particularly important in the analysis of TBRLs. As highlighted by Chapman and Lounkaew (2016):

RBs are the critical issue associated with mortgage-type student loans because for a given level of income the higher is the proportion of a graduate's income that needs to be allocated to the repayment of a loan the lower will be disposable income. And lower student debtor disposable incomes have the two mortgage-type loan problems: higher default probabilities and repayment hardship (CHAPMAN; LOUNKAEW, 2016, p. 7).

Therefore, the government must manage a trade-off between the size of implicit subsidies and RBs in government-administered TBRLs. This trade-off can be summarised as follows:

- The larger the implicit subsidy the less of the original loan is required to be repaid (in present value terms);

- High levels of implicit subsidy are expensive to the taxpayer but can make the loans affordable to more people (i.e. lower RBs);
- Low levels of implicit subsidies increase the cost share allocated to graduates, but RBs that are too high induce some of them to default;
- Higher default rates reduce loan's recovery ratios, increasing fiscal costs.

These issues are of importance when comparing student loan policies. As the RBs in ICLs are set in advance as a proportion of the borrowers' future income or earnings, these are unaffected by the level of interest rates. Therefore, concessional interest rates are not required to achieve the main purpose of an ICL, namely, contingent repayment to protect against default and financial hardship. Higher interest rates increase duration until repayment, and so increase the potential unpaid debt. Non-repayment becomes a source of implicit subsidy in ICL schemes designed with debt-forgiveness rules, but it benefits only low-income debtors. Consequently, ICL subsidies could be limited to unpaid or written-off debts (by design, there is no default in ICL schemes). These are the reasons why, in theory, ICLs deal with the trade-off between implicit subsidies and RBs better than TBRLs.

2.4 INCOME CONTINGENT LOANS: GENERAL CONCEPTS AND THE INTERNATIONAL EXPERIENCE

ICLs have begun to be consolidated as a student financing alternative as HE costs in developed countries grew larger and after this type of student loans was revealed to be viable and relatively successful in Australia, New Zealand and the United Kingdom, countries where large-scale national ICLs were implemented between 1989 and 1998.

More recently, crises related to growing student debts in countries such as the United States, Chile, and Colombia, as well as the need for reforms in the HE student financing in countries like Ireland, Japan and Brazil, have intensified the debate about this form of educational credit. As Courtioux (2015) describes it:

[ICLs] for students have been implemented in many countries. [Evidence of some national cases] shows that the practical consequences differ depending on the institutional context. In countries where students have to borrow in order to pursue tertiary education, ICL aims at reducing the level of debt: the scheme thus allows for the attenuation of the phenomenon of self-selection of students from low-income backgrounds and reduces career constraints once the degree is obtained. In countries where there is a tuition-free higher education system, the schemes aim to increase the contribution from former students when they enter the labour market, thus preserving a kind of equity (COURTIOUX, 2015, p. 191).

In addition to their applications for students, ICLs have been theoretically discussed to finance many other human needs (not yet tested in the real world), from unemployment insurance and parental leave to residential photovoltaic panels. This type of loan is seen by Stiglitz (2016) as an important social innovation in response to the imperfections that emerge in the capital market due to transaction costs associated with problems of adverse selection and moral hazard.

2.4.1 Theoretical and practical background

Income contingent financing has been discussed theoretically in the economic literature since the 1950s and emerged as a desirable feature in student financing both via arguments mainly associated with the right and via arguments commonly associated with the left of the spectrum of political ideas (BARR, 2014).

Based on the benefit principle, Friedman (1955) argued that high average payoffs could enhance private financing in postsecondary education even without any collateral, so long as society were ready to accept someone temporarily receiving a share of someone else's income in exchange for financing his or her studies. Based on the ability-to-pay principle, Glennerster, Merrett and Wilson (1968) argued for the introduction of taxes to ensure graduate professionals repay taxpayer-funded debts that allowed investments in their postsecondary education. Both propositions relate to equity finance: equity-like schemes for investment in human capital (FRIEDMAN, 1955)⁹ or a graduate tax to share the costs of HE between taxpayers and direct beneficiaries (GLENNERSTER; MERRET; WILSON, 1968). Meanwhile, student aid initiatives started to take place in Latin America based on the same principle of making the future professional pay for the present student (fuelled by the thesis of BETANCUR-MEJÍA, 1944).

2.4.1.1 The graduate tax

Graduate tax dominated the debate in the 1950s and 1960s in the United States and Europe. This format, which has not been implemented in practice in any country, would accompany, for life, former students of tertiary education. Such a tax would potentially affect the decision

⁹ see Friedman (1955), for his original article, and Glennerster, Merrett and Wilson (1968) and Palacios (2007), respectively for proposals of graduate taxes (GT) and human capital contracts (HCC) plus other equity-like instruments (such as human capital options – HCO) to finance human capital acquisition. HCC are also sometimes known as income share agreements (ISA) – see a recent analysis on these as an alternative to ICLs in Holliday and Gide (2016).

to go to college. Moreover, a graduate tax would certainly make some taxpayers pay back much larger sums than the actual costs of their studies. Barr (2014) formulates the expression ‘Mick Jagger’s problem’ to refer to this potential unfair result of the introduction of a graduate tax: if such a tax was effectively collected from Mr Jagger’s income for life, his payments would massively exceed the direct costs of his uncompleted studies at the London School of Economics and Political Science (LSE).

As mentioned previously, introducing a tax was not Friedman’s original idea. Instead, he proposed an equity-like instrument based on income share agreements between students and investors:

Underinvestment in human capital presumably reflects an imperfection in the capital market: investment in human beings cannot be financed on the same terms or with the same ease as investment in physical capital. [A solution] would be to ‘buy’ a share in an individual's earning prospects: to advance him the funds needed to finance his training on condition that he agree to pay the lender a specified fraction of his future earnings (FRIEDMAN, 1955, p. 133).

In any case, at the heart of Friedman's (1955) arguments was that the trained professionals should pay for the investment made in their studies. In this way, credit restrictions would not be an obstacle to pursuing studies after completing basic education. The costs of the studies, however, would be charged to the former students when they began to receive salaries in line with their training.

2.4.1.2 The rise of educational credit in Latin America

While in the United States and Europe the debate centred on theoretical justifications for collecting a percentage of the income of those who had undergraduate studies as a way of recovering the public investment made in their tertiary education, in Latin America the solution flourishing at the time was based on conventional loans. Idealised by Gabriel Betancur Mejía, a Colombian politician and diplomat, the first national agency specialising in educational credit was founded in 1950 in Colombia. The idea of educational credit as a policy that enables today's student to be financed by tomorrow's professional quickly spread across the continent,

and other similar governmental organisations were created in other countries (TÉLLEZ-FUENTES, 2009). At present, subsidised educational credit exists in dozens of countries¹⁰.

Student loans were not a new idea back then. Private student credit agencies had existed in the United States since the 19th Century, with Harvard University establishing the very first one in 1838, developing a new system of student financial aid that quickly spread throughout the nation's institutions, based on zero or low-interest loans (FULLER, 2014). Notwithstanding, the idea of institutionalising student loans as a public policy was first proposed by Betancur-Mejía (1944), and the Colombian agency was the first specialising in educational credit that was of a public nature (BETANCUR-MEJÍA, 1992; DOMÍNGUEZ-UROSA, 1973). Thereafter, government-administered student loan schemes have been adopted by a growing number of countries, with or without specialised agencies to operate them.

None of the initiatives spread around the world in the 1950s and 1960s included income-contingent repayments. However, proposals to introduce government-administered ICLs to finance higher education did exist. ICLs would have been the basis, for example, of the Educational Opportunity Bank, a recommendation from the 1967 US Government Panel on Education Innovation. The Bank would lend money to postsecondary students at the government's cost of borrowing to finance their tuition fees and subsistence costs in exchange to a given percentage of their incomes for a fixed number of years (SHELL *et al.*, 1968). The Carnegie Commission on Higher Education recommended a similar loan plan in December 1968, but both recommendations were discarded in 1969 because the US Government feared that only students with low future earnings would borrow from ICL plans and thus large subsidies would be required (A TAX SHELTER..., 1972). In the US and elsewhere, the focus of government educational credit policies at the time was on TBRLs. Still, it was not long before someone tried to implement an ICL.

2.4.1.3 The pioneer ICL at Yale University

The first ICL scheme was introduced by Yale University in the 1970s, designed by James Tobin, who was to win the Nobel Prize for Economics a few years later (1981) for his analysis of financial markets and their relations to expenditure decisions, employment, production and

¹⁰ See <https://bit.ly/2C9F465> for a list prepared by "The International Comparative Higher Education Project" (<https://bit.ly/2QJV9W5>) with 65 student loan schemes in operation in 46 countries. Shen and Ziderman (2009) compare 44 student loan programmes from 39 countries.

prices. Yale's ICL¹¹ funded the fees charged by the university and allowed for monthly loans to support the students during their studies. A percentage of borrowers' future income was required for the loan's repayment for up to thirty-five years (YALE UNIVERSITY, 1971). At the time the scheme was considered an innovative way to fund HE, but it was discontinued after a few years. This failure is attributed to a number of factors, in particular: (i) the limited ability of the university to charge payments effectively, and to accurately assess the person's income to calculate the due instalments; and (ii) problems of moral hazard and adverse selection, since the cost of default was shared among the borrowers, generating incentives, for example, to omit income, or for the loan to be applied for mainly by those not expecting a high future income or planning to emigrate (FELDMAN, 1976; NERLOVE, 1975).

The Yale experiment is the most well-known and cited of the pioneering ICL experiments, but two other American universities – Harvard and Duke – also implemented ICL schemes for their students roughly at the same time. Introduced at a historic time when the US government was expanding federal student aid schemes – mostly through low-interest TBRLs – none of these three initiatives went much further (PALACIOS, 2007).

2.4.2 Nation-wide government-administered ICLs

The Yale experiment failed. Nonetheless, “one of Tobin's students would later bring the idea to Australia and show that income-contingent lending could work at the national level, so long as the national tax authority was put in charge of collection” (MOSS, 2012, p. 35)¹². Other countries followed a similar route. Successful experiences have been observed in countries that have the necessary institutional conditions to grant student loans, maintain up-to-date records of the outstanding balances, accurately gauge borrowers' income, and effectively collect due payments (CHAPMAN, 2014).

This subsection briefly presents the experiences of Australia, New Zealand, England and Hungary. Besides these countries, national ICL schemes for HE are currently in operation in Ethiopia, Japan and South Korea, and there are income-based educational credit schemes with national scope and reasonably wide application in operation in Chile, the United States, South Africa and the Netherlands. Thailand experienced a single year of implementation of a national

¹¹ Yale's ICL plan was named Tuition Postponement Option (TPO).

¹² The student Moss (2012) refers to was Bruce James Chapman, nowadays a Professor at the Australian National University (ANU) and widely cited across this work.

ICL scheme (CHAPMAN, 2014). The Swedish student aid system used to rely on a mix of ICLs and grants to finance student maintenance (as public universities charge no tuition fees in Sweden), but reforms introduced in 2001 replaced that system by a mix of TBRLs and more generous and accessible grants (JOENSEN; MATTANA, 2017). Previous attempts at implementing ICLs, whose effectiveness has been limited by the low institutional capacity regarding system administration and collection of payments, have also been reported. These initiatives were mainly carried out between 1995 and 2003 in some countries in Asia and Africa (CHAPMAN, 2006a). In Germany, survey experiments reported by Busemeyer, Lergetporer, and Woessmann (2018) suggest that providing information on university graduates' relative earnings changes public preferences from opposing to favouring the introduction of tuition fees in HE. The same experiment also shows that proposing to defer payments and collect them in the future through an income-contingent system increases public support for the introduction of tuition fees. Finally, income-contingent educational credits are on the political agenda in Colombia, Ireland, Malaysia and Brazil, where contemporaneous reforms are expected to move the large federal student loan arrangement for students enrolled in fee-paying undergraduate programmes from a TBRL towards an ICL paradigm (see chapter 3 of this thesis).

2.4.2.1 The Australian ICL: the first national system and reference model

In 1989, the Australian Government designed and implemented the Higher Education Contribution Scheme (HECS), the world's first ICL to be collected through the income tax system (CHAPMAN, 1997). Instead of a system of risk pooling, where, as at Yale, the cost of defaulting is shared among the cohort of borrowers, the Australian ICL shares such risks with the taxpayer, as the government fully covers the cost of unpaid debts. Besides, subsidised interest rates apply, as outstanding debts are adjusted solely by the Consumer Price Index (CPI).

In 2005, HECS was replaced by the Higher Education Loan Programme (HELP). Main features were preserved, but the scheme has grown in scale, expanded in scope, and multiplied in form.

Originally, students could borrow from HECS only to pay for their contributions and tuition fees at public HEIs. Under HELP, this is still the major available credit line, called HECS-HELP, but it is now also possible to borrow to pay for tuition fees at private HEIs (FEE-HELP),

as well as for student services and amenities (SA-HELP) and expenses related to studying abroad and exchange programmes (OS-HELP)¹³. Non-repayment has been rising since HECS became HELP and incorporated these other credit lines. At present, doubtful debts represent the main cost of HELP, and the Australian government estimates that 18 per cent of the loans disbursed between 2016-2017 will not be recovered (AUSTRALIA, 2017). The government has tried to reduce the fiscal cost of non-repayment through propositions such as reducing the initial repayment threshold, but has not been successful in Parliament. Universal loan fees (e.g., NORTON; CHERASTIDTHAM, 2016) and mechanisms to share the risk of non-repayment with the HEIs (e.g., LEAVER, 2015) are some of the propositions coming along this debate in Australia.

Regardless of these drawbacks, over the years the Australian ICL has been relatively cheap and effective in raising new resources for educational institutions: it is estimated that past disbursements provided additional annual revenues for the Australian public HE system at an order of magnitude twenty times greater than that of the scheme's maintenance costs (as it can be inferred from the costs and revenues reported by CHAPMAN, 2006b). It has apparently imposed no additional access constraints for disadvantaged students, although evidence on its effect on access to HE for ethnic minorities and people from low-income families is inconclusive (CHAPMAN; NICHOLS, 2013). It is known, however, that enrolments in Australian public HE have grown by about 50 per cent in the first twelve years of operation of this system, with larger increases in the participation of women and students from families in the middle of the wealth distribution (CHAPMAN, 2011).

2.4.2.2 The ICL in New Zealand: from a text-book application to a highly-subsidised system

Inspired by the Australian experience, the New Zealand government implemented an ICL in 1992 to finance tuition fees and part of the cost of living during studies (CHAPMAN, 2006a). Initially, it charged an interest rate equivalent to the government's cost of borrowing plus a spread to cover administrative costs and half the cost of expected delinquency. Loans covered fees and living costs and income contingent repayments were collected as a payroll deduction.

¹³ There exist also ICLs to finance vocational education in Australia. The modality VET FEE-HELP offered ICLs for vocational education under the HELP system until 2016. In January 2017, it was replaced by a more restrictive scheme, the VET Student Loans Programme. For more details, see Australia (2016) and <https://bit.ly/2jp0Dm0> (accessed on 16 Oct. 2018).

Under such an arrangement, it is estimated that it was possible to recover something around 90 per cent of what was lent. However, the system seems to have been misunderstood and raised strong political opposition. A reform made to the system in 2000 zeroed the nominal interest rate during studies and froze the real rate of interest to be charged upon graduation at a lower level than the country's basic interest rate. From then on, it is estimated that the New Zealand government only recovered 77 per cent of what it lent (BARR, 2014).

2.4.2.3 The English ICL: expanding access and equity while boosting fees

England has maintained an ICL to cover the living expenses of HE students since 1998. As of 2006, it has also started to cover tuition fees. Two decades of income-contingency financing has moved the English HE system from a free college system to one in which tuition fees are among the highest in the world. Evidence suggests that this shift has resulted in increased funding per head, rising enrolments, and a narrowing of the participation gap between advantaged and disadvantaged students (MURPHY; SCOTT-CLAYTON; WYNESS, 2017).

Unlike New Zealand's system, England's ICL started with blanket interest subsidies and tried to evolve as close as possible to a fiscally neutral scheme, with the 2012 reforms introducing a real interest rate above the government's cost of borrowing, together with targeted subsidies for low earners (BARR, 2012). The 2012 reforms expanded the borrowing limits for living costs and multiplied by three the maximum tuition fee public universities are allowed to charge full-time domestic students¹⁴. These limits have been updated periodically since then. For the 2018/19 academic year, the tuition-fee limit was £9,250 and the limit for maintenance loans for living costs varied between £7,324 and £11,354, depending on whether the student lived at or away from home and studied in or outside London¹⁵. These features make the average student loan disbursed by the English government much larger than the average student loans disbursed by the Australian and the New Zealand governments (BRITTON; VAN DER ERVE; HIGGINS, in press). On one hand, impacts in terms of revenue are uncertain: the currently large loans and rates of interest combined with 30-year write-off condition make the student debt purely notional, with most debtors eventually being subsidised. On the other, as highlighted by Murphy, Scott-Clayton and Wyness:

¹⁴ Murphy, Scott-Clayton and Wyness (2017) highlight that the average tuition fee in England became one of the highest in the world since the 2012 reforms.

¹⁵ For details on tuition fees and loan limits in England, see <https://bit.ly/2nWf17a> (accessed on 16 Oct. 2018).

(...) despite the large increase in fees in 2012, the system actually became more progressive in the sense that poorer graduates repay much less in 2012 than they would have had to in 2006 (due to the increase in repayment threshold), and because higher earning graduates pay much more than lower earning graduates (MURPHY; SCOTT-CLAYTON; WYNESS, 2017, p. 16)

2.4.2.4 The Hungarian ICL: a risk-pooling approach

Introduced in 2001, the Hungarian model is the nation-wide ICL currently in operation with the closest characteristics to a risk-pooling scheme, that is, costs of non-repayment are borne by the cohort of borrowers (BARR, 2014; BERLINGER, 2009; RACIONERO, 2014). According to the reported, the system is self-financing, with non-repayment and administrative costs completely falling on the beneficiaries themselves. A state-owned entity was created to operate the loans. The issuance of government bonds financed the initial resources of the programme, but additional credit lines have since been raised from external agencies¹⁶. Loans cover part of students' living costs. Borrowers must repay six per cent of the national minimum wage or own gross income, whichever is higher, to the loan company. Instalments are calculated based on the graduate income information (provided by the tax authorities) from two years earlier. Institutional constraints make it impossible to collect repayments automatically based on contemporaneous incomes.

It is worth noting that the Hungarian system only partially insures the debtors, because minimal repayments (six per cent of the national minimum wage) are required even if the person does not earn any income. Barr (2014) highlights that cumulative repayments by past borrowers were enough to cover loan disbursements to the 2011 cohort of new borrowers. It is estimated that costs related to non-repayment remain historically between 1 per cent and 2 per cent. The system is not cheap, though: it costs 0.82 per cent of Gross Domestic Product – GDP (BERLINGER, 2009, for more details on the Hungarian system).

The ICL systems in Australia, New Zealand, England and Hungary have in common the fact that they are all universal, that is, no student fails to obtain a loan. They have also notable differences in terms of coverage, conditions of repayments and effectiveness in insuring borrowers and ensuring greater transactional efficiencies. Table 1 summarises these differences.

¹⁶ The official website of the European Investment Bank (EIB) reports that the Bank financed almost half of all student loan disbursements in Hungary. It totalised 500 hundred million euros, in four loan agreements established between 2005 and 2014. See <https://bit.ly/2IZ4Nhc> (accessed on 16 Oct. 2018).

Table 1: Summary of the main differences between the universal ICL systems in operation in Australia, New Zealand, England and Hungary.

COUNTRY	DOES IT COVER TUITION FEES?	DOES IT COVER LIVING EXPENSES?	HOW ARE THE REPAYMENTS MADE?	WHAT IS THE ANNUAL INTEREST RATE?	IS THERE AN INSURANCE MECHANISM?	ARE THERE GREATER TRANSACTIONAL EFFICIENCIES?
Australia	Yes	No	4-8% of total income is withheld if assessable annual income exceeds initial threshold (upper thresholds apply).	Inflation	Yes. No minimal repayment is required, and outstanding debt is written off upon death.	Yes
New Zealand	Yes	Yes	12% of marginal income is withheld if assessable annual income exceeds initial threshold.	0%*	Yes. No minimal repayment is required, and outstanding debt is written off upon death.	Yes
England	Yes	Yes	9% of marginal income is withheld if assessable annual income exceeds initial threshold.	Inflation + 0-3%	Yes. No minimal repayment is required, and outstanding debt is written off after 30 years.	Yes
Hungary	No	Yes	Debtors must repay 6% of the national minimum wage or own gross income , whichever is higher.	Treasury bond rate + ~3%**	Partially. Debtors must repay 6% of the minimum wage if their assessable incomes are below that level.	Marginally. Payments based on income assessed 2 years earlier; collection is not automatic.

Sources: Author's own elaboration. Information on Australia, England and New Zealand as reported by Britton, Van der Erve and Higgins (in press). Information on Hungary as reported by Berlinger (2009).

* Student loans are interest-free for New-Zealand-based borrowers. Overseas-based borrowers must pay interest rates (4.3% p.a., for the tax year started on 1 April 2018). See details on <https://bit.ly/2oz6R4Y> (accessed on 16 Oct. 2018).

** "The interest rate of the loan equals the financing cost (slightly above the Treasury Bond rate) plus a risk premium (of 2 per cent) and administration costs (1 per cent)" (BERLINGER, 2009, p. 258).

2.5 RECENT DEVELOPMENTS IN INCOME-CONTINGENT FINANCING

Two recent developments in income-contingency financing are discussed in this section: human capital contracts and options and ICLs with surcharges in a graduate-tax fashion, but with a cap on maximum overpayment. Neither of these two are new concepts. As already seen, human capital contracts are the basis of the policy recommendations for HE student financing in Friedman (1955). The second recent development presented here is an arrangement strongly related to the hybrid instruments theoretically discussed in Barr (2014). In practical terms,

however, human capital contracts are a relative novelty. In turn, the hybrid arrangement discussed in this section is not in operation anywhere yet but was proposed during the campaign for the 2016 presidential elections in the US and is worth discussion.

2.5.1 Human capital contracts and options

As an alternative to ICLs and graduate taxes, Palacios (2007) revisits Milton Friedman's work to develop specific versions of instruments commonly used in the financial markets. The main instrument proposed by him would consist of contracts between private individuals in which students destine a percentage of their future income to someone else (e.g., a bank, a firm or even another person), for a term established in the agreement, in exchange for the financing of their studies. Palacios (2007) refers to this equity-like instrument as *human capital contracts*.

More recently (see, for example, HOLLIDAY; GIDE, 2016), human capital contracts are also referred to as income share agreements, a term that gives a more general character to the financial instrument imagined by Friedman (1955) and theoretically detailed by Palacios (2007). The latter author also proposes the operation of human capital options, a tool analogous to the instrument commonly used in financial markets to give the holder the right to buy a certain asset for a previously agreed amount, obliging the issuer of the option to complete the transaction in accordance with the agreement. It would function as a kind of insurance policy against economic contingencies during the period in which the instalments of the student loan are due.

To our knowledge, human capital contracts are currently in operation in Chile, China, Colombia, Mexico and the United States. Lozano-Rojas evaluates the potential of human capital contracts to finance HE studies in Colombia (LOZANO-ROJAS, 2009) and Chile (LOZANO-ROJAS, 2012). Kroencke, Muehler and Sprietsma (2013) analyse the expected return and risk of hypothetical human capital contracts for Germany. This instrument is an alternative to traditional financial assets with promising prospects to help complementing limited public funding for postsecondary education.

2.5.2 Hybrid arrangements: ICLs with surcharges in a graduate-tax fashion

Interest rates are a sensitive issue across the world in the debate about student loan schemes. Loan surcharges may thus become more feasible alternatives to manage political

opposition to charging interest rates at the government's cost of borrowing or greater. Surcharges can be introduced in different ways. Loan fees are the most straightforward form of surcharges: a proportion of the loan amount is added to the borrower's outstanding balance.

Alternatively, surcharges could be introduced in a graduate-tax fashion. In this case, graduates are charged a proportion of their incomes for n years or up to reaching cumulative payments equivalent to x times the original borrowed amount. In such arrangements, graduates with a low income throughout the n years do not repay in full, whereas high earners pay more than the original borrowed amount, with a cap on maximum overpayment. The proposed student loan scheme would also have an implicit incentive for price control by the borrowers: for each l amount borrowed while studying, a p proportion of the graduate's income would be allocated for servicing their student debt. This alternative was proposed during a presidential campaign in 2016 (CHINGOS, 2016), has not been implemented anywhere yet, and is less transparent than a pure ICL scheme applying a cohort risk premium or a simple loan surcharge; however, it may prove to be a politically more palatable way of introducing cross-subsidy into HE student financing in the future.

In summary, there are three major categories of income-contingent financing: graduate taxes (GT), income contingent loans (ICLs) and human capital contracts (HCCs). The main differences between them are listed in Table 2. Hybrid arrangements and variations of these three instruments may have characteristics of two or even the three of them. The fundamental characteristics common to all three can be summarised in the insurance feature for debtors and the transaction efficiency.

Table 2: Income-contingent financing: the main differences between graduate taxes (GT), income contingent loans (ICLs) and human capital contracts (HCC).

Graduate tax (GT)	Income contingent loans (ICL)	Human capital contracts (HCC)
A Pigouvian tax designed to ensure wealthier households do not contribute less than poorer households and households with brighter children contribute more than those with less bright children	A loan repaid based on the ability-to-pay principle of taxation (“you pay when you can, if you can”)	Equity-like financial instruments
A person pays x proportion of his or her income for life or for n years	A person pays x proportion of his or her income until debt is quitted	The closest arrangement to Milton Friedman’s original idea
No billing ceiling (by time or by amount of payment) can give rise to the “Mick Jagger problem”	Forgiveness may apply after n years or upon retirement or death	A person or organisation invests in someone else’s education and receives a share of his or her income during a period of n years in the future

Source: author’s own elaboration.

2.6 AGENCY COSTS AND NON-REPAYMENT IN INCOME-CONTINGENT FINANCING

A major advantage of income-contingent repayments is insuring the debtor against income shocks and low lifetime returns. Two concerns immediately arise, however:

- (i) to what extent may moral hazard and adverse selection become a problem?
- (ii) who should bear the costs of non-repayment?

In any kind of insurance, asymmetry of information is a source of potential agency problems. Information tend to be asymmetric when an insurance contract is at stake, as the insured parties are better informed than the insuring party about their ability and willingness to make efforts towards desirable outcomes as well as about their propensity for taking risks. In such a context, two well-known problems may arise:

- moral hazard, that is, the increase in the likelihood of the insured-against event happen as the insuree has less incentives to avoid the risky outcome and the insurer lacks the ability to observe the efforts of the insuree to avoid such risks; and
- adverse selection, that is, the situation in which the insurer, unable to observe the risk type of the insurees, ends up with an insuree portfolio predominantly composed of risky individuals.

Adverse selection in ICLs for HE could occur if the scheme design favours the participation of individuals who foresee one or more of these conditions for themselves in the future (i) low

lifetime earnings; (ii) low participation in the labour force; (iii) permanence in the informal economy for long periods; (iv) plans to emigrate or spend long periods abroad. Racionero (2014) highlights that self-financing or risk-pooling ICLs, in which surcharges and cohort risk premiums are introduced in sufficient levels to make high earners finance low earners, increase the prospects of adverse selection, as it became evident with the failure of Yale's TPO scheme in the 1970s (see section 2.4.1.3). However, the degree to which risk-pooling schemes induce adverse selection relates to the availability of attractive funding alternatives. Nation-wide ICL schemes that are sufficiently universal and/or compulsory reduce the prospects of adverse selection and may, as argued by Barr and others (2017), parsimoniously involve surcharges and cohort risk premiums to help financing non-repayment.

Moral hazard issues may arise in the short run in the form of behavioural tax reporting effects (BARR *et al.*, 2017), a distortion related, for example, to a bunching of earnings just below repayment thresholds¹⁷, to tax evasion or to tax avoidance practices¹⁸. Moral hazard may arise in the long run as potential distortions to labour supply if repayment rates are too high, as the labour supply is affected by the marginal tax rate. Palacios (2014, p. 207) argue that this moral hazard issue is minimised in short-run arrangements because “the trade-off between leisure and work at the beginning of a graduate's career should consider the impact of today's work on the lifelong value of future earnings”.

Scheme design is critical in mitigating adverse selection and moral hazard problems (HIGGINS, 2010). Another concern is how the scheme design allocates the cost of non-repayment. While in risk-pooling ICLs this cost is borne by the cohort of borrowers, in risk-sharing ICLs it is financed by contributions from general taxes. Most ICLs currently in operation are totally or predominantly risk-sharing schemes. The exception is the Hungarian system (see section 2.4.2.4 and BERLINGER, 2009). Del Rey and Racionero (2010) show that, when risk aversion is sufficiently large, risk-pooling ICLs can induce the optimal level of participation in HE if individuals are fully insured (i.e., both financial costs of education and forgone earnings are covered). Risk-sharing ICLs, however, lead to greater likelihood of participation (GARCIA-PENALOSA; WÄLDE, 2000), implying that, in the event of positive

¹⁷ Evidence from Australia suggests that bunching tends to be a small and is a short-run problem in well-designed ICL systems (CHAPMAN; LEIGH, 2009).

¹⁸ The term tax evasion refers to illegal practices, in special: (a) not reporting income; (b) reporting expenses not legally allowed, in order to fraudulently obtain tax deductions and credits; (c) not paying tax owed. Tax avoidance refers to legitimate practices to minimise tax.

externalities, risk-sharing ICLs might be preferred (HIGGINS, 2010). For the borrowers' point of view, a great attraction of ICLs is precisely its insurance feature, which implies that non-repayment is a built-in subsidy and, unlike default in TBRLs, leads to no penalties. Barr and others (2017) list as a characteristic of a well-designed ICL system that repayment rates and thresholds are chosen in such a way that at least part of the costs of non-repayment are borne by the high earners, but with a cap on maximum overpayment (in present value terms) to avoid not only adverse selection and moral hazard but also the so-called Mick Jagger problem (see section 2.4.1.1).

2.7 BEYOND HIGHER EDUCATION: SUMMING UP THE POTENTIAL OF CONTINGENT FINANCING AS A POLICY TOOL

ICL extensions to a wide range of other areas are on academic and political agendas. In a recent book discussing contemporary issues in Microeconomics, an entire section of chapters is about this loan type (STIGLITZ; GUZMAN, 2016). Theory and practice concerning ICL is extensively discussed in another recent book, edited by Chapman, Higgins and Stiglitz (2014). In that book, Withers (2014) sees theoretical foundations for income-contingent financing in the theory of rational individual choice and in the analysis of market failures. But he also argues that new directions are “especially promising in positive political economy analyses of the role of voters, politicians, bureaucrats and interest groups, in normative political economy relating to social welfare function optimisation and in ‘grand theory’ relating to the fiscal crisis of the state” (*idem*, p. 241). He defines ICLs as a “close substitute policy instrument for general revenue taxation” (*idem*, p. 246).

Beyond applications to educational contexts, it is worth recalling that financing systems involving the tax or social security system in collecting income contingent repayments would reduce transaction costs in private financial markets – the spread between financing costs and what creditors receive in return of loans. Consequently, they would cheapen and expand credit. Without minimal regulation, however, there would be people borrowing more than they could repay, which would increase the taxpayer subsidy. The initial profusion of the most varied financial products would possibly be followed by a rearrangement of the markets. After all, efficient ICL systems increase the guarantees for borrowers, but they do not make it possible to borrow *ad infinitum*.

Even if ICLs were the most widespread credit tool, incomplete and asymmetric information would still be a feature of credit markets, with or without efficient regulation. Private lenders would continue to be encouraged to seek “winning tickets”, lending to people with a low-risk profile and high willingness to borrow under overdue interest rates. Stiglitz (2016) argues that because private lenders are driven by profit, they strive to maximise transaction costs, which are a source of profits for them. Therefore, they resort to discriminatory practices in the credit analysis phase and make the entire lending process more complex. This would not change substantially with the adoption of ICL systems. Considering the insurance nature inherent to income contingent financing, moral hazard and adverse selection problems could even increase the spread of some ICLs, for example in situations in which future earnings do not depend on current efforts, or when the expected work life of the individual is relatively short (PALACIOS, 2014; RACIONERO, 2014). For this reason, Stiglitz (2016) sees greater advantages in ICLs as a tool of public policy than as a financial instrument *per se*.

Stiglitz (2016) outlines four central arguments supporting the potential of ICLs as a funding tool when provided by governments. First, the economies of scope provided by the simultaneous collection of income-contingent taxes and payments, which would reduce the costs of enforcing contractual obligations and increase contract effectiveness, while allowing greater control over the total level of indebtedness of each citizen. The second is the presence of significant (pecuniary) externalities, which would result from the fact that private markets do not consider, when defining the terms of their credit lines, potential impacts on tax revenues. The third is the resilience of part of transaction costs in private markets, which constrains access to credit. The fourth, the author's own disbelief in the effectiveness of regulatory instruments.

For Denniss (2014a), the most significant developments in the adoption of successful contingent financing systems are still to be seen in public policies. The author argues that in the current stage of technological development, unique opportunities are open for governments equipped with advanced tax collection and income transfer systems to develop a real infrastructure for providing low-cost loans for the most diverse human needs. Libich and Macháček (2016) discuss how governments could make their role of risk manager in many areas using ICLs much more effective if institutions and governance models of high quality are in place. In the view of these authors, ICLs for artists, athletes, victims of natural disasters, or even for collapsing financial institutions could advantageously replace the current usual model of unilateral transfers and subsidies.

This is the motivation underlying the recent proliferation of papers and book chapters discussing applications of ICL systems for the most varied purposes. In recent years, ICL formulations have been discussed for subjects as diverse as unemployment insurance (STIGLITZ; YUN, 2014), access to health services (VAITHIANATHAN, 2014) and legal assistance (DENNISS, 2014b), housing (GANS; KING, 2004), loans for retirees (CHOMIK; PIGGOTT, 2014), extensions for maternity and paternity leave (HIGGINS, 2016), agricultural credit (BOTTERILL; CHAPMAN, 2009), elite sports training (DENNISS, 2003), expansion of residential access to photovoltaic solar panels (BALDWIN; CHAPMAN; RAYA, 2015) and investments in innovation (DENNISS; YUAN; WITHERS, 2009; GUPTA; WITHERS, 2014). This variety of possible ICL applications suggests that, rather than a cost-sharing financing model, there is a latent potential in this instrument for reformulating how governments provide certain public services and benefits, and even how they structure their tax systems.

Nevertheless, income-contingent financing is still an open field of study. Most of the current related literature is based on theory and practice concerning ICL applications. Further empirical analyses are needed¹⁹. Researchers struggle to have access to suitable data all over the world, as data on student loans tend to be scarce in comparison to the size of this market (DYNARSKI, 2015). Student debt crises have been taking place in both the developed and developing world (DYNARSKI, 2015; SALMI, 2013), thus quality empirical analysis is in high demand. However, evidence-based policies preferably require individual-level panel data, and so far, few countries produce feasible longitudinal data on individual education, earnings and financial burdens. Alternatives using short rotating panels or, in the absence of these, cross-sectional unit data on earnings and education have been used instead, as will be discussed in Chapter 4. Before that, a summary of the Brazilian HE student financing system is presented in Chapter 3.

¹⁹ Some recent papers grouped together in a special edition of the *Economics of Education Review*, to be released in 2018, make important empirical contributions to the ICL literature.

3 HIGHER EDUCATION STUDENT FINANCING IN BRAZIL

3.1 INTRODUCTION

Brazil is a large developing country with growing, but still low, participation rates in HE. Expanding access and completion at the pace required to meet the goals stated by the 2014-2024 National Education Plan (NEP)²⁰ of adding 50 per cent more enrolments by 2024 to the numbers registered in 2014 (with 40 per cent of the growth target to be served by the public sector), involves several challenges. One of these is how to finance such an expansion, especially considering the additional constraints imposed on the government's budget by the 2014-16 Brazilian Recession²¹. A politically sensitive reform, namely introducing tuition fees in the currently mostly free-of-charge public sector, frequently arises in the debate but faces fierce opposition from politically organised groups. In parallel, high default rates and fiscal constraints have jeopardised the government-administered loans and bursaries that have long been subsidising expansion in the private sector.

In this chapter, we discuss the HE student financing system in Brazil, emphasising the free college debate in the public sector and the student loan scheme to finance tuition fees in the private sector.

3.2 SUBSIDIES FOR HIGHER EDUCATION STUDENTS IN BRAZIL

Public HEIs are essentially free of charge in Brazil^{22 23}, but the bill for the taxpayer is

²⁰ The NEP goals were approved by law in June 2014.

²¹ According to the Brazilian Business Cycle Dating Committee (CODACE), the 2014-16 Brazilian Recession finished at the end of 2016, lasting for 11 quarters, and was the longest recession in the country since 1980, reducing Brazil's GDP by 8.6 per cent between the second 2014 quarter and the fourth 2016 quarter. The economy has in fact restored an upward trend throughout 2017, although potential output forecasts based on the scenario for 2018 show that, even with accelerating growth, GDP would continue below its potential at the end of 2018 (see SOUZA JUNIOR, 2017). For many authors, this Recession is "the worst recession ever recorded in the country's history" (ORAIR; GOBETTI, 2017, p. 219) and was not over in 2017 – that opinion is expressed, for example, in all the 13 chapters published in the book edited by Arestis, Baltar and Prates (2017), as well as in a policy brief by Cardim de Carvalho (2017). The GDP growth rate in 2017 was + 1.0 per cent. At the time this thesis was being finalised, the expected GDP growth rate for 2018 was +1.5 per cent (as reported by BCB, 2018).

²² HEIs maintained by municipal levels of government can charge tuition fees, but these institutions represented less than 2 per cent of total enrolments in 2016.

²³ Besides free tuition for all in federal and state HEIs, needy students usually have access also to reduced-price and lunch and housing, and eventually to monthly stipends provided either by the university or by

substantial. In 2014, the taxpayer cost per student enrolled in tertiary degrees at public institutions (including research and development – R&D – activities) was approximately 73 per cent of the average amount in USD purchasing power parity (USD PPP) spent per tertiary student by OECD members (this figure rises to 95 per cent if R&D activities are excluded). This is over three times more per pupil than the country's expenditure on secondary school students compared to an OECD average of 1.6. Total public expenditure on tertiary education consumed 3.5 per cent of Brazil's total public expenditure in 2014, well above the OECD average of 3.1 per cent.²⁴ Enrolments in the public sector HEIs grew by 28 per cent between 2008 and 2016, but it would need to grow another 76 per cent by 2024 to achieve the NEP targets. This is simply not economically viable in the current climate whilst public universities in Brazil remain free-of-charge.

Despite allocating significant proportions of budgetary resources for public HEIs, three quarters of the eight million enrolments registered in 2016 in the Brazilian HE system were in fee-paying programmes run by private institutions. The private sector has experienced different waves of growth since the late 1960s. In the past, religious and non-profit institutions were responsible for most places offered by the private sector, but since the 1990s the leading role in number of enrolments has been consolidated and fostered by for-profit HEI, because of beneficial regulations combined with a massification process boosted by two major forces: i) growing public subsidy; ii) distance learning. After for-profit institutions became eligible for public subsidy and degrees based mostly on distance learning started to be officially recognised in Brazil, the number of enrolments in for-profit institutions scaled up.

Public HEIs control most of the university research and development projects, lead enrolments in postgraduate programmes and are generally perceived as more qualified providers of HE services (GUSSO; NASCIMENTO, 2015). The federal government administers the majority of public HEIs, although most states and few municipalities do maintain their own systems. A federal policy intervention implemented between 2003 and 2012 (the Programme to Support the Restructuring and Expansion Plan of Federal Universities – REUNI) has achieved relative success in expanding offerings in federal universities in

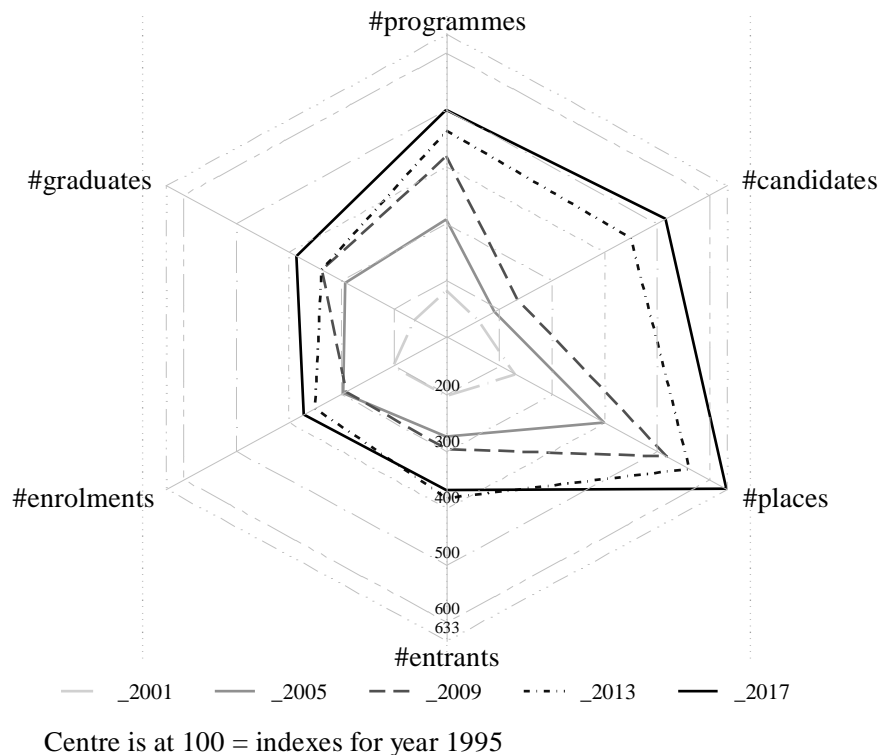
governments – see in the case of the federal government, the National Programme of Student Assistance (PNAES, the acronym in Portuguese).

²⁴ Figures obtained from data reported by OECD (2017).

recent years, but most of the growth observed for the federal universities after REUNI has been followed by a reduction of enrolments in state and municipal institutions. Consequently, public HEIs have systematically experienced reductions in their relative participation in the Brazilian HE market, as the HE censuses annually released by the Ministry of Education indicate.

Summing up the private and the public sector, the annual flow of new graduates has nearly quadrupled between 1995 and 2017 (Figure 1). Still, relatively few adults hold a HE degree – as mentioned in section 2.2.1, according to the OECD (2017), only 15 per cent of Brazilians from 25 to 64 years old have completed a tertiary degree, while the average for OECD countries is 37 per cent.

Figure 1: Higher education in Brazil (1995-2017) – evolution of selected indicators.



Source: Author's elaboration with official data from the Ministry of Education.

Obs.: Data related to programmes mostly delivered online were not included.

Boosting graduation rates is indeed a compelling need in a country whose youngsters do not attend tertiary education in large numbers: data from the 2015 edition of the Brazilian Annual National Household Sample Survey (PNAD 2015) shows that only 18 per cent of 18-24-year-old Brazilians were enrolled in tertiary degrees that year. However, further waves of expansion face four major constraints:

1. *low completion rates of secondary education*: PNAD 2015 also shows that just 57 per cent of 18-24-year-olds have completed secondary schooling.
2. *low learning performance in secondary education*: results from the Programme for International Student Assessment (PISA) show that Brazilian students have historically performed much worse than the OECD average in all three assessed subjects – OECD (2016)²⁵.
3. *signs of saturation in the private sector*: data from the national HE censuses indicate that the growth of enrolments in private HEIs has been mostly decelerating over the last two decades²⁶.
4. *fiscal austerity*: the Brazilian Congress approved an amendment to the Constitution in December 2016 linking public spending growth to the official rate of inflation for twenty years, starting in 2017 – hereafter referred to as the *spending freeze amendment*, following terminology adopted in English by Cardim de Carvalho (2017).

Cost sharing initiatives as well as broad and well-designed student aid schemes are particularly relevant in face of the last two constraints.

3.2.1 The free college debate in Brazil

Free access to higher education is often posited as a non-negotiable condition by those who value education as a right and perceive it as a means of empowering people and their communities. Even for those who emphasise higher education as an investment in human capital, gratuity at the point of use is a necessary condition to guarantee access to those who would not have the financial means to pay for a higher education degree²⁷.

Unrestricted gratuity, however, also brings problems. Even incomplete, the transition to free education in Chile already shows signs of a cut in total investment in HEIs and the prospect of reducing the quality and the size of the part of the system made free, possibly crowding out poor students from the most demanded programmes (BUCAREY, 2018;

²⁵ Soares and Nascimento (2012) show that performance for Brazilian students in PISA improved substantially between the first edition (in 2000) and the fourth (in 2009). In the following two editions (2012 and 2015), Brazil's performance stabilised, and the country remains far behind OECD average in all three subjects (as shown in OECD, 2016).

²⁶ Data on enrolments, conclusion rates and the characteristics of HEIs and HE programmes are collected annually by the National Institute for Educational Studies and Research "Anísio Teixeira" (INEP), a government agency linked to the Ministry of Education. Microdata for Brazil's higher education census from 1995 to 2016 can be downloaded from <http://inep.gov.br/web/guest/microdados#>.

²⁷ See the literature discussed in chapter 2.

DELISLE; BERNASCONI, 2018). In Argentina, unrestricted and free access to all those who hold a secondary school diploma imposes upon public universities the enrolment of more students than their installed capacity allows, as well as very low graduation rates (FANELLI; DEANE, 2016). In Greece, official non-recognition of tuition-fee based HEIs atrophies the system and compels many Greeks to seek higher education in other countries (BROMME; BRITTEN, 2017).

In Brazil, public HEIs are free-of-charge for all students. Unrestricted gratuity, in tandem with legal difficulties to raise funds from private sources, constrains the growth of enrolments in public HEIs²⁸. Problems of this order require complex solutions that also involve discussing funding for research and outreach activities, university autonomy, and the risks and opportunities related to private financing of education. Nevertheless, part of the solution is the way in which free access is guaranteed. Free access for the student does not necessarily imply banning private investment and relying solely on public resources. The end of free college in Australia (three decades ago) and in England (two decades ago) has shown that it is possible to share the funding of higher education between the State and the graduates, exempting all students from payments during their studies while ensures that they will only contribute financially to the costs of education if and to the extent that their future incomes permit.

There has been strong historical political opposition but growing recent support for the introduction of user charges²⁹ in public HEI in Brazil. Main arguments for and against the charge are summarised in Table 3.

²⁸ As already mentioned, tertiary education is largely provided by the private sector in Brazil: three-quarters of all enrolments in undergraduate programmes were in private HEIs in 2017.

²⁹ The main form of user charge in HEI are tuition fees, defined by Johnstone (2014, p. 236) as “a charge imposed by the university or the state on students to cover a portion of the costs of their instruction—as opposed to a fee to cover one-time costs of, e.g., registration or graduation or the costs of add-ons like transportation, recreation, or technology”.

Table 3: Summary of arguments against and in favour of introducing tuition fees in public universities in Brazil

Common arguments against	Common arguments in favour
Economic and non-economic benefits outweigh costs; User-charges are an additional barrier to access;	Social benefits justify subsidies, private benefits justify user-charges; Public is not synonymous of free – no user-charges simply means taxpayers cover 100% of the costs;
Student loans only postpone debt - barrier to access remains for the risk-averse;	User-charges should be combined with loans and bursaries to guarantee access;
Student body in public HEI is more diverse since affirmative actions took place;	HE provision is, by its very nature, a pro-rich policy – user-charges are also a matter of social justice;
Neither the cost structure nor the public benefits of public HEI can be comparable with the private ones; User-charges tend to generate low impact in the HEI budgets, but high risks of commodification of the public education system;	The public HEI are burdensome and inefficient; User-charges would free up resources for basic education; Budgetary problem is at the heart of the public university crisis and its reduced participation in total enrolments - gratuity limits expansion;
Tuition fees little contribute to the improvement of public universities.	User-charges would enhance institutional efficiency and autonomy and reduce overconsumption.

Source: Author's own elaboration.

Obs.: this Table summarises arguments discussed in Waltenberg (2017), Malbouisson and others (2017), The World Bank (2017), Lenk and Pereira (2017), Azevedo and Salgado (2012), and De Negri, Knobel and Brito Cruz (2018).

In Table 3, each of the arguments against the introduction of user charges is mirrored with an argument in favour. It is worth highlighting the argument about the changes in student composition at public HEIs since the introduction of affirmative actions in Brazil³⁰.

Affirmative action, usually in the form of the reservation of places for students identified as ethnic minorities or from low-income families or public-school graduates, was first implemented by a public university in Brazil in 2002. By 2008, over two thirds of the Brazilian federal universities and many state universities were adopting some form of affirmative action. A law enacted in 2012 requires that every federal university adopt policies that reserve 50 percent of its places for black, brown and indigenous people, as well as for students from public high schools (DAFLON; FERES JUNIOR; CAMPOS, 2013).

Data reported by Franco and Cunha (2017) and Malbouisson and others (2017) show that student composition at public HEIs has indeed changed considerably in Brazil. The gap in terms of ethnicity and socioeconomic diversity between public and private HEIs has

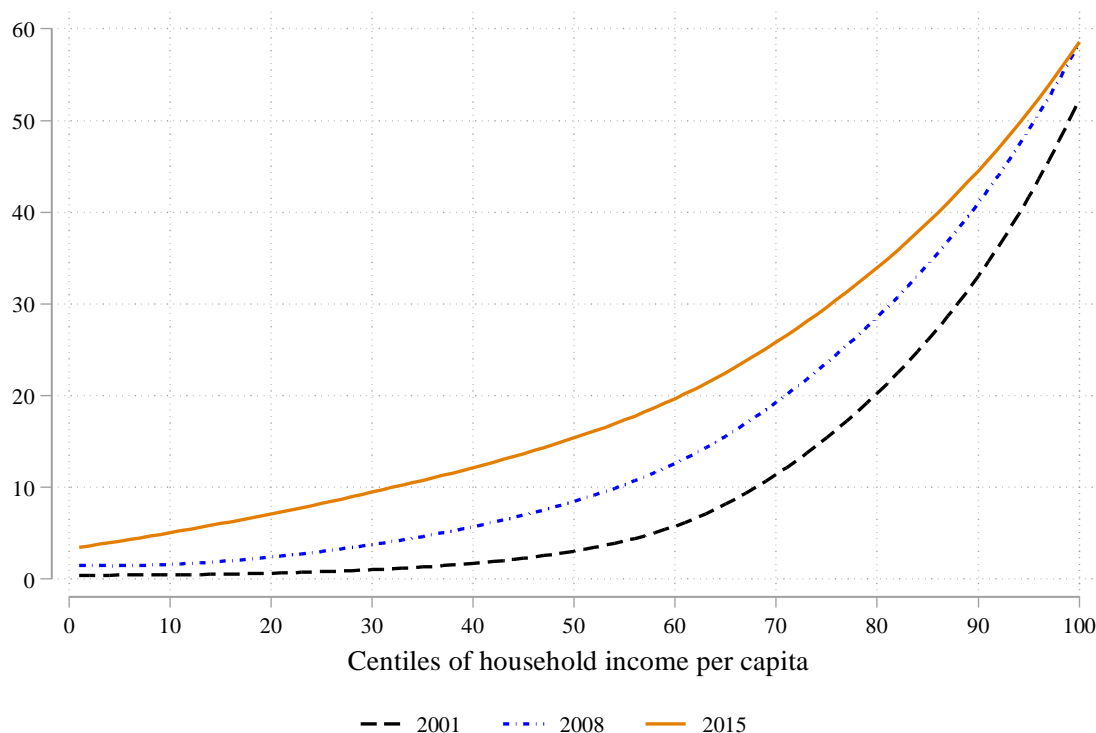
³⁰ For literature written in English about affirmative actions in higher education in Brazil, see Bailey and others (2015), Francis-Tan and Tannuri-Pianto (2012, 2015), and Marteleto and others (2016). For a broader analysis of issues concerning access in higher education (affirmative actions and beyond) in Brazil, see Pedrosa and others (2014).

reduced. Even so, students from low-income families still appear in higher proportions in the private sector.

Free-of-charge and usually perceived as of better quality, public universities have historically been selective in Brazil. Considering that educational outcomes tend to be correlated with socioeconomic status³¹, it might be the case that the historical selectiveness of public universities is being replicated among the beneficiaries of affirmative actions. In other words, policies such as quotas for ethnic groups or for individuals who completed their secondary education at public schools might be simply cream-skimming within these categories, that is, selecting mostly the better-off amongst ethnic minorities as well as graduates from the best (and often also selective) secondary public schools. Most importantly, whether in the public or the private sector, data reported by Franco and Cunha (2017) and Malbouisson and others (2017) show that students from low-income families are, as expected, far under-represented in HE. As Figure 2 illustrates below, the richer the household in Brazil, the more their offspring access HE, as it usually is anywhere. Affirmative action increases diversity on campus, but it does not make free provision of HE a pro-poor policy.

³¹ Jerrim, Chmielewski and Parker (2015) report evidence that individuals from low socioeconomic backgrounds in Australia, England and the US are much less likely to enter a high-status college than their more advantaged peers. Using longitudinal data from the US, Walpole (2003) find evidence that disadvantaged HE students do not follow the same patterns of college and post-college cultural capital accumulation and conversion as students in general or their high peers with high socioeconomic status, reporting different activities within the college environment, as well as lower incomes, educational attainment, and educational aspirations after college. Descriptive statistics highlighting inequality of access in the Brazilian HE system are reported by Corbucci (2016).

Figure 2: Incidence of 18-24-year-olds in higher education, per quantiles of household income – Brazil, 2001, 2008 and 2015.



Source: PNAD (IBGE).

Justifying the provision of free college as a fair and focused-on-the-poor policy is problematic, for at least three reasons. First, economic returns from a tertiary education degree are high, in average. In the case of Brazil, Carnoy and others (2013) estimated a 24.6 per cent private rate of return from HE in Brazil for 2008, while Barbosa Filho and Veloso (2015) point to a similar figure, 25.6 per cent, for 2012³². Additionally, the payoff for HE in Brazil is one of the largest in the world: data from OECD (2017) reveals that adults aged between 25 and 64 years-old earn 150 per cent more if holding a tertiary degree in comparison with those who have completed no more than secondary schooling, the largest payoff for HE reported in that year's *Education at a glance* OECD global report. Second, wealthier families are often overrepresented among tertiary students. Third, tertiary education is expensive, labour-intensive, and its costs tend to naturally present an ascending trajectory (Baumol's cost disease³³), leading to pressures for resources that are beyond the capacity of most

³² Both references report declining trends over the years, but their numbers are still above the world average private rates of return to investment in higher education reported by Psacharopoulos and Patrinos (2004).

³³ The term refers to the theory proposed by William Baumol and William Bowen in the 1960s to explain why prices rise faster than overall inflation in certain sectors of the economy, such as healthcare and education. In summary, cost disease is associated with salaries rising above labour productivity in some sectors, simply in response to the rise of salaries observed in more productive sectors. See Baumol (2012).

government budgets – particularly in those countries with growing but still low participation rates, such as Brazil.

Moreover, free-of-charge HE provision “can support effective but elite and small number of universities, especially in trends with a focus on fiscal rigour” (OKETCH, 2016, p. 526), but it imposes greater pressure on the system not to grow (BARR, 1993). Evidence reported by Murphy, Scott-Clayton and Wyness (2017) associates the end of free college in England with a large expansion of the system afterwards. Free college may also crowd out low-income students. Evidence reported by Bucarey (2018) shows that this is likely to be the case following the recent expansion of free-of-charge places in Chilean universities. This is because the new policy in practice reduces the funding of participating universities and thus hinders an expansion in the magnitude necessary to compensate for the increase in demand for higher education among the middle-class segments that since then have had free access to higher education in Chile.

Putting it in other terms, “free” college is rather a neologism for a 100 per cent tax-funded under-resourced HE system – and it is often a regressive way to redistribute wealth. Karl Marx recognised the regressive nature of free-of-charge provision of HE in 1875, when he wrote:

If (...) higher educational institutions are also "free", that only means in fact defraying the cost of education of the upper classes from the general tax receipts (MARX, 1922, p. 51).

Azevedo and Salgado (2012) defend tuition fees in Brazilian public universities under the argument that individuals from families with higher incomes receive more education than individuals from low-income families, so tuition fees could encourage richer students to pursue private education and thus increase the access of needy students to public universities. Castro and Tannuri-Pianto (2016) analyse the redistribution effects of public spending on higher education in Brazil and find evidence of a net transfer from the richest 20% to the rest of the population and a concentration of this net benefit in the interval from the 4th to the 7th decile of per capita household income.

Setting aside the debate on how regressive (or not) the public spending on higher education is in Brazil, when free college implies limited access, it may result in higher private spending by the families, to prepare their offspring for the usually competitive entrance exams as well as to pay for the living costs while studying. Psacharopoulos and

Papakonstantinou (2005) report evidence on this for Greece. A similar trend is likely to occur in Brazil. Yet, the Federal Constitution of Brazil (FCB, hereafter) guarantees all levels of education free of charge in public-administered institutions.

The FCB, promulgated in 1988, is a 68,000-word document covering a wide range of aspects of public policy and daily life (including interest rates, education, health, strikes and the minimum wage). This comprehensiveness has resulted in time-inconsistency, i.e., high frequency of constitutional amending, despite locking mechanisms (TSEBELIS, 2017).

Changing the FCB requires two rounds of approval in each of the two chambers of the Brazilian Congress (i.e., *Camara dos Deputados*, the lower chamber, and *Senado Federal*, the upper chamber), and favourable votes from at least two thirds of the congressmen and congresswomen in each of the rounds. Introducing tuition fees at public HEIs is a sensitive topic and would imply political battles in the Brazilian Congress, but such a change may nonetheless arise in the foreseeable future, given the growing fiscal pressure that came along with the 2014-16 Brazilian Recession. The topic has gained even more relevance after the spending freeze amendment, which will certainly impose new barriers for additional budgetary resourcing for public HEIs³⁴.

At least five amendments to the FCB have been proposed in the Brazilian Congress to review free access to public HEIs. The first two (proposed respectively in 2003 and 2009) expired without being voted. The third one (proposed in 2014) was approved in a first round by the lower chamber, but not in the second – therefore, it was not even voted on by the upper chamber.

The fourth proposed amendment dates from 2014 and was started in the upper chamber. The fifth was proposed in 2017 in the lower chamber. Although neither had been voted upon at the time this thesis was finalised, both proposals were signed by politicians from very different parties and ideological positions and were still on the agenda when the 2018 Legislative Session started. The 2014 proposal focuses on undergraduate programmes and intends to introduce a contribution scheme to be paid by graduates from public HEIs and

³⁴ The pressure is rather on the opposite direction, i.e., to decrease public spending in higher education. The World Bank released, in November 2017, a report analysing government spending in Brazil. Policy recommendations included introducing tuition fees in public HEIs and reducing direct government expenditures in this area. The World Bank recommended also extending FIES to the public sector, but no reference was made to ICLs as an alternative design for FIES (THE WORLD BANK, 2017).

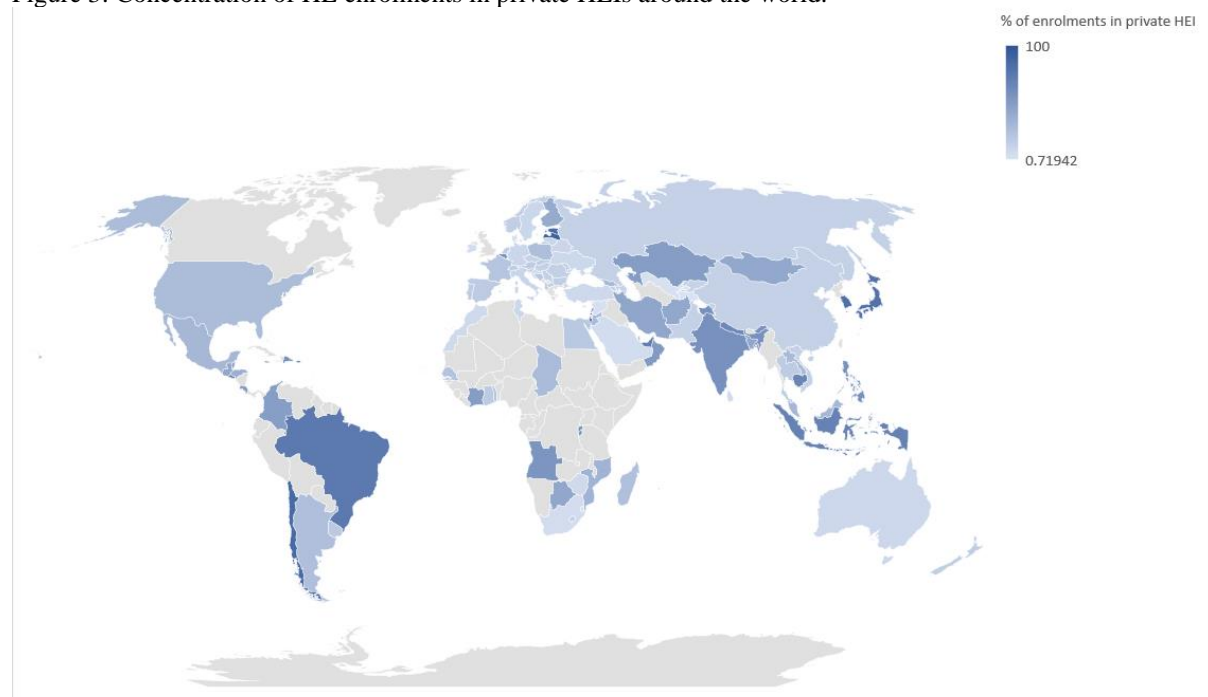
by graduates whose degrees from private institutions were financed by any grant, scholarship or subsidised loan provided by the government. The 2017 proposal intends to introduce tuition fees in all programmes run by public HEIs, but charges would be linked to the student's socioeconomic status and those who completed upper secondary education entirely at public schools or had full scholarships to study in private schools would have their tuition waived.

A joint analysis of all these proposals suggest that: a) albeit sensitive, free provision of HE is not an absolute commitment for any of the 25 parties represented in the Brazilian Congress; b) some form of protection for low income individuals is highly valued in the Brazilian context; c) the implementation of general upfront fees seem to be problematic in Brazil, but there is scope for the discussion of schemes with fee waiving or deferring mechanisms. Therefore, ICL arrangements have political potential to be raised as a feasible and fair alternative for cost sharing in public HEIs in Brazil.

3.2.2 Public subsidies for students enrolled in private HEIs in Brazil

The Brazilian HE system is currently one of the most privatised in the world. This is illustrated by Figure 3 below.

Figure 3: Concentration of HE enrolments in private HEIs around the world.



Source: UNESCO. Author's own elaboration.

Obs.: ash-coloured countries did not have information concerning enrolment shares in the UNESCO database.

Until the 1960s, however, most of the HE services in Brazil were provided by public institutions. Private HEIs started to take the lead after the 1968 University Reform, which was followed by an initial demand boom during the 1970s. A growing private sector enrolment share has been observed ever since (CORBUCCI; KUBOTA; MEIRA, 2016; KNOBEL; VERHINE, 2017; SAMPAIO, 2015).

The policy decision made over the years in Brazil has been to subsidise enrolments at private HEIs rather than to finance an expansion of the public sector on a sufficient scale to meet the recurrent waves of booming demand for HE the country has experienced since the 1970s. This option may reflect paradoxical outcomes of the 1968 University Reform: having albeit set the grounds for the integration of teaching and research activities in Brazilian universities, it has also produced a system with low diversity and low institutional differentiation. All universities in Brazil are compulsorily required to link their teaching activities to research and outreach activities, a requirement that makes universities expensive enterprises. As a result, public and private sectors have played supplementary roles in the last 50 years in Brazil: the former runs most of the universities and concentrates most of the research and postgraduate programmes, whereas the latter runs mainly non-university institutions and concentrates most of the enrolments in undergraduate programmes (GUSSO; NASCIMENTO, 2015; MARTINS, 2009; SAMPAIO, 2015).

As part of this context, the Brazilian Federal Government started offering student loans in 1975. The scheme introduced at that time was called *Educational Credit Programme* (CREDUC). Students could borrow from CREDUC to pay for tuition fees and living costs. The scheme was discontinued in 1997, due to fiscal constraints, high default rates and the absence of an appropriate monetary correction of outstanding debts³⁵ (RESENDE, 2018).

In 1999, the federal government introduced the FIES, initially denominated *Student Financing Fund for Higher Education*, renamed to *Student Financing Fund* (the acronym FIES was maintained) in 2010, upon inclusion in FIES legislation of the possibility to finance vocational education and training (VET) programmes. The change of names reflects an ambition to expand the scope of FIES; however, in practice, the loans to finance VET programmes are yet to be implemented. FIES remains, at present, a subsidised

³⁵ As did many Latin American countries in the same period, Brazil suffered with hyperinflation during the 1980s and early 1990s.

student loan scheme designed to defer fee-payment for students enrolled in fee-paying on-site tertiary degrees³⁶. Unlike CREDUC, however, students can borrow from FIES to pay for tuition fees, but not for living costs.

Historically a TBRL, FIES is starting to adopt income contingency as of 2018. Like in the previous format, means-testing will still apply in the new income-contingent FIES, for modalities lending public funds to students at subsidised rates, but private commercial banks are also encouraged to operate the loans. An employer withholding system will collect payments in the new FIES, but the requirement of a minimum payment (regardless of the ability to pay) distorts one of the main advantages of income contingency, which is to protect the borrower from income shocks during the repayment of his or her loan.

In 2005, a federal scholarship arrangement, called *University for All Programme* (PROUNI) was also introduced. Under PROUNI, private HEIs agree to waive fees for students selected into the scheme in exchange for tax exemptions for themselves. Full or partial PROUNI scholarships are provided for low-income students who completed their upper secondary schooling at public schools or had full scholarships to study at private schools. Students receiving full PROUNI scholarships may additionally apply for monthly stipends. Students receiving partial PROUNI scholarships may borrow from FIES to pay for the remaining fee costs not covered by the scholarship. In average, PROUNI beneficiaries come from a poorer background than FIES' borrowers, but many are eligible for both schemes. Despite the overlapping between the two schemes and even though the federal government administers both, there is no integration in the application and selection processes.

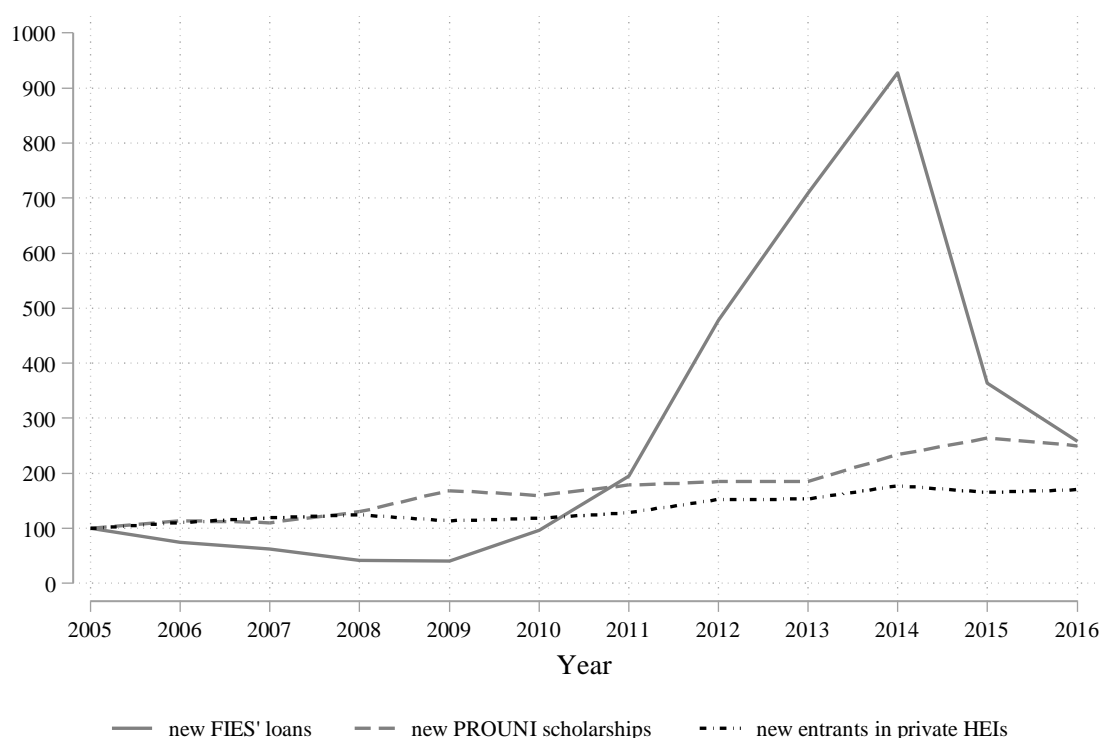
Some state and local governments also offer financial aid schemes for students enrolled in fee-paying tertiary degrees, but none of these initiatives are close to the federal schemes in any dimension. Tax benefits could also be considered a type of student aid, since students can recover part of the money spent on tuition and books. However, the main sources of student aid for students enrolled in the private sector remain the federal loan and scholarship arrangements, namely FIES and PROUNI. The FIES is thus the initial point of analysis for modelling a broad HE student loan system for Brazil, eventually comprising both the public and the private sectors.

³⁶ Programmes mostly delivered online are not eligible for FIES.

3.3 THE ONGOING REFORMS IN THE BRAZILIAN STUDENT LOAN SYSTEM

The FIES was introduced as a scheme for low-income students enrolled at private institutions³⁷; thus, it was always means-tested based on family income. For approximately ten years, the cap on family income was linked to the tuition fee level paid by the student, and loans did not cover 100 per cent of the tuition fee costs. Back then, the FIES was not a large scheme. However, the demand for FIES loans amplified once loans started to cover full fees (after 2007) and the cap on family income was raised and no longer linked to the cost of the degree (after 2012). The number of loans made available by the government also increased. As a result, the FIES experienced its largest wave of expansion between 2010 and 2014, much larger than PROUNI. The number of new loan contracts was multiplied by 9.5 in that period. By 2015, according to the federal government, 39 per cent of all six million students enrolled in private HEIs in Brazil were FIES borrowers. Figure 4 shows changes in the FIES trajectory after 2009 and again after 2014.

Figure 4: FIES loans, PROUNI scholarships, and enrolments of 1st year students in private HEIs: trajectories between 2005 and 2016 (2005=100).



Source: Author's elaboration with official data from the Ministry of Education.

³⁷ As of 2018, as already mentioned, students enrolled in public HEIs maintained by municipal level of government (which are the only public HEIs allowed to charge fees) can also borrow from FIES.

Mello and Duarte (2016) observe that the 2010–14 expansion wave reduced the tuition-elasticity of demand and resulted in price increases. After playing a supporting role in its early years, the FIES became a large and expensive³⁸ subsidised loan scheme. However, it has failed to foster access to HE, as the data plotted in Figure 4 suggests.

Default is a large problem with the FIES. Official data reported by Almeida Jr and others (2018) show that 61.8 per cent of all FIES loans contracted since 2010 and in repayment period in March 2018 were in arrears. Roughly two thirds of these were in arrears for more than 90 days, which is considered by the BCB as debts with low probability of recovery. The government attributes FIES problems to three sets of factors:

- (a) Moral risk of the debtors, as they treat loan as grants. In addition, the student does not have enough information about his or her debt balance and how this evolves.
- (b) Moral risk of the HEIs, whose contribution to the Guarantee Fund of Educational Credit Operations (FGEDUC) was very low, meaning low risk sharing because the FGEDUC was designed to cover the cost of non-repayment.
- (c) Underestimation of default, causing FGEDUC to be required above its capacity.

The FIES' increasing fiscal costs were partially hidden by how loans are disbursed, because the loan's disbursements were financial expenses that do not appear in the federal budget until the bonds issued to pay the HEIs and the repayments from graduates are not reconciled. Under the FIES, the federal government issues specific bonds to the participating private HEI to pay their taxes. The government periodically uses funds from the National Treasury plus contributions from a national lottery to buy back the remaining bonds in the possession of institutions with no outstanding tax debts. Government-owned banks later collect repayments from the graduates. The FIES bonds are remunerated by the government's cost of borrowing, but student debts are adjusted over time by subsidised rates. The National Treasury bears the full cost of the subsidy implicit in the FIES contracts, as well as most of the costs associated with non-repayment. In some cases, students must present a guarantor to borrow from the FIES. In other cases, the cost of unpaid student debt is borne by a guarantor fund of compulsory contributions from the participating HEI. If none of

³⁸ According to the federal government (see BRASIL, 2017a), since 2016 FIES' annual tax burden is greater than the annual budget for *Bolsa Familia*, a large money transfer scheme that benefited 13.2 million poor families in Brazil in 2017.

these mechanisms work, the National Treasury bears the cost of default.

The fiscal crisis associated with Brazil's 2014–16 recession forced a significant reduction in the number of available loans in 2015 and beyond. Additionally, changes were made to the eligibility and preference criteria that reduced the attractiveness of the loan scheme. Two changes were critical: loans started to be determined by an algorithm that, in practice, capped loan amounts well below 100 per cent of the tuition costs and minimal performance was now required in a national exam.

Figure 4 also illustrates the downsizing of the FIES in the wake of the 2014–16 recession. The number of new loan contracts was 9.3 times higher in 2014 than it had been in 2005. This ratio then fell rapidly and by 2016 the number of new FIES contracts was only 2.6 times higher than it had been in 2005, roughly equivalent to the growth rate of PROUNI between 2005 (first year of the federal scholarship programme) and 2016.

The FIES was redesigned again in 2016 and 2017. New legislation was enacted in December 2017, introducing income-based repayments and abolishing grace periods. The new law is relatively broad in scope, and most of the parameters are to be announced by a committee headed by the minister of education and comprising officials and bureaucrats from the federal government (hereafter, the FIES Committee). By the time this thesis was finalised, these were the main features:

- i) An employer withholding system will collect payments for the FIES ICLs at a maximum repayment rate of 20 per cent. The FIES Committee later established that repayment rates will vary incrementally with income. No repayment thresholds had yet been set by the time this thesis was being finalised, but the FIES Committee announced that loans undertaken in 2018 would be charged a maximum repayment rate of 13 per cent.
- ii) At least 100,000 ICLs adjusted solely by an official CPI have been offered in 2018 by government-owned banks. Only students with per capita family incomes up to Only students with per capita family incomes up to three times the national minimum wage are eligible for these loans;
- iii) Both government-owned and private banks are encouraged to operate the FIES under market interest rates. There will be no cap for family income for the FIES loans operated by private commercial banks if using only private funding;
- iv) Public funding will be available for an additional 210,000 means-tested loans, for

students with per capita family incomes up to five national minimum wages;

v) Minimal repayments will be required during study and repayment periods.

The 310,000 government-guaranteed loans initially announced for 2018 is approximately 1.5 times greater than the number of new FIES loans offered in 2016, or four times more than in 2005, when the PROUNI was introduced. It represents nearly 20 per cent of the total number of first year students enrolled in 2016 in fee-paying undergraduate programmes delivered by private HEIs.

The new FIES is an improvement in comparison to the previous TBRL format, but it can be criticised for maintaining minimal repayments during the study and grace periods, as required by the FIES since 2007. The government argues that students' co-participation during the utilisation period increases their commitment to their studies, decreases moral hazard risk, and reduces the average cost, allowing a greater number of contracts with the same resources (BRASIL, 2017b). Despite these arguments, and considering that many students enrolled at private HEIs in Brazil work while pursuing a degree, it sounds counterintuitive that individuals receiving student loans designed for low-income people are required to pay minimal instalments during the study and grace periods of a TBRL. Minimal repayments make even less sense in the case of an ICL, as one of the main advantages of this loan type is the protection against periods of low or null income.

The 2017 legislative reforms approximated the FIES of an ICL, since it now involves income-contingent repayments collected by an employer withholding system. The legislative reforms have also increased the compulsory contribution of HEIs to the FGEDUC. These are novelties that seek to reduce delinquency, to better share the risks of non-payment with the HEIs and to take up the fiscal sustainability of FIES.

It is worth mentioning, however, that the FIES keeps requiring small repayments from all debtors during the study period as well as minimum repayments from the debtors whom the employer withholding system in operation does not reach. There is also a lack of clarity as to whether and how forgiveness rules will be applied over time. All this compromise the insurance feature that characterises ICLs. In addition, however much the involvement of an employer withholding system to collect repayments represents advances, the government misses a great opportunity to maximise repayments by not reaching other sources of income beyond wages and salaries. It should also be noted that zero real interest rate policy generates unnecessarily

high taxpayer subsidies. FIES is on the way to become an ICL, but crucial issues of protecting the debtor against income shocks, optimising collection, and simplifying the rules still need to be addressed.

3.4 IMPLICIT SUBSIDIES IN FIES

As discussed in Chapter 2, the gap between the government's cost of borrowing and the loan's rate of interest is the major source of implicit subsidies in government-guaranteed student loan schemes. The higher the government's cost of borrowing, the higher the cost of each percentage-point subsidy implicit in the loan's rates of interest.

Governments in developed countries face relatively low costs of borrowing, especially since the 2007-09 Great Recession. Conversely, governments in developing countries tend to be exposed to high and volatile costs of borrowing because capital inflows tend to be lower, and risk premiums tend to be much higher in these countries in comparison with developed countries (STIGLITZ, 2010).

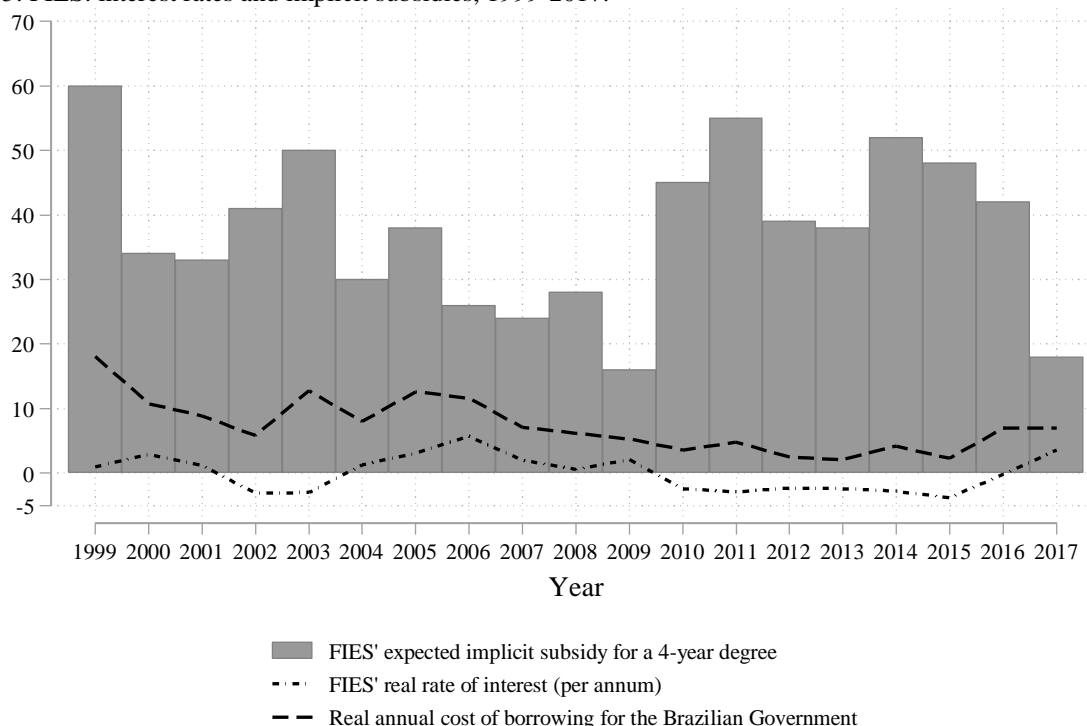
In Brazil, fluctuations in the government's cost of borrowing reflect responses from the national monetary authority to changes in the agents' expectations. In some cases, these changes follow the knock-on effects of an external crisis. In others, they follow internal political instability or a declining confidence in the authority's capacity to control inflation, or on the government's ability to repay its loans. All these factors frequently overlap and bring together the changes in the expectations of the agents that are reflected in the volatile costs of borrowing for the government. The volatility of the government's cost of borrowing in Brazil is reflected in the levels of FIES' implicit subsidies.

From the introduction of FIES, in 1999, until 2017, the last year of the TBRL version of FIES, the average cost of borrowing for the Brazilian government was, in real terms, 7.4 per cent per annum (p.a.), with a standard deviation of 4.2 per cent. The high and volatile costs of borrowing directly impact implicit subsidies because this calculation is very sensitive to the adopted discount rate, particularly if the nominal rate of loan interest is relatively rigid. Figure 5 helps to illustrate this point. It shows the evolution of real interest

rates, the government's real cost of borrowing, and implicit subsidies³⁹ for the FIES between 1999 and 2017.

On the one hand, all indicators plotted in Figure 5 fluctuated significantly during that period. On the other hand, only four regimes of nominal rate of interest were applied to FIES contracts during the same years: (i) 9.0 per cent p.a. for all degrees (1999–2006); (ii) 6.5 per cent p.a. for most degrees or 3.5 per cent p.a. for selected degrees (2007–2009); (iii) 3.4 per cent p.a. for all degrees (2010–2014); and (iv) 6.5 per cent p.a. for all degrees (2015–2017). The relative stability of FIES' nominal rates of interest contrasts with the high variability in the indicators shown in Figure 5. Consequently, the FIES has historically been unprotected against uncertainty and systemic risks: higher or lower fiscal costs were verified in years of the same regime of nominal rate of loan interest, simply because the government's cost of borrowing was volatile in the period.

Figure 5: FIES: interest rates and implicit subsidies, 1999-2017.



Source: Author's own calculations.

Obs.: Government's cost of borrowing in this figure relates to the cumulative SELIC rates (Special Settlement and Custody System, i.e., Brazil's base interest rate) for the period from 1 January to 31 December of each year, which can be obtained through this link: <https://bit.ly/1hyThmj> (last access: 25th March 2018).

³⁹ Implicit subsidies reported in Figure 5 do not include taxpayer costs due to default. The costs of non-repayment in TBRLs are considered here to be an administrative factor leading to *ex post* subsidies, as opposed to built-in design factors leading to *ex ante* subsidies. Under this point of view, non-repayment becomes an implicit subsidy only if associated with written-off debt rules.

The implicit subsidies reported in Figure 5 are the expected implicit subsidy for a hypothetical loan contract signed in year y by a borrower expected to graduate in year $y+4$. The SELIC rate, that is, the base interest rate set by the Central Bank of Brazil (BCB, acronym in Portuguese), is used as the γ discount rate. In the calculation of the implicit subsidies, simulations were made for a 48-month degree with the average tuition fees paid by FIES contracts signed in 2014. The simulations consider changes in the length of grace and amortisation periods, which impact the size of the implicit subsidy if, in real terms, the rate of loan interest remains below the government's cost of borrowing. Payments that FIES' beneficiaries are required to make during the study and grace periods were also considered. Losses due to non-repayment are not included in the calculation of the implicit subsidies.

The volatile costs of borrowing lead to a policy recommendation: rather than fixed interest rates, the FIES should apply floating interest rates to adjust outstanding balances. In other words, instead of setting the loan interest rates, the level of interest subsidies embedded in the loan design should be defined, updating the loan interest rates every time the government's cost of borrowing change. In this way, the government would maintain the same initial level of interest subsidy and better control the fiscal costs of the scheme. It is worth highlighting, however, that fiscal sustainability needs to be balanced with social concerns. The loan scheme must be affordable for borrowers. Therefore, the government must manage the trade-off between the size of implicit subsidies and RBs in government-guaranteed TBRLs (see discussion about this trade-off in Chapter 2).

3.5 ICL DISCUSSION IN BRAZIL

ICL is not exactly a new topic of discussion in Brazil, but it was neglected for decades. Souza and Faro (1980) proposed a switch to ICL for the CREDUC scheme, the predecessor of FIES, and its extension to public universities, which were intended to charge tuition fees if their proposition was to be fully implemented. The same authors again mention this loan type, which they knew from the work of Shell and others (1968), when, in a later article (SOUZA; FARO, 1982), they carry out an economic and financial analysis of educational credit. After that, discussions about whether public HE should be paid or free permeate some analyses, but the ICL as a modality of educational credit seems to have disappeared for a long while from the Brazilian academic and policy environments.

Within the framework of the Housing Finance System (Portuguese acronym SFH), it was sought between 1967 and 1988 to protect homeowners' ability to pay by equating the uprating of instalments with that of salaries. This was not an ICL, since the payments were not based on the individuals' salaries. Moreover, the collection did not involve any kind of employer withholding and repayments continued to be due even in case of unemployment. It also implied subsidies that proved to be unsustainable when, in the 1980s, real wages fell significantly. In 1993, the Income Commitment Plan (PCR, acronym in Portuguese) was created, which allowed the borrower to request a review of the value of the benefits whenever they exceeded 30% of their gross income. It was not, however, capable of reversing the SFH crisis because, in addition to the bureaucracy involved in reviewing the instalments, payments were not automatically withheld, implying a high risk of income underreporting. The PCR was the closest government initiative to an ICL scheme to date in Brazil. Besides the technical problems, the PCR was not an ICL in its entirety because the payments were not contingent on income. At best, there was an income-based parameter in its design, as debtors could request revisions in the amount due every time instalments exceeded 30% of their incomes.

In the last few years, a growing number of academic works have been discussing income contingency for HE in Brazil. Duenhas (2013) simulates the potential revenue under two different cost sharing schemes for public HEIs: upfront fees and a graduate tax. Nascimento and Longo (2016a, 2016b) recommend transforming the FIES into an ICL when presenting RBs at the mean of the graduates' income distribution and implicit subsidies for FIES. Nascimento (2015, 2016) discusses the ICL literature and Brazil's institutional capacity to effectively implement ICLs, besides presenting initial results from this thesis when discussing deferring fees with ICLs as an alternative for the free college system in Nascimento (2017). Chapman and Nascimento (2017) discuss elements of the Australian ICL that could be useful for Brazil. Resende (2018) compares the student loan system of Australia, Brazil and the US, and recommends the Brazilian system to move towards income contingency. This thesis goes beyond these previous works and simulate repayment profiles and distributional effects for a variety of alternative ICL designs for HE in Brazil, providing a glance on the potential results of a broad ICL scheme in terms of fiscal sustainability and graduate affordability.

Ongoing reforms of FIES seem to be moving the scheme towards the direction of an ICL, although many details of the new system are still to be decided and others remain unclear (e.g., how effective the collection will be, why minimum repayment is required regardless of individual financial conditions and whether there will be different repayment rates and thresholds). A two-day workshop in Brasilia with Professors Bruce Chapman (from the Australian National University – ANU) and Lorraine Dearden (from the University College London – UCL) in February 2018 seems to imply the reforms may complete the transition towards income contingency. General elections scheduled for October 2018 will be crucial in deciding which way this debate moves. The use of appropriate empirical methods helps to assess the new FIES and design a broad reform of higher education student financing in Brazil.

4 EMPIRICAL METHODS FOR ASSESSING AND DESIGNING STUDENT LOAN SCHEMES

4.1 INTRODUCTION

Reliable simulations of the entire distribution of future graduate earnings or income is key for understanding and designing effective and sustainable student loan systems (DEARDEN, in press). Methods to generate reliable age-income profiles for student loan analysis will be discussed in this chapter, and data from Brazil will be applied to assess some of these methods and simulate age-income profiles for Brazil's graduates, which will be used later in this thesis to assess and design student loan schemes.

As previously mentioned in Chapter 1, unit data on income (or earnings) and debt at every stage of graduates' lives is the most appropriate type of data to use in simulations. However, lengthy panels are not available in most countries, Brazil included. Short rotating panels with at least two consecutive years of data on income or earnings, age and sex of graduates can be used to incorporate realistic earnings mobility across the lifecycle (dynamic simulation). In the absence of any of these alternatives, or as a point of comparison, earnings simulations where there is no earnings mobility across the lifecycle (static simulation) can be calculated using cross-sectional data. Dynamic earnings models usually lead to greater repayments, lower projected debt, and significantly lower aggregate taxpayer subsidies when compared to models that ignore earnings mobility (HIGGINS, 2010).

4.2 KEY CONCEPTS

Potential fiscal impacts will be assessed in terms of the expected taxpayer costs due to: (i) concessional interest rates; (ii) non-repayment. The impacts on debtors will be assessed in terms of distributional implications across the cohort of debtors when varying parameters such as rates of interest, surcharges, cohort risk premiums and repayment rates and thresholds. This includes potential repayment difficulties graduates may face during the repayment period. In TBRL schemes, affordability relates to the manageability of the RBs faced by different debtors across the graduates' earnings or income distribution.

4.2.1 Defining manageable RBs

Defining manageable RBs is not straightforward. They certainly differ from context to context, and the literature is still vague in this sense: there are only *ad hoc* general definitions. Woodhall (1987) argues that manageable RBs are those not higher than 8 per cent or at most 10 per cent of disposable personal income. Carlson (1992) assumes a maximum feasible RB of approximately 10 per cent. Salmi (2003) claims that 18 per cent of disposable personal income would be the limit to classify RBs as manageable. Baum and Schwartz (2006) propose benchmarks for student debt service ratios⁴⁰ for student debt according to individual income levels, with the top being 18 per cent of pre-tax (rather than disposable) income or 20 per cent of discretionary income, with discretionary income defined as income exceeding 150 per cent of the poverty level for a single person. In the absence of specific definitions based on the context of Brazil, the upper limit of 18 per cent of pre-tax income is used in this thesis as a rule of thumb for manageable RBs.

4.2.2 The relevance of RB analysis

Ideally, RB analysis should rely on longitudinal data on the earnings and borrowings of real debtors, incorporating other factors affecting the ability to pay, such as debts other than student debts, number of dependents, and household taxes and benefits (DEARDEN, in press; DYNARSKI, 2015). Even using simple calculus, however, RB analysis is useful for policy analysis: the higher a debtor's RB, the higher their probability of defaulting on a loan repayment at some point. However, it is worth emphasising that debtors might choose to default even if they can afford repayment, so long as the financial costs of repayment outweigh the costs associated with the penalty for defaulting (CHAPMAN; LOUNKAEW, 2016) and repayment collection is not automatic (i.e., if it requires an action from the debtor to proceed to payment)⁴¹.

It is also important to note that delinquency and default are normal 'repayment states' and do not necessarily imply inefficiencies in the TBRL's schemes, especially because borrowers can resort to defaulting as an insurance mechanism in the absence of income-contingency features in the loan design (LOCHNER; MONGE-NARANJO, 2016). Notwithstanding, the key point

⁴⁰ The terms RB and debt service ratios are used here interchangeably.

⁴¹ Therefore, ICLs involving withholding systems have the additional advantage of avoiding behavioural distortions in the payment of the due instalments.

here is that excessive RBs lead to high prospects of debtors defaulting because of low incomes, and this influences governments' decisions on the size of the subsidies implicit in the policy design (CHAPMAN; LOUNKAEW, 2015).

4.2.3 The relevance of simulating student loan designs

Evaluations of student funding schemes often rely on dynamic microsimulation models (FLANNERY; O'DONOGHUE, 2011) – techniques that use actual or synthetic micro-datasets to construct prospective or alternative contemporaneous scenarios that account for changes over time in the characteristics of the micro-units and allow to look beyond the averages (DEKKERS, 2017). This type of study is very useful to compare potential results of different possible designs for the same public policy. Using these techniques to emulate student loan designs in advance of their implementation is therefore relevant in anticipating potential positive and negative impacts, both on the government budget and on the borrowers' welfare.

Dynamic microsimulations are often used to estimate taxpayer costs in countries with mature national ICL schemes (DEARDEN, in press) – see, for example, Crawford, Crawford and Jin (2014) simulations for the UK and Higgins and Sinning (2013) simulations for Australia. The dynamic modelling applied in this thesis is simpler but related to these approaches and rigorously meets the requirements being reviewed by the Brazilian Congress to have *ex ante* evaluations carried out in advance to the implementations of new public policies within the federal government.⁴²

4.3 WHAT TYPE OF DATA CAN BE USED?

Longitudinal microdata on graduates' age and income are the most appropriate sources of information to produce reliable age-income profiles to assess RBs in TBRLs and simulate applications and costing of alternative ICL schemes. Additional information concerning individuals' outstanding debts (including student debts, but also other sources of debts) and family size and composition would be desirable to examine whether some graduates are likely to be facing financial hardship. However, longitudinal datasets are not readily available in many countries. When they are, sample sizes may turn out to be too small (DEARDEN, in press). In the absence of panel data, static approaches provide an upper bound on costs of student loan systems. Their major limitation is that the use of single year data does not allow

⁴² See Supplementary Bill (Projeto de Lei Complementar – PLP) 295/2016.

for mobility across the earnings or income distribution (HIGGINS; SINNING, 2013).

Notwithstanding, a growing number of countries have been following the methodological and conceptual recommendations of international organisations such as the International Labour Organisation (ILO) and the United Nations Statistics Commission (UNSC) and implementing surveys based on rotating panel designs (IBGE, 2014), which may be used for simulating earning or income dynamics. As few as two consecutive years of microdata on graduates' age and income (or earnings) suffice for this purpose, as Dearden (in press) demonstrates using copula functions to simulate reliable dynamic age-income profiles for US graduates.

4.3.1 Data available in Brazil

In the context of Brazil, individual tax records would be the ideal source of information to simulate repayment patterns for different designs of student loan schemes. Assessable incomes of current graduates could be used to simulate alternative student loan designs. Additionally, administrative microdata on FIES' debts would allow the calculation of actual RBs of real debtors found on the tax records. The RB analysis could be enhanced by microdata on other debts besides student debts, obtainable from private databases regulated by the state, as well as on the number of dependents of the debtors, obtainable from tax records and other sources of administrative data. The federal government is thus able to access quality data to proceed to *ex ante* assessments of alternative student loan schemes. However, access to individual tax records and debts is very restricted, so researchers need to rely on other datasets to simulate such policies.

One alternative would be combining the administrative microdata from the HE censuses (annually collected by the Ministry of Education) with the administrative data from the Annual Social Information Report (RAIS, employee census data annually collected by the Ministry of Labour). The merged dataset should provide panel data with reasonably large sample sizes (N) and short to medium time coverage (T) to simulate earning dynamics. Income data would be limited to wages and salaries from formal jobs, so the main advantage of this exercise would be to assess the potential repayment ratios for ICL schemes relying strictly on employer withholding mechanisms to collect repayments, as is so far the case for the new FIES design implemented in 2018. On request, these administrative datasets are made partially available for researchers. However, confidentiality issues impose barriers upon accessing RAIS and the HE censuses with the individuals' names and national security numbers, key variables to combine

both datasets. RAIS microdata without these confidential variables could stand alone to provide a panel of employees holding a tertiary degree. Hypothetical loan repayments could still be simulated. However, doubtful debts would be poorly estimated and would need to be supplemented with aggregate projections of graduates' participation in the labour force and assumptions about transitions across labour market states (i.e., in or out of the labour force, employed versus unemployed) and unobserved conditions of work (e.g., employer and self-employed).

Other alternatives include population census data and household surveys conducted by the IBGE. Brazil's population censuses occur every ten years – the last one took place in 2010. Detailed information from a sampled questionnaire provides the necessary data for the purposes discussed here, but only for static simulations of graduates' lifetime incomes. Similar data are available from the PNADs, collected cross-sectionally every year from 1976 to 2015 (except for years of population censuses). In 2012, a rotating panel design was implemented independently of the then standard annual PNAD. The new design is referred to as Continuous National Household Sample Survey (Continuous PNAD), and is Brazil's sole national household survey since 2016. Continuous PNAD collects data on workforce indicators every quarter, with households remaining in the sample for up to five quarters.

The Continuous PNAD enables, therefore, the construction of a panel of individuals, with two consecutive years of observations on income and schooling. This is the necessary and sufficient condition to simulate the amortisation patterns that would be observed among people with higher education if they were exposed to hypothetical student loan designs. This illustrates the potential impacts of changes in the loan parameters in terms of affordability for graduates and sustainability for the government budget. Although the ideal would be to carry out such simulations using longer longitudinal data, the simulations made with this short-duration panel already represent a great improvement in the quality of *ex ante* evaluations of government financing programmes. Instead of a static and erroneous single estimate of the fiscal costs associated with each possible design for the scheme, the approach proposed herein provides to the policy maker a more plausible range of costs. The dynamic results obtained by the short panel serve as a lower limit and the static results serve as an upper limit of the potential costs and distributional impacts related to each policy design under review.

Continuous PNAD will be used in Chapter 5 to simulate student loan schemes for Brazil and also later in this chapter to illustrate and assess key static and dynamic approaches discussed in the literature of student loan analysis for contexts lacking quality long panels. It is worth noting again, however, that the Brazilian federal government has fiscal and administrative records that would allow a much more reliable mapping of income mobility patterns in the country. Unlike other countries, for which the method used in this thesis becomes the only viable alternative to the simple static simulations, in Brazil there are data that, although not readily available to researchers, are under the authority of the Public Administration. These would therefore provide the best conditions for designing financing policies that are best aligned with long-term public choice trends.

4.3.2 Descriptive analysis for the panel used in this analysis

Continuous PNADs for years 2014 and 2015 are used to simulate static age-earnings profiles as well as to construct a short panel for the dynamic simulations⁴³. The analysis involves male and female tertiary-degree holders aged between 24 and 64. This age span was chosen because, for simplicity, it is assumed that all students conclude a four-year degree⁴⁴ at age 23, which was the modal age for graduating students registered in recent years by the official Higher Education Census, enter the labour market as graduates at age 24, and remain active until they turn 65 years old, which was the proposed minimal age for retirement in a reform of the social security system under analysis in the Brazilian Congress at the time this thesis was being written.

Samples for years 2014 and 2015 total 147,319 observations for 24-64-year-old graduates, 39.2 per cent of which relate to male and 60.8 per cent to female individuals. The panel with graduates appearing in both consecutive years has 25,240 individuals, 38.4 per cent of which are male and 61.6 per cent are female graduates. All graduates are included in the analysis, even those who have reported zero earnings. As Higgins and Sinning (2013)

⁴³ The IBGE specifies a group-wise ID to nest surveyed individuals into their respective households, but an appropriate ID to be used for panels at the individual level is still to be incorporated to the datasets released so far. In addition to the required variables to form the group-wise ID suggested by IBGE, the variables for day, month and year of birth, plus a dummy variable for sex, were also concatenated, deleting all observations not informing year of birth. With this procedure, we identified individuals surveyed in these two consecutive years of Continuous PNAD.

⁴⁴ The Brazilian higher education system includes degrees with different lengths, but it is not possible to trace the length of the degrees pursued by individuals surveyed by the Continuous PNADs. Simulations will assume a typical degree lasts four years, because most intake of students are in four-year degrees.

highlight, it is important to include zero earners in this type of analysis because it is necessary to know the proportion of graduates who would not be able to repay their debts had they undertaken student loans.

Table 4 reports the descriptive statistics for earnings, age and the number of graduates by sex in the final panel as well as in each of the two years of analysis separately.

Table 4: Descriptive statistics (Continuous PNAD 2014-2015)

		All graduates		Male graduates		Female graduates	
		Whole sample	Panel	Whole sample	Panel	Whole sample	Panel
TOTAL GROSS EARNINGS IN 2014 (IN BRL)	Mean	53,779.94	56,454.53	75,183.00	79,896.78	39,393.04	41,217.58
	(SD)	(77,972.38)	(73,821.12)	(100,458.80)	(93,605.60)	(53,553.17)	(52,034.51)
TOTAL GROSS EARNINGS IN 2015 (IN BRL)	Mean	51,679.72	55,007.19	71,580.89	76,977.47	38,147.39	40,724.45
	(SD)	(71,355.40)	(73,566.29)	(87,547.27)	(87,478.38)	(53,756.42)	(58,635.09)
AGE IN 2014 (IN YEARS)	Mean	39.9	40.7	40.2	41.1	39.7	40.4
	(SD)	(11.1)	(11.1)	(11.3)	(11.2)	(11.0)	(11.0)
% WITH ZERO EARNINGS IN 2014		16.9	16.0	10.4	9.7	21.1	20.1
% WITH ZERO EARNINGS IN 2015		18.3	17.2	11.4	10.2	22.7	21.7
% WITH ZERO EARNINGS IN BOTH YEARS		Not applicable	12.7	Not applicable	6.9	Not applicable	16.3
N (24-64-year-old graduates)		2014: 72,405 2015: 74,914	25,240	2014: 28,453 2015: 29,346	9,697	2014: 43,952 2015: 45,568	15,473

Source: Continuous PNAD 2014-2015. Author's own calculations.

Notes: 1. Sample weights were applied; 2. Earnings were uprated to 2017 average prices using the Extended Consumer Price Index (IPCA); 3. Graduates include all individuals holding degrees classified by the International Standard Classification of Education (ISCED 2011) as level 5 to level 8 degrees.

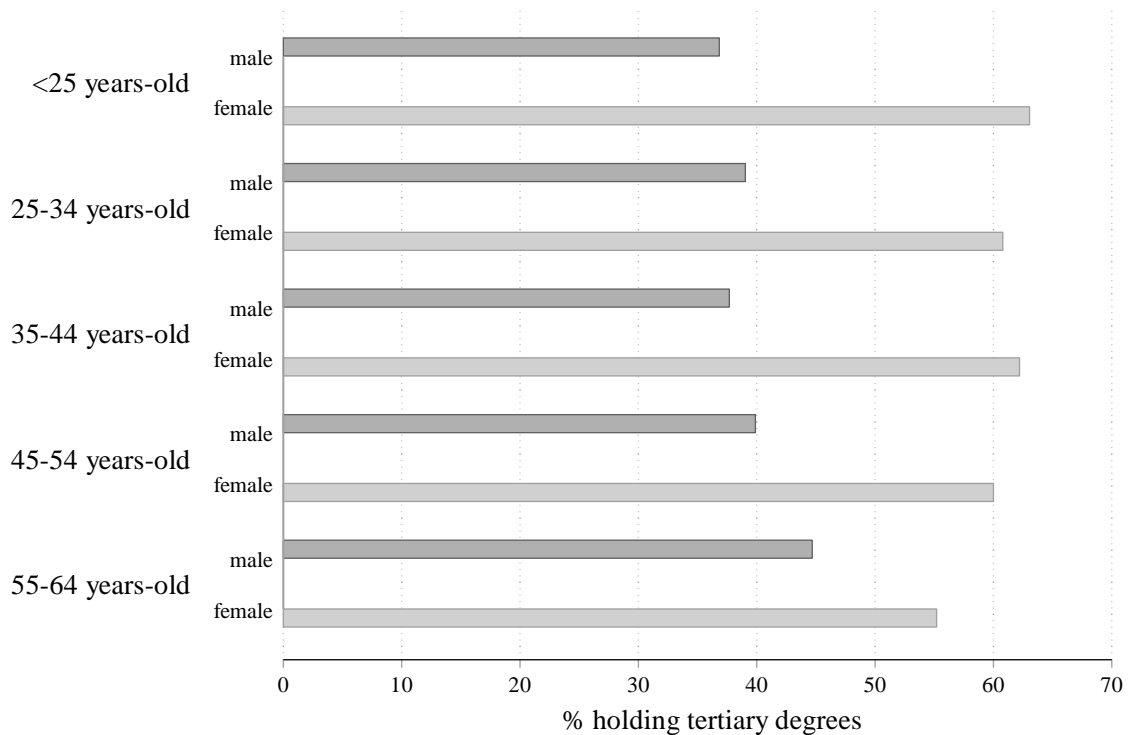
Labour earnings are the sole income measure, although ideally data from all sources of income should be used, particularly for the estimation of RBs. Data on labour earnings is available for all Continuous PNADs, but, at the time this thesis was finalised, only the surveys from years 2016 and 2017 were reporting both labour earnings and income from other sources. However, 2016 was the year the domestic labour market was affected the most by Brazil's recent economic recession, so data from 2016 and 2017 are likely to be less representative of the Brazilian labour market⁴⁵.

It is worth highlighting that the considerably higher proportions of female in comparison with male graduates has nothing to do with attrition and is consistent with the reality in Brazil for

⁴⁵ Average unemployment rate, calculated from the Continuous PNADs, was 12.0% for the 2016-2017 period, against 7.5% for the 2014-2015 period.

the last five decades. Beltrão and Alves (2009) show that the reversal of the gender gap in HE completion happened in Brazil in the 1970s and the proportion of women with tertiary degrees is almost twice that of men at the youngest cohorts. Data from the most recent Population Census (2010) confirms this trend (as can be seen in Figure 6) and reinforces the representativeness of the data reported in Table 4.

Figure 6: Proportion of men and women holding tertiary degrees, by age - Brazil, 2010.



Source: 2010 Brazil's Population Census (IBGE). Author's own elaboration.

Recent graduation rates follow a similar path, implying that the current graduate flows continue to consolidate the gender composition that has been observed for decades in the Brazilian population with higher education. In 2016, the last year with data available from the Higher Education Census, nearly 1.2 million people completed tertiary degrees in Brazil, 61.4 per cent being females. Although more numerous, women with HE earn much less than men with HE in all parts of the distribution (Appendix A). They are more likely to face excessive RBs - regardless of the method of estimating the age-earnings profiles.

4.4 STATIC APPROACHES TO ESTIMATE AGE-EARNINGS PROFILES WITH CROSS-SECTIONAL DATA

In the absence of longitudinal data, a strand of the student loan literature has been estimating age-income profiles using single or pooled cross-sectional data to simulate student loan

repayments in different parts of the graduate income distribution. This approach means an improvement in comparison with previous RB analysis. Until mid-2000, RB calculations were usually performed at the mean of the data⁴⁶ or using illustrative hypothetical incomes lower than the means⁴⁷ – in both cases relying on projected incomes smoothed by ordinary least square (OLS) age-earning profiles. However, the picture can be very different for those individuals at the tails of the income distribution. Since Chapman and Lounkaew (2010b)⁴⁸ applied to US data⁴⁹ the *repayment burden empirical method* (RBEM), a parametric approach described in detail in Lounkaew (2012), the empirical research on RB analysis moved its attention towards the bottom quantiles of graduate’s earnings or income distribution.

More recently, Dearden (in press) also uses data from the US⁵⁰ to evaluate the RBEM and show that a different functional form and smoothing method should be applied for RB analysis and student loan design. Her paper develops a more appropriate static model and proposes a dynamic extension to the RBEM. In this section, both Chapman-Lounkaew’s and Dearden’s static approaches will be discussed and compared, and Dearden’s dynamic model will be shown later in this chapter.

4.4.1 Chapman-Lounkaew’s Repayment Burden Empirical Method (RBEM)

The original version of the RBEM simulates repayment patterns for graduates at different parts of the income distribution and then calculate their RBs. Repayment patterns are simulated using age–earnings profiles predicted from cross-sectional data after estimating quantile regressions from the following variant of the classical Mincerian earnings function:

$$Y_{ij} = \beta_{0j} + \beta_{1j}X_{ij} + \beta_{2j}X_{ij}^2 + \varepsilon_{ij}, \quad (3)$$

where:

- $i=1, 2, 3, \dots, n$ represents individuals;

⁴⁶ See, for example, Ziderman (2003), Chung (2003) and Kim and Lee (2003).

⁴⁷ See, for example, Schwartz and Finnie (2002) and Shireman and others (2006).

⁴⁸ Just before that, the same authors (in coauthorship with others) truncated OLS estimates to simulate age-earnings profiles in different parts of the lifetime graduate earnings distributions (CHAPMAN *et al.*, 2010, where they apply the method for Thailand; see also CHAPMAN; LOUNKAEW, 2010a). The static RBEM was preferred in later work, as it relies on quantile regressions and thus performs better than OLS methods in smoothing earnings or income data by quantiles.

⁴⁹ They used data from March 2009 Supplement of the US CPS, uprating earnings data to 2015.

⁵⁰ Dearden uses March 2014-2017 CPS data.

- j stands for any additional level of analysis one could be willing to incorporate, such as the area of the degree individual i holds or the type of educational provider where they studied;
- X is either age or potential experience (i.e., age at the year of analysis minus assumed age of graduation);
- Y is the personal income (or earnings), which can be estimated separately by sex, ethnicity, region of residence, or any other dimension with the available data.

Schooling measures do not appear as regressors because only incomes earned by graduates are modelled – and potential differences due to further schooling in postgraduate level are not considered, for simplicity. For the same reason, it is assumed that no income is earned prior to completing the degree. Experience is replaced by age or measured in terms of potential experience, that is, length of assumed participation in the labour market as a graduate, given by the difference between the observed individual age and the age all graduates are assumed to have concluded their degrees. Note, however, that potential experience is simply a monotonic transformation of age.

The innovation lies in estimating RBs across the entire range of debtor's incomes by age and sex. The method was replicated for other settings (see, for example, CHAPMAN; LIU, 2013; CHAPMAN; SINNING, 2014; CHAPMAN; SURYADARMA, 2013) and has also been used to illustrate repayment profiles in alternative loan systems including ICLs (see, for example, CAI; CHAPMAN; WANG, in press; CHAPMAN; DORIS, in press).

The advantages of this empirical strategy are straightforward:

- (i) Easy to implement;
- (ii) Replicable with any national cross-sectional database with information available on graduates' age and earnings or income;
- (iii) Results are powerfully illustrative for policymakers.

A limitation of this static approach for determining age–income profiles is that there is no allowance for individuals to move across labour force states or earnings quantiles. Ignoring labour market dynamics leads to unrealistic repayment profiles (DEARDEN, in press; HIGGINS; SINNING, 2013). In practice, the method tends to overestimate the number of years of excessive RBs experienced by TBRL borrowers as well as the proportion of non-repayments and the speed of full repayments in ICLs. Besides that, the method also tends to underestimate the numbers of graduates facing repayment difficulties in TBRL schemes at some stage of their lives.

Most of the applications of this approach rely on nationally-representative survey or administrative data, so no econometrics would be required at all. One could possibly reach similar results if calculating RBs and simulating repayment patterns directly from raw data tabulated by age at different quantiles (so long as observing the appropriate weighting for the survey data being used). However, since there is usually high volatility in the incomes, some smoothing is desirable.

There are several ways of smoothing income or earnings data. It does not have to be based on Mincerian equations, but this is the tradition in the RBEM literature. Age-earnings profiles are smoothed by using polynomials in age or potential experience. The debate within the RBEM literature is which quantile regression model⁵¹ and which functional form should be used. Given that causation analysis is not the purpose here but rather just best fit to the data, non-parametric methods could also be considered. Nonetheless, the discussion in the remainder of this section will concentrate on the parametric forms for fitting the age-income profiles in the RBEM tradition.

4.4.1.1 Choosing the way to smooth the data

First applications of the RBEM use loglinear unconditional quantile regression (UQR) models, introduced by Firpo, Fortin and Lemieux (2009)⁵². These regressions imply a transformation known as re-centred influence function (RIF). The RIF for the quantile of interest q_τ is given by:

$$RIF(I; q_\tau) = q_\tau + \frac{\tau - D(I \leq q_\tau)}{f_I(q_\tau)}, \quad (4)$$

where $f_I(\cdot)$ is the marginal density function of I and D is an indicator function. One estimates the sample counterpart of $RIF(I; q_\tau)$, which is:

$$RIF(I; \hat{q}_\tau) = \hat{q}_\tau + \frac{\tau - D(I \leq \hat{q}_\tau)}{\hat{f}_I(\hat{q}_\tau)}, \quad (5)$$

⁵¹ It is worth noting that regressions are applied here as smoothing techniques, not as analytical toolboxes for causal inference. There is no need to apply sample selection models, because we are not interested in the regression's coefficient estimates per se. In effect, lifetime earnings are the outcome of a process that does include selection bias, hence our simulations should not tackle this.

⁵² It is worth noting, however, that the literature on *conditional* quantile regressions goes back to the seminal work of Koenker and Basset Jr (1978), and since then this strand of the statistical and econometric literature has been developed. The current standard text on the quantile regression framework is Koenker (2005), but it relates solely to the conditional quantile regression method.

where \hat{q}_τ is the sample quantile and $\hat{f}_i(\hat{q}_\tau)$ is the kernel density estimator, with this transformed variable replacing the original dependent variable of the variant of the standard earnings function shown in (3). Dearden (in press) argues that conditional quantile regression (CQR) models using raw data as the dependent variable are in fact the optimal approach for calculating the RBs by age across the distribution of graduate incomes or earnings.

To understand why CQR is more appropriate than UQR, it is important to summarise what each approach does. UQR marginalises the effect over the distributions of other covariates in the model, by performing CQR and then integrating out all the conditioning variables to find the unconditional effect of the variable of interest on the outcome of interest. Therefore, UQR estimates one joint effect of the conditioning variables on the a q_τ^{th} unconditional quantile of Y_i , which does not vary depending on the covariates included in the model. CQR assesses the impact of a covariate on a quantile of the outcome, conditional on specific values of other covariates. Consequently, as the levels of these other covariates vary, CQR produces different results for the effect of a variable X on the q_τ^{th} conditional quantile of Y_i . These differences in estimating procedures often result in a q_τ^{th} unconditional quantile of Y_i significantly different from the q_τ^{th} conditional quantile of Y_i when multiple regressors are included in the model (BORAH; BASU, 2013; DEARDEN, in press; FIRPO; FORTIN; LEMIEUX, 2009).

When there is only one conditioning variable, both procedures often lead to similar outcomes, so long as the sole conditioning variable is appropriately specified. However, even with appropriate specifications, in general CQR performs better than UQR at the tails of the earnings distribution. This is important because bottom quantiles are precisely the ones requiring greater concern in RB analysis. UQR is sensitive to the age range over which the analysis is conducted, so CQR is more reliable. Moreover, the q_τ^{th} quantile of the graduate income or earnings distribution *conditional on age* (i.e., $Q_q(y|age)$) is what is needed to see how this conditional quantile changes with age. Therefore, CQR – not UQR – should be used to estimate graduates' age-earnings profiles for simulating repayment prospects of a student loan scheme (DEARDEN, in press).

4.4.1.2 Which functional form shall be used?

Functional form is a critical issue when smoothing data for RBEM purposes. Past research in the RBEM tradition regressed the natural logarithm of an income variable on a quadratic

polynomial of potential experience. Dearden (in press) shows that the most appropriate form uses the income variable in level (not in log) and regresses it on a quintic polynomial of age (or potential experience). Before showing evidence that Dearden’s preferred model is also more appropriate to the Brazilian context, it is worth summarising the theoretical reasons for disregarding log-earnings specifications in RBEM applications.

Although still preferred by most labour economists, log-earnings specifications are an option for classical Mincerian equations only when income or earnings always assume positive values and so long as the error term is symmetric and homoscedastic (NICHOLS, 2010; WOOLDRIDGE, 2010). In such cases, the partial effect of experience on earnings, considering the most widely used version of the Mincerian earnings equation, reproduced in (3), is given by:

$$\frac{\partial E[\ln(\text{earnings})](\text{experience})}{\partial(\text{experience})} = \beta_2 + 2\beta_3(\text{experience}) \quad (6)$$

With the dependent variable in the form of logarithms, (6) can be directly interpreted as the expected percentage change in earnings for an additional year of experience – a very informative piece of information if one is studying the relationship between experience and earnings. Letting aside the assumption about the error term (which brings a wide range of other problems for log-earnings specifications), earnings (or income) will not be always positive in applications of the RBEM. In these contexts, it is critical to incorporate all graduates in the simulation, even those with zero earnings or income, no matter they were unemployed or out of the labour force during the period covered by the survey, because it is necessary to know who will and who will not afford to repay the loan (HIGGINS; SINNING, 2013).

However, log regressions do not handle outcomes that are zero, because $\ln(0) = -\infty$. Aware of that, most economists estimate earnings equations using the property that $\ln(1 + \omega) \approx \omega$ if ω is a small number (CHISWICK, 2006), transforming thus zero earnings to $\ln(1 + 0) = 0$ or to a small non-zero value. Nichols (2010) criticises this strategy, even if Tobit and “two-part” or “hurdle” models are applied, because this makes sense only when zero represents the result of a known lower detection limit, or rounding, of very small positive observations – which is not the case, as zero reflects no earnings in the RBEM approach.

In cases in which the dependent variable may assume either zero or positive values and the quantity of interest is $E(y|\mathbf{x})$, Wooldridge (2010) makes the case to model the expected value

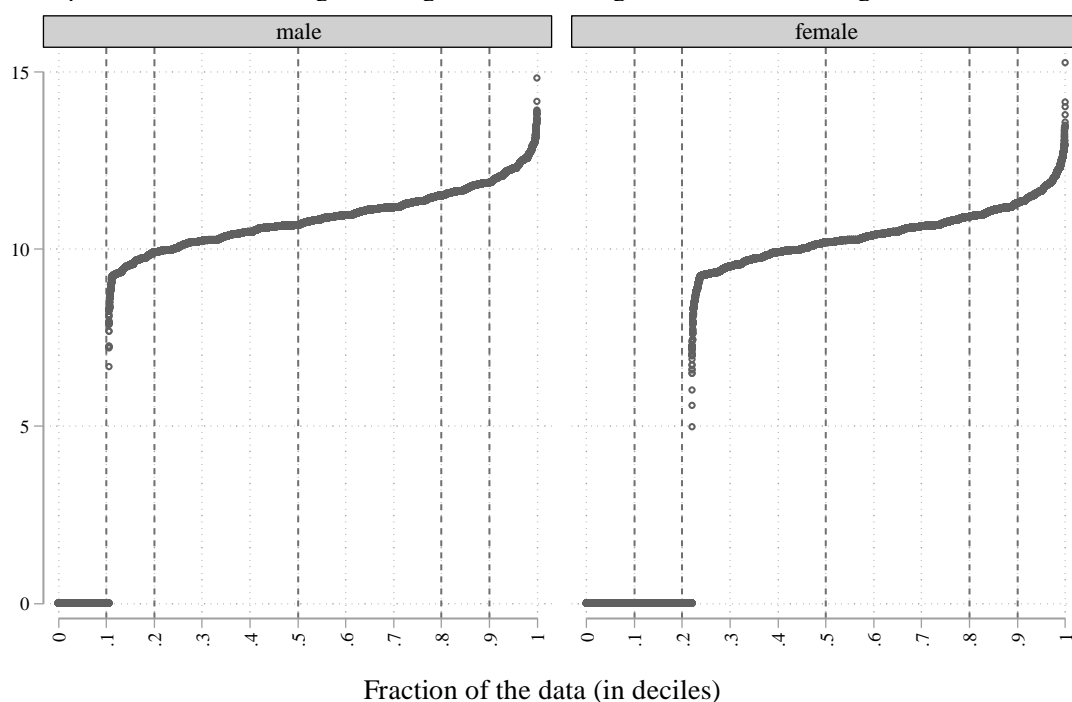
of nonnegative, continuous response variables directly (i.e., using the dependent variable in level rather than in natural log). Then, whether or not the error term is heterocedastic and even if $\ln(y)$ is not defined, a more general definition of the partial elasticity of $E(y|\mathbf{x})$ with respect to x_j , holding $x_1, \dots, x_{j-1}, x_{j+1}, \dots, x_K$ constant, applies to any model of $E(y|\mathbf{x})$ and is given by:

$$\frac{\partial E(y|\mathbf{x})}{\partial x_j} \cdot \frac{x_j}{E(y|\mathbf{x})} = \frac{\partial \mu(x)}{\partial x_j} \cdot \frac{x_j}{\mu(x)} \quad (7)$$

Wooldridge (2010) stands for applying a quasi-maximum likelihood estimate (QMLE), emphasising specifically the Poisson QMLE, which delivers consistent, \sqrt{N} -asymptotically normal estimators of the parameters in $E(y|\mathbf{x}) = \exp(\mathbf{x}\boldsymbol{\beta})$ even if y is continuous on $(0, \infty)$. Gould (2011) and Nichols (2010) also point to Poisson QMLE as the most consistent method of estimating earnings equations that include zero values. Gould, however, highlights that Poisson QMLE handles *natural* zeros, i.e., zeros that arise when all the subjects participate in the data generating process. He is particularly clear that this method is not suitable for handling zeros in an earned income model that includes those whose null income is a consequence of not having participated in the labour force, because, had they participated, their earnings may or may not have been zero.

In fact, there is no regression method to handle that problem. Had we been interested in the coefficients of the regression, we would need first to model labour market participation. In the context of the static RBEM, however, all that matters are the income measures available for the representative individual at age x lying in the q_τ^{th} conditional or unconditional quantile of the graduate earnings or income distribution. Although it is a matter of deciding the smoothing technique to be used, log-earnings specifications should be avoided. In practical terms, incorporating zero earners into the analysis generates a sharp discontinuity in the cumulative distribution function (CDF) of the earnings variable if this is specified in logarithmical form, as Figure 7 shows with data from the Continuous PNAD.

Figure 7: Empirical CDF of the log of the graduates' earnings, male and female graduates, Brazil 2015.



Graphs by Person's sex

Source: Author's own elaboration using the 2015 annual data of the Continuous PNAD.

The consequence of the discontinuity illustrated in Figure 7 is that unrealistic earnings are predicted if log-earnings specifications are used to estimate the Mincerian equation, leading to wrong repayment patterns. The best way to overcome this problem is to use the earnings variable in level, instead of in the logarithmic form.

We have already concluded that both UQR and CQR shall be tested for that purpose, and have also eliminated log-earnings specifications as a reliable option for that, implying that the dependent variable should be in level in all applications of the RBEM. The last step is to see whether Dearden's preferred model for the static RBEM smooths the Brazilian data better.

4.4.2 Does Dearden's preferred approach smooth the data better?

Using US data, Dearden (in press) shows that a quintic polynomial in age (or potential experience) is more appropriate than the usual quadratic specification to capture fluctuations in earnings over the life-cycle. Income or earnings in level shall be regressed on that polynomial (using CQR) to estimate the graduates' age-earnings profiles and then simulate the repayment prospects of a student loan scheme. Following Dearden (in press), Figure 8 shows estimates from UQR and her preferred approach for male and female graduates at the 25th percentile of their respective earnings distribution using the short panel made from 2014-2015 Continuous

PNAD data in 2017 prices. ‘Raw percentile data’ is the q^{th} quantile of earnings at each age. ‘Exponential UQR quadratic’ is the model used by Chapman and Lounkaew (2015). ‘Exponential UQR quintic’ is the same model, but using the more flexible quintic polynomial in age. ‘Quintic raw percentile data’ is Dearden’s preferred model, which consists of regressing raw earning percentiles (100 in all) by age and gender on a quintic polynomial of age, in order to predict the percentiles of graduate earnings at each age (assuming graduates stay in the same percentiles throughout their entire lives).

Figure 8: Male and female graduates at the 25th percentile of their earnings distributions: comparing methods.



Graphs by person's sex

Source: Author’s own calculations and elaboration using data from the Continuous PNAD 2014 and 2015.

Figure 8 shows that Dearden’s preferred model (quintic raw percentile data) approximates the true marginal distribution of earnings (the raw percentile data) at each age in a more reliable way than the exponential UQR methods, including at the tails of the distributions. The Appendix A compares these methods for males and females in all deciles of their earnings distributions. Dearden’s preferred model performs better in all cases and will be used for the static simulations presented alongside the dynamic simulations discussed in Chapter 5.

4.5 DYNAMIC APPROACH TO ESTIMATE AGE-EARNINGS PROFILES WITH SHORT ROTATING PANELS

Authors who simulate income-contingent payments to finance investments in human capital

often find potential gains for public budgets and positive impacts in terms of fiscal justice when ICL schemes or some form of graduate tax are hypothetically introduced into the framework of a country's HE student financing. Angles (2013), Courtioux (2012), Flannery and O'Donoghue (2011), and Vodopivec (2009) apply dynamic microsimulation models to simulate effects of income-contingent financing instruments for HE in countries where ICLs do not yet exist and public funding is the main source of finance for HEIs. Angles (2013) and Courtioux (2012) investigate the French context. The former simulates the effects of a graduate tax on government budget margins and tax justice while the latter simulates the effects of ICL schemes on career equity (in terms of collective public spending versus individual gains) and the risk of widening low education traps (by reducing the incentives to pursue HE). Flannery and O'Donoghue (2011) simulate the potential effects of ICLs in Ireland with risk sharing and risk pooling, from fiscal and distributional viewpoints. Vodopivec (2009) investigates the impact of an ICL scheme on government revenues in Slovenia, where the government maintains a tuition-free HE system⁵³. They all favour income-contingent financing as alternatives to the current system in these countries.

As discussed in section 4.3.1, tax records would be the most appropriate longitudinal data to use in Brazil to calculate RBs and to apply micro-simulation techniques to provide the closest thing to what would be a forward-looking prospect for graduates' repayment of a student loan⁵⁴. Hence, the Brazilian Government has the appropriate raw material to generate accurate lifetime age-earnings profiles for *ex ante* assessments of alternative student loan schemes and to design ICLs efficiently. Appropriate methods to do so are also well-documented in the literature. Besides the examples mentioned in the previous paragraph, dynamic simulations are also used to estimate taxpayer costs in countries with mature national ICL schemes, as mentioned in section 4.2.3. A selected review of labour force and earnings models in micro-simulation can be found in Higgins (2010), where earnings model complexity and ICL costing are discussed in detail.

⁵³ Vodopivec (2009) does not directly employ microsimulation methods; instead, he merges two datasets to simulate life-cycle earnings and employment patterns.

⁵⁴ A proper forward-looking model of student loan repayments would also require modelling behavioural responses to different loan parameters. Higgins (2010) highlights that some micro-simulation model structures have been trying to incorporate behavioural feedbacks to other simulated policies (e.g., tax and labour policies). Nonetheless, behavioural aspects of student loan repayments are still a poorly developed field. As more and better data become available on household consumption and individual debts and investments, Behavioural Economics may contribute substantially to this strand of the literature. Meanwhile, panels of tax records are the most appropriate raw material to generate accurate lifetime age-earnings and age-income profiles for *ex ante* assessments of alternative student loan schemes.

In this thesis, the innovation lies on outlining how a broad HE student financing reform based on income-contingency might look like in Brazil, eventually comprising both the public and the private HE systems. It is important to bear in mind that models of earnings dynamics are the key issue for research on the application and costing of income-contingent financing schemes (HIGGINS; SINNING, 2013). To model earnings dynamics effectively without access to tax records or other longitudinal datasets with accurate information on graduates' lifetime income and labour market, this thesis applies Dearden's simplified copula approach using the short panel data from the 2014/2015 Continuous PNAD that is described in section 4.3.2 (Table 4).

4.5.1 Copula functions

Copulas formalise dependence structures between random variables, joining two or more marginal CDFs to form their joint CDF. The greatest advantage of copulas is that one can basically isolate the marginal distributions from the dependence structure and model them separately, with no previous assumption about the dependence characteristics of the data. Marginal distributions are easier to model than a joint distribution, and once they are defined (parametrically, semi-parametrically or even non-parametrically), there will be an unique copula function that captures the dependency between the individual marginal CDFs (MIC, 2016; NELSEN, 2006; SCAILLET; CHARPENTIER; FERMANIAN, 2007).

As Demarta and McNeil (2005) present it, a d -dimensional copula C is a d -dimensional distribution function on $[0,1]^d$ with standard uniform marginal distributions. Sklar's Theorem (SKLAR, 1959) states that every distribution function F with margins F_1, \dots, F_d can be written as:

$$F(x_1, \dots, x_d) = C(F_1(x_1), \dots, F_d(x_d)), \quad (8)$$

for some copula C , which is uniquely determined on $[0,1]^d$ for distributions F with absolutely continuous margins. Conversely, any copula C may be used to join any collection of univariate distribution functions F_1, \dots, F_d using (8) to create a multivariate distribution function F with margins F_1, \dots, F_d .

Copula functions have been used by Dearden and others (2008) and by Bonhomme and Robin (2009) to simulate future age-earnings profiles using short panels. Dearden (in press) presents a simplified version of this copula approach, requiring observations for the same graduates for

as few as two successive years. This is an innovation for student loan analysis because many countries lack quality longitudinal data, but in some countries data from rotating panels (such as the Continuous PNAD) is available for researchers. Dearden's dynamic approach produces more realistic age-earnings profiles than the static approach, as it accounts for earnings transitions, that is, it does not hold graduates in the same position in the earnings distribution throughout their lives.

4.5.2 Simulating earnings dynamics with only two earnings observations

Following Dearden (in press), the weighted cumulative distributions of earnings by age, year and gender are used to operationalise the copula functions for the purposes of this thesis. To simulate dynamic age-earnings profiles and go beyond the static analysis, graduates' individual earnings in years 2014 and 2015 are now turned into their CDFs at each age t (i.e., u_{it} and u_{it+1}). Assuming these CDFs are continuous and have joint distribution $F(u_t, u_{t+1})$ as well as marginal distributions $F(u_t)$ and $F(u_{t+1})$, we need to find the unique copula function C_t , such that:

$$F(u_t, u_{t+1}) = C_t(F(u_t), F(u_{t+1})) = C_t(u_t, u_{t+1}), \quad t = 24, 25, \dots, 64, \quad (9)$$

with the d -dimensional C_t copula presenting two dimensions (because earnings are observed here only at two moments of time), and $F(u_t) = u_t$ and $F(u_{t+1}) = u_{t+1}$ (because u_t and u_{t+1} are standard uniform marginal CDFs of the earnings variable at each age t).

With a panel of two years, we are restricted to choosing among joint bivariate copulas. Following Dearden (in press), the marginal distributions are modelled using 100 percentiles and the bivariate Copula that best captures the joint distribution of the adjacent marginals (essentially the continuous transition matrix) for each age transition from 24 to 64 will then be used in the simulations. Zero earners are once again randomly distributed for this exercise.

The student's t copula (t -copula) provided the best fit for most ages both for female and male graduates from the short panel data from Brazil⁵⁵. The Akaike Information Criterion (AIC) was

⁵⁵ Copulas were tested for all 40 age transitions from ages 24 to 64. T-copula was best for 22 age transitions for female earning dynamics and for 29 age transitions for male earning dynamics. T-copula performed particularly well for most of the age transitions from ages 24 to 50 amongst women and 24 to 55 amongst men. T-copula was not as appropriate at later ages, possibly reflecting lower sample numbers and the more notable changes in earnings paths as graduates grow old.

used to pick the t -copula amongst all the several bivariate copula families available in the BiCopSelect function of R's "VineCopula" package⁵⁶.

Having established the appropriate copula to formalise the dependence structures of the graduates' earnings distribution in Brazil, R's "Copula" package⁵⁷ was used to estimate the relevant parameters for t -copulas: ρ (the rho correlation parameter) and ν (the degrees of freedom). These parameters could be estimated from the data using maximum likelihood estimation (MLE), but the maximisation process underlying this method is likely to be slow in higher moments. Hence, even for two-dimension t -copulas, it is common practice to estimate ρ by method-of-moments using Kendall's tau, and then estimate the parameter ν by MLE (DEMARTA; MCNEIL, 2005; MCNEIL; FREY; EMBRECHTS, 2015).

Figure 9 shows, by age, the estimates of the ρ parameter, its confidence intervals and its smoothed estimates for both male and female earnings.

Figure 9: Estimates of rho (ρ) from t-copula.



Source: Author's own calculations and elaboration using data from the Continuous PNAD 2014 and 2015.

⁵⁶ Version v2.1.6, documented by Nagler ([\[n.d.\]](#)).

⁵⁷ Version v0.999-18, documented by Maechler ([\[n.d.\]](#)).

Dearden (in press) interprets the ρ parameter as describing the overall level of immobility in the distribution. The higher the ρ parameter, the lower the mobility across the graduates' earnings distribution. The diagrams plotted in Figure 9 show an increasing level of immobility in the earnings distribution for graduates in Brazil for approximately the first ten years upon graduation. Then the earnings distribution becomes slightly more mobile for males until they reach their mid-50s, but the level of immobility for female graduates continues to rise until they reach their early 50s. After those points, immobility for men returns approximately to the same level observed for their 30s, but it drops sharply for women over 50. In either case, Figure 9 implies considerably lower earnings mobility among graduates in Brazil in comparison with trends reported by Dearden for US graduates (DEARDEN, in press).

The other parameter, ν (the degrees of freedom), can broadly interpreted as the excess immobility in the tails of the distribution. The lower the ν parameter, the lower the mobility in the tails. Figure 10 shows, by age, the ν degrees of freedom estimates, their confidence intervals and the corresponding smoothed estimates for both males and females.

Figure 10: Estimates of degrees of freedom (ν) from t -copula.



Source: Author's own calculations and elaboration using data from the Continuous PNAD 2014 and 2015.

Figure 10 implies that, as ν decreases, a graduate i who was in either the bottom (or top) quantiles of the earnings distribution in year t will face a higher probability of upward (or

downward) mobility in the first years upon graduation, and again at later ages. However, the large confidence intervals at later ages, especially where graduate sample sizes are much smaller (particularly for women), mean that caution is needed.

Having obtained our estimates, we have a relatively straightforward way of simulating forward for a sample of 24-year-old graduates taken from our 2014-15 Continuous PNAD panel. This involves⁵⁸:

1. Drawing a sample of 10,000 women and 10,000 men aged 24 with replacement from our panel;
2. Estimating the conditional distribution of the marginal CDF at age 25 (u_{25}) given the marginal CDF at age 24 (u_{24}) which is given by:

$$c_{u_{24}}(u_{25}) = \frac{\partial}{\partial u_{24}} C_{24}(u_{24}, u_{25}) \quad (10)$$

where C_{24} is the estimated Copula (t -Copula) with parameters ν and ρ from our smoothed estimates at age 24.

3. Generating a random standard uniform variable r with the same dimension as u_{24} , i.e., 10,000.
4. Generate $u_{25} = c_{u_{24}}^{-1}(r)$ to get our uniformly distributed predicted rank at age 25, which has a stochastic element due to the rank prediction being determined by the draw from the random uniform.
5. Repeat steps 2 to 5 for each sequential age.

These simulations are then re-weighted by gender to reflect gender-specific graduation rates for Brazil in 2016, which was the year of the most recent annual edition of the Higher Education Census available at the time this work was done⁵⁹.

How do these simulations perform? Besides examining overall and tail dependences in the earnings data, it is also relevant to analyse its monotone dependence, usually referred to as *concordance*. A pair of CDFs $\{(u_{ti}, u_{t+1i}), (u_{tj}, u_{t+1j})\}$ are concordant if both values of one pair are greater than the corresponding values of the other pair. That is if $u_{ti} < u_{tj}$ and $u_{t+1i} < u_{t+1j}$ or $u_{ti} > u_{tj}$ and $u_{t+1i} > u_{t+1j}$. They are discordant if for one pair one value is greater

⁵⁸ The author thanks Professor Lorraine Dearden, from the University College of London (UCL), for patiently explaining all the steps of her dynamic model and summarising the simulations with these bullets.

⁵⁹ Graduation rates in Brazil in 2016 were: 61.4% females, 38.6% males.

and the other smaller than for the other pair. That is if $u_{ti} < u_{tj}$ and $u_{t+1i} > u_{t+1j}$ or $u_{ti} > u_{tj}$ and $u_{t+1i} < u_{t+1j}$. Finally, they are tied if $u_{ti} = u_{tj}$ or $u_{t+1i} = u_{t+1j}$ (DEARDEN, in press; NELSEN, 2002).

When dealing with copulas, two common measures of association are Kendall's Tau and Spearman's Rho (MIC, 2016). Kendall's tau-b rank correlation (τ) is used here to measure the degree of concordance of the earnings CDFs at adjacent ages. Denoting the number of concordant and discordant pairs respectively by n_c and n_d , and the number of tied pairs by n_t and n_{t+1} , Kendall's tau measure for our panel of Brazil's graduates is given by (DEARDEN, in press):

$$\tau = \frac{n_c - n_d}{\sqrt{(n_c + n_d + n_t) \times (n_c + n_d + n_{t+1})}}, \quad (11)$$

and the total number of pairs that can be constructed and compared for a sample of size T is $n = (1/2)T \times (T - 1)$. For copulas of essentially all useful distributions in the elliptical class, Demarta and McNeil (2005) show that Kendall's tau can be estimated from the copula's parameters and is given by $\tau = \frac{2}{\pi}(\arcsin(\rho))$. Figure 11 compares Kendall's tau from the panel, from the t -copula estimates and from the simulated earnings sample with pseudo-observations (where smoothed model estimates of ρ and ν were used).

Figure 11: Measuring the degree of concordance of the earnings CDFs at adjacent ages using Kendall's tau: estimates from the initial panel, from the t -copula and from the simulations with pseudo-observations.



Source: Author's own calculations and elaboration using data from the Continuous PNAD 2014 and 2015.

Note: zero earners are randomly distributed at the bottom of the cumulative earnings distribution at each age.

Figure 11 shows that estimates for both the t -copula and the simulated sample satisfactorily replicate the dependence structures over adjacent ages of the panel data obtained from the Continuous PNAD. Figure 9, Figure 10 and Figure 11 together suggest that the graduates' earnings distribution in Brazil is characterised by low mobility and high dependence at adjacent ages, particularly compared to US graduates analysed in Dearden (in press). Intuitively, this seems to reinforce the prognosis that Brazil's labour market is much less flexible than the US labour market.

It is worth highlighting that mobility and dependence trends are likely to change for future graduates. Moreover, the copula models used in this thesis only consider first order rank dependence, and it is likely that where a person ends up in the earning distribution now may be determined partially by earlier outcomes. It is not possible to test for this in Brazil, because only transitions over a single year are observed. These limitations need to be emphasised, but age-earnings profiles obtained from the simulated sample are a first best guess about future earnings paths for graduates in Brazil and provide a useful starting benchmark for analysis in the next chapter.

5 SIMULATING ALTERNATIVE STUDENT LOAN DESIGNS FOR BRAZIL

5.1 INTRODUCTION

In this chapter, different scenarios will be simulated for a broad reform of the Brazilian system of HE student financing. Hypothetical student loan schemes for Brazil are analysed in terms of repayment hardship and taxpayer costs. Initial scenarios use parameters from the old TBRL and the new ICL versions of FIES to simulate alternative student loan designs and compare both the cost implications for taxpayers and the distributional implications for the cohort of borrowers. Other scenarios modify the parameters to illustrate the fiscal and distributional implications of interest rates, repayment rates and thresholds, surcharges and cohort risk premiums. Repayment patterns in both TBRL and ICL scenarios are simulated by applying the key parameters of the hypothetical loan designs to the age-earnings profiles obtained from a simulated cohort of graduates, applying the dynamic copula approach proposed by Dearden (in press) to a two-period panel constructed with household survey data from Brazil (Chapter 4). Comparisons with Dearden's (in press) preferred static approach (also outlined in Chapter 4) will show how allowing mobility in the graduates' earnings distribution improves the quality of the results.

The static approach will overestimate the cost of an ICL and thus provide an upper bound on costs – see Higgins and Sinning (2013) and Dearden (in press). The dynamic approach will provide more robust evidence on likely taxpayer costs and the implications for graduates in different parts of the lifetime graduate earnings distribution. Although the dynamic models account for earnings mobility, it is important to recall that this is done based on transitions from just one year to another and then the models replicate these mobility trends into the future. In the real world, earnings mobility across the lifetime also depends on factors other than single-year transitions. Therefore, results from the dynamic simulations shall be taken as a more realistic, but still limited, picture of the reality. The upper bound on costs provided by the static simulations represents a maximum limit of subsidies involved in the ICL design, keeping constant the external conditions that may affect the size of these subsidies. The method applied to simulate repayment patterns for different student loan designs is at the frontier of student loan analysis and is a valuable approach to model HE student financing reforms.

Although the reported results may also help assess the potential of the new FIES to balance repayment flows and social concerns, the ultimate objective of the simulations is to show what a feasible broad ICL system in Brazil might look like, eventually comprising both public and private sectors, and how it would be better than TBRL alternatives. While providing a useful discussion for improving the design of the new FIES, results may fuel the debate about the introduction of tuition fees at public HEIs, perhaps reshaping legislative propositions under review in the Brazilian Congress (Chapter 3, section 3.2.1), as the ICL alternatives represent affordability for the borrower and sustainability for the scheme.

Simulations assume that a typical four-year degree costs BRL 50,000 on average⁶⁰. This is roughly equivalent to the average annual earnings for graduates in our whole sample (pooling male and female graduates together). It is also assumed that the size of the loans fully covers tuition fees, but not living costs. Loans follow a skewed distribution, approximately log-normally distributed, and have a standard deviation of BRL 25,000. Students can borrow a minimum of BRL 5,000 and a maximum of BRL 300,000 in the simulated scenarios⁶¹. Unlike FIES, no payments are required during the study period. Inflation is assumed to be 4.5 per cent p.a., which is the centre point of the official inflation target range in Brazil since 2005, and a real discount rate of 5 per cent p.a. applies, consistent with market expectations for the long-term cost of borrowing to the Brazilian government⁶². A 1 per cent annual real growth is assumed for all earnings during the simulated years. First, a scheme resembling the last TBRL version of FIES (offered in 2017) will be discussed. Then, some alternative designs for a broad ICL system will be assessed. The first one will replicate parameters applied to the income-based FIES offered in Brazil in 2018. Additional scenarios will change the assumptions regarding the discount rate to illustrate the sensitiveness of the results to this parameter.

⁶⁰ According to the *National Fund for Educational Development (FNDE)*, the federal agency controlled by the Ministry of Education that is responsible for the administration of FIES, the average tuition fee paid by the federal government for FIES contracts signed in 2014 was BRL 45,840.

⁶¹ Initially, the ICL version of FIES, introduced in 2018, financed up to BRL 30,000 per semester (which would give BRL 240,000 over four years). Contracts signed in the second semester of 2018 will be subject to a loan cap of BRL 43,000 per semester (which would give BRL 344,000, over four years). A BRL 300,000 upper limit is, therefore, realistic. Converting it into 2017 USD using purchasing power parities (PPPs) for GDP (following OECD, 2018), the maximum amount to borrow in our simulations is approximately USD PPP 148,200. The minimum amount would be equivalent to USD PPP 2,470.

⁶² According to a survey conducted in April 2017 by the Central Bank of Brazil (2017), the real rate of interest in Brazil is neutral between 4 and 5 per cent p.a.

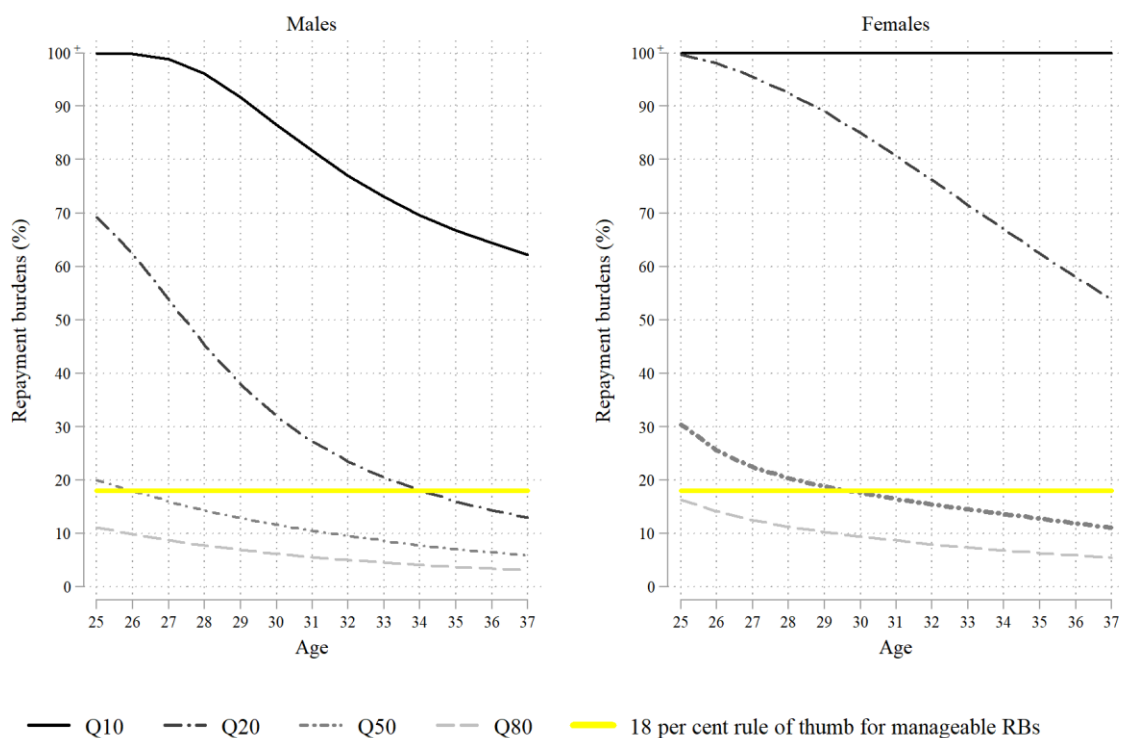
5.2 RESULTS FOR TBRLS

The last TBRL version of FIES was offered in 2017, with a nominal interest rate of 6.5 per cent p.a., an 18-month grace period upon graduation and a repayment period of up to three times the normal length of the degree plus 12 months (i.e., thirteen years, for individuals borrowing to pay tuition fees related to a typical four-year degree). Simulating a TBRL with these parameters illustrates the proportion of Brazil's graduates who would be likely to face RBs above a manageable level if borrowing from the FIES in recent years.

Two features of the FIES TBRL are not incorporated into our simulations. First, in the actual scheme loans were defined based on the student's family income, the area of the degree and the location of the HEI. Most of the loans did not cover 100 per cent of tuition fees while in our simulations we assume they do. Second, during the study and grace periods of the actual FIES, small quarterly payments were required to cover part of the accrued interest. Our simulations do not incorporate these payments.

For simplicity, we will consider here that exceeding the rule of thumb for manageable RBs entails repayment hardship. Similarly to Chapman and Lounkaew (2015), Chapman and Doris (in press) and Cai, Chapman and Wang (in press), Figure 12 reports RBs by age for selected percentiles, as if all graduates held a BRL 50,000 TBRL. This is the typical static approach (i.e., it assumes no earnings mobility) used in RB analysis. As in the cited analyses, prospects of repayment hardship affect considerably the bottom 20 per cent of the graduate earnings distribution. Even graduates at the median of the earnings distribution face excessive RBs, at least at young ages and particularly amongst women.

Figure 12: Repayment burdens for FIES TBRLs, various quantiles of the earnings distribution.

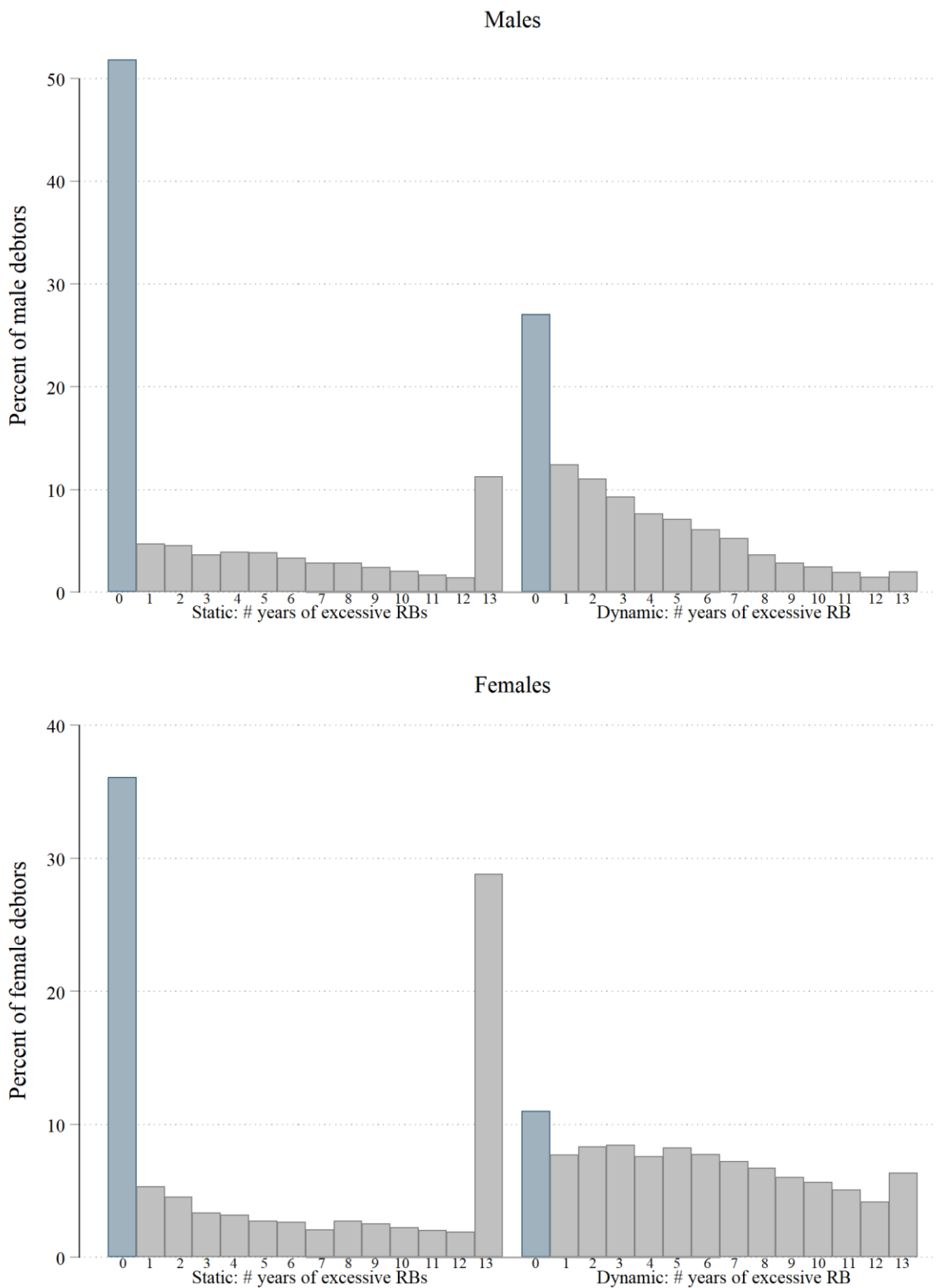


Source: Author's own calculations and elaboration using data from the Continuous PNAD 2014 and 2015.

Allowing for mobility reveals that repayment hardship tend to be greater than the static simulations show. We can see that by following Dearden (in press) and analysing repayment hardship in terms of the number of years a debtor faces excessive RBs.

Figure 13 plots the proportion of borrowers facing RBs above the 18 per cent rule of thumb for manageable RBs for each of the n number of years comprising the thirteen-year repayment period (i.e., $n = 1, 2, \dots, 13$). The blue bars show the proportions of borrowers not facing any year of excessive RBs (i.e., $n = 0$). The diagrams report results separately by sex for both static and dynamic simulations.

Figure 13: Measures of years of excessive RBs for the TBRL version of FIES.



Source: Author’s own calculations and elaboration using data from the Continuous PNAD 2014 and 2015.

Obs.: the light blue bars represent the proportion of graduates not facing RBs above the 18-percent rule of thumb for manageable RBs in any of the years of the repayment period.

Figure 13 reinforces the importance of dynamic models for RB analysis. The diagrams make explicit a point anticipated in Chapter 4: static simulations underestimate the total proportion of borrowers facing high RBs at some point of the repayment period and overestimate the proportion of borrowers facing excessive RBs during the entire repayment period. Overall, the proportion of individuals facing one or more years of excessive RBs is considerably higher in simulations incorporating earnings mobility than in static simulations. If no mobility is assumed, 51.8 per cent of the males and 36.1 per cent of the females would never face RBs greater than 18 per cent when repaying a typical FIES TBRL. The estimates from the dynamic model are much lower: only 27.0 per cent of the males and 10.9 per cent of the females would never face excessive RBs. So, even in a country like Brazil, where earnings mobility is relatively low (Chapter 4), static and dynamic simulations entail very different results.

RB calculations reported in this Chapter illustrate that TBRLs are likely to impose problems for individual graduates in Brazil. High default rates reported by Brazil (2017a) for the FIES TBRLs seem to provide additional support to this statement: nearly 30 per cent of contracts in repayment period were over a year in arrears, and there was a prospect of default eventually reaching 50 per cent of all loan disbursements. Next, it will be discussed whether ICLs are feasible alternatives to balance this trade-off between taxpayer subsidies and RBs in a hypothetical government-guaranteed student loan system for Brazil.

5.3 RESULTS FOR ICLS

This section reports the results of simulations involving five alternative ICL arrangements for Brazil. Unlike in TBRLs, RBs in ICLs are controlled by the policymaker, as maximum RBs can never exceed the maximum repayment rate of the ICL (BARR *et al.*, 2017). Further default is not an issue for the borrower, as repayments are automatically suspended in periods of low or zero earnings (depending on the repayment threshold) and continue until the loan is repaid or the debt is written off. Further non-repayment does not affect an individual's credit reputation and becomes a built-in design factor of the ICL. This means that subsidies can be more effectively aligned with public preferences over time with fine adjustments to parameters such as the loan's size, scope, length, rates of interest, and repayment rates and thresholds (BARR *et al.*, 2017).

As is the case in Australia, repayment rates are levied on total (rather than marginal) gross earnings in all but the last model, which also uses a marginal repayment rate (as is the case in England) to compare the results. Any outstanding debt is forgiven at age 65, implying a loan write-off after 41 years for the 24-year-old graduates in the simulated sample. The following scenarios will be presented:

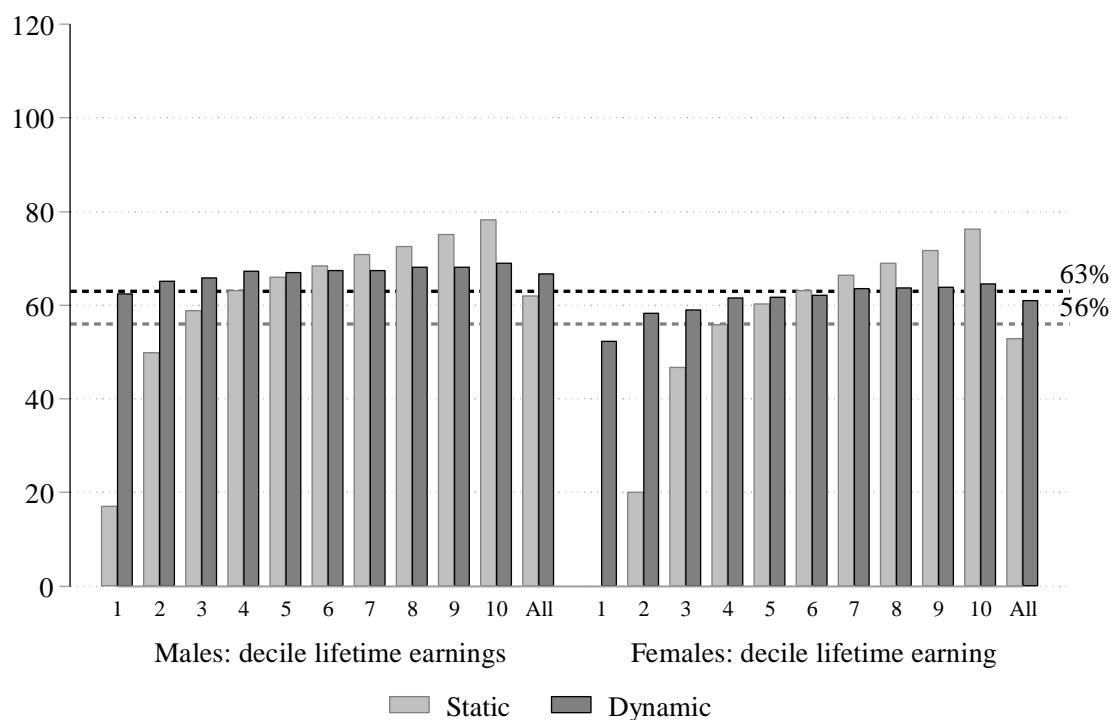
- Scenario 1: a baseline scenario with no earnings threshold and outstanding balances adjusted by inflation (i.e., a subsidised zero per cent real interest rate is applied).
- Scenario 2: real interest rate is introduced, and it is equal to the government's cost of borrowing;
- Scenario 3: a cohort risk premium is tested to help financing non-repayment, that is, the rate of interest is set above the government's cost of borrowing;
- Scenario 4: an initial threshold is introduced, as well as a loan fee; interest rate at the government's cost of borrowing applies upon graduation, so long as earnings are above the initial threshold.
- Scenario 5: four different repayment rates are introduced, aligned with repayment thresholds valid for taxing personal income.

Additional scenarios will be presented in the next section to illustrate implications when changing external conditions such as the discount rate and the earnings growth rate.

5.3.1 Scenario 1: a flat repayment rate with no earnings thresholds, outstanding balances adjusted by inflation.

The first simulated ICL scheme applies parameters of the income-based scheme introduced by the Brazilian federal government in 2018: a flat 13 per cent repayment rate with no earnings thresholds and outstanding balances adjusted by CPI. Static and dynamic results are shown in Figure 14 by deciles of lifetime earnings for both male and female graduates. The dynamic approach overcomes the limitation of no earnings mobility that characterises the static method. However, the dynamic results are also limited: it relies on data related only to two years, so it is likely to overestimate short-lived mobility trends. In a way, the static and the dynamic results set respectively an upper and a lower boundary on the true taxpayer subsidy.

Figure 14: Scenario 1: proportion of ICL loan repaid by decile of male and female lifetime earnings, static vs dynamic earning simulations.



Source: Author's own calculations and elaboration using data from the Continuous PNAD 2014 and 2015.

In scenario 1, the dynamic model estimates that women would be subsidised 39 per cent and men 33 per cent of the original loan amount in net present value (NPV) terms. Ignoring dynamics would incorrectly imply substantial higher overall subsidies – 47 per cent for women and 38 per cent for men. Weighting males and females according to their respective recent graduation rates,⁶³ it is shown that the government would recover around 63 per cent of the total loan disbursements – seven percentage points above the estimation from the static model.

The size of the taxpayer subsidy depends on the individual lifetime earnings profile, the size of the loan and the scheme's parameters. Because the length of the repayment period in ICLs differs across borrowers, the higher the subsidy the lower the graduate's assessable income during the period they must repay the loan. This is because interest-rate subsidies are cumulative, so individuals who take longer to repay their loans end up receiving higher interest-rate subsidies. These are, therefore, progressive. Nevertheless, indiscriminate concessional interest rates benefit all borrowers, including those at the top

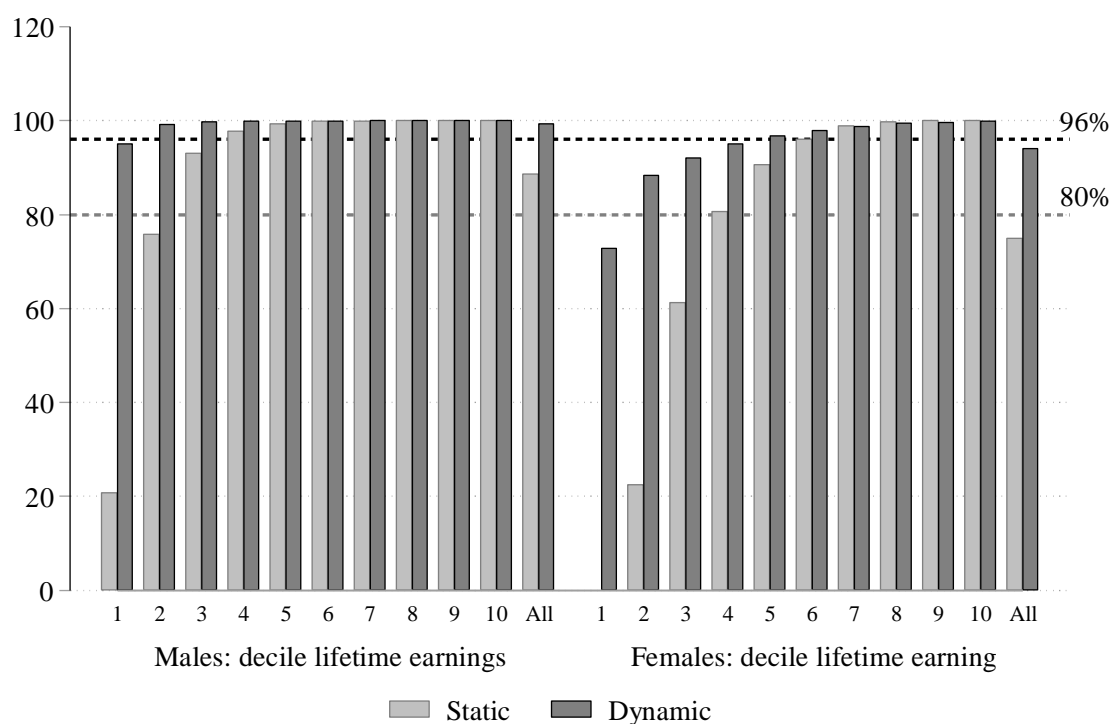
⁶³ As shown in Chapter 4, graduation rates for males and females reported by the 2016 edition of the official Higher Education Census were used: 61.4% females, 38.6% males.

deciles of the earnings distribution. Given the precarious nature of Brazil's government finances, the subsidies involved with this current FIES ICL seem unreasonably large. Distributional impact of introducing real rates of interest will be shown with the results from the next scenarios.

5.3.2 Scenario 2: raising interest rates to the government's cost of borrowing

The second simulated ICL scheme maintains the same parameters as in scenario 1, but applies a real rate of interest of 5 per cent p.a., equal to the level assumed in this thesis for the government's cost of borrowing in Brazil. This ensures that those who pay off their loan in full will pay off the full NPV of their loan (BARR *et al.*, 2017). Figure 15 shows the static and dynamic results for this scenario.

Figure 15: Scenario 2: proportion of ICL loan repaid by decile of male and female lifetime earnings, static vs dynamic earning simulations.



Source: Author's own calculations and elaboration using data from the Continuous PNAD 2014 and 2015.

Comparing Figure 14 and Figure 15 illustrates how equalising interest rates with the discount rate reflects on the repayment patterns for males and females across the graduates' earnings distribution in Brazil. While subsidies in scenario 1 point toward none of the debtors fully repaying their loans in present value terms, in scenario 2 all males in the fourth decile and above repay, as well as females in the top two deciles. Eliminating interest-rate subsidies

increases recovery ratios considerably, alleviating the fiscal budget. The cut in subsidies increases repayment also from the bottom of the earnings distribution, but – most importantly – it barely affects those who undeniably earn low levels of income throughout life. This is because: (a) keeping all the other parameters constant, raising interest rates lengthens the repayment period, but, unlike in TBRLs, it does not affect the debtor’s annual inflows of net income; (b) lifelong low earners end up having all or part of their debts written-off when the time forgiveness rules apply. Even graduates with ‘good’ or ‘high’ lifetime earnings profiles may eventually benefit from the insurance features of an ICL scheme, because payments are suspended in periods when the borrower does not earn any income. This is the intuition underlying the insurance component that characterises ICL schemes designed with debt-forgiveness rules.

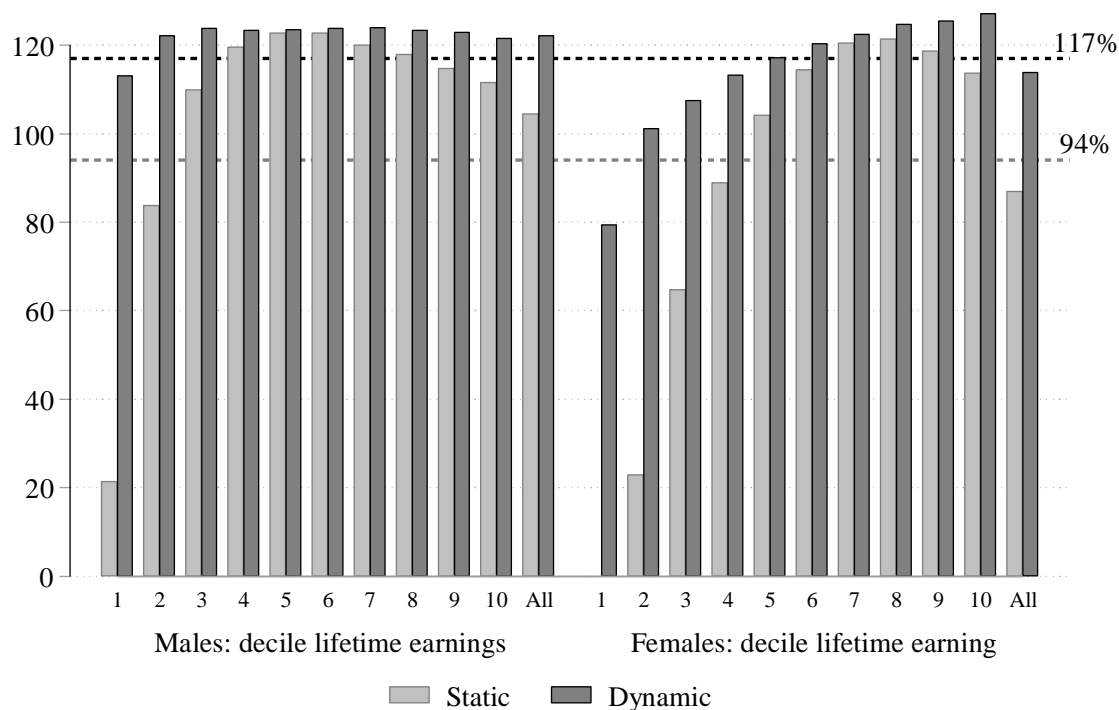
Summing up, concessional interest rates are not required to protect borrowers against default and financial hardship in ICLs (as discussed in Chapter 2). Interest subsidies do increase the costs of government-guaranteed ICLs, particularly if the gap between the loan’s rates of interest and the government’s cost of borrowing is high, as it has been in Brazil. Setting interest rates at the government’s cost of borrowing would be a simple adjustment to the current FIES system that could save taxpayers a considerable amount of money and a possible solution if the government values social justice and aims to concentrate ICL subsidies on graduates with low lifetime earnings. For this reason, this is going to be the preferred scheme until one of the forthcoming scenarios illustrates design features best balancing taxpayer subsidies and debtors’ insurance.

All the same, scenario 2 still imposes the full costs of non-repayment on the taxpayer. Next, we discuss whether rising interest rates above the government’s cost of borrowing could be an alternative to finance non-repayment in Brazil.

5.3.3 Scenario 3: testing a cohort risk premium to finance non-repayment

The third simulated ICL scheme introduces real interest rates 2 p.p. above the government’s cost of borrowing, maintaining all the other parameters constant. This change moves our hypothetical ICL system from a 100 per cent risk-sharing approach towards a risk-pooling approach. This implies transferring at least part of the cost of non-repayment from the taxpayer to the pool of debtors. Figure 16 shows how repayments for our risk-pooling ICL would be distributed across the simulated cohort of borrowers.

Figure 16: Scenario 3: proportion of ICL loan repaid by decile of male and female lifetime earnings, static vs dynamic earning simulations.



Source: Author's own calculations and elaboration using data from the Continuous PNAD 2014 and 2015.

Real interest rates above the government's cost of borrowing allow some "profit" to be raised from the student loan scheme. Results from the static model hide these potential fiscal gains, but the dynamic model reveals that, at a real rate of 7 per cent p.a. (instead of 5 per cent p.a.), it would be expected to recover 17 per cent more than the present value of the disbursed loans. However, two major pitfalls arise:

- (i) this surplus would come at the expense of progressivity within the cohort of borrowers: although everyone repays more, those requiring longer repayment periods to service the debt would have to pay the interest rate premium for a longer period than high earnings graduates. Therefore, some individuals in the middle of the earnings distribution may end up repaying more (in NPV terms) than peers at the top (this is evident in Figure 16 within the cohort of male debtors)⁶⁴;

⁶⁴ Note, in *Figure 16*, that regressive trends are more severe when mobility is not considered. Relying only on results from static simulations, strong regressive repayment patterns are also reported by Chapman and Doris (in press) in scenarios involving real rates of interest in hypothetical student loans for Ireland.

- (ii) risk pooling increases the chances of adverse selection: wealthy high-ability individuals may opt out if more advantageous financing options become available for them (DEL REY; RACIONERO, 2014).

In view of these drawbacks, and assuming the government does not aim to use student loans to subsidise other areas of public policy, cohort risk premiums need to be carefully designed if they are to be considered at all to help financing non-repayment in an ICL in Brazil. The next scenario will assess whether loan surcharges tends to work better for this.

5.3.4 Scenario 4: introducing loan surcharges to reduce taxpayer subsidies

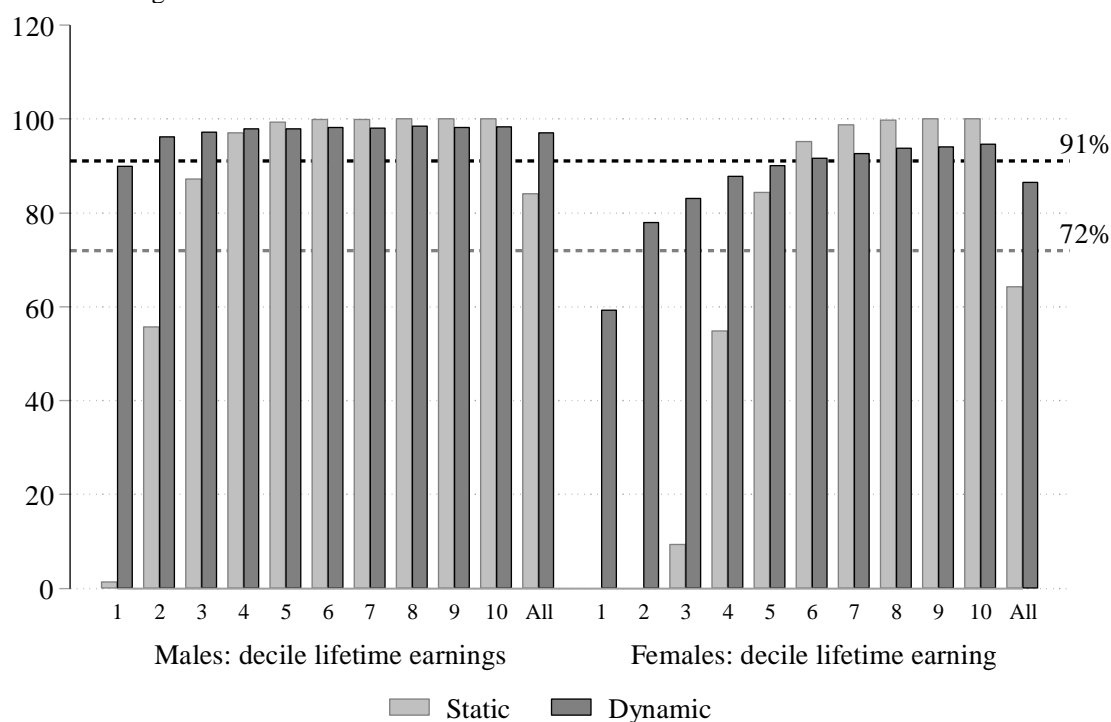
The fourth simulated ICL scheme restores the rate of interest to the level of the government's cost of borrowing, but introduces the following changes to the original design simulated for scenario 1:

- (i) during the study period, outstanding balances are adjusted by CPI and a universal loan fee of 25 per cent is charged on the initial borrowing⁶⁵;
- (ii) during the repayment period, outstanding balances are adjusted by the government's cost of borrowing, except for debtors whose earnings lie below the same initial threshold as the one valid for personal income tax purposes (in 2017, this was set at BRL 22,847.76 per year, roughly equivalent to 2017 USD PPP 11,300). For these, outstanding debts are adjusted by CPI and payments are suspended.

Results for this scenario are shown in Figure 17.

⁶⁵ The choice to apply 25% in this scenario takes as benchmark the loan fees paid by full-fee undergraduate students borrowing from the Australian ICL system to study in private HEIs (NORTON; CHERASTIDTHAM, 2016).

Figure 17: Scenario 4: proportion of ICL loan repaid by decile of male and female lifetime earnings, static vs dynamic earning simulations.



Source: Author's own calculations and elaboration using data from the Continuous PNAD 2014 and 2015.

Loan fees are a type of loan surcharge. Introducing them alongside providing concessional interest rates while the debtor studies or falls below an earnings threshold implies two things: first, controlling debts' growth before the repayment period commences; second, protecting both temporary and lifetime low earners during the repayment period. In addition, the choice of the initial threshold at the level valid for personal income tax purposes disentangles student loan repayments from the welfare system and simplifies the collection mechanism.

It is important to verify the costs of these changes in terms of revenue loss. To do this, overall results from our benchmark scenario (Figure 15) are compared with those from Figure 17 as well as with overall results obtained when testing an alternative threshold for scenario 4, at the level of the national minimum wage (not shown in the diagrams of Figure 17). Simulation with the alternative initial threshold for scenario 4 follows the Hungarian system, which insures only debtors earning below the national minimum wage (BERLINGER, 2009).

Setting the repayment threshold at the higher level implies relatively low revenue loss for the hypothetical ICL system, even though the initial threshold for personal income tax purposes is more than twice the level of the national minimum wage in Brazil. In scenario

2, loan recovery modelled with dynamics has reached 96 per cent of the total loan disbursements. If a repayment threshold were introduced, however, revenue would be reduced by 4 p.p., if the threshold is set at the level of the national minimum wage, or by 6 p.p., if set at the same level as the initial threshold for personal income tax purposes. Given its equity and efficiency gains, this new scheme, introducing a surcharge and levying the 13 per cent repayment rate only on taxable earnings, now replaces the scheme simulated in scenario 2 as our preferred system and will be compared with the next scenario introducing more repayment thresholds.

5.3.5 Scenario 5: incorporating additional thresholds and comparing results when marginal repayment rates apply

The fifth simulated ICL scheme uses all four thresholds that are valid for taxing personal income in Brazil as thresholds for the ICL, with progressive repayment rates instead of a flat 13 per cent rate. It also compares the impacts when introducing marginal rather than average repayment rates. Repayment rates are set to half of the respective marginal rates for taxing income. The loan fee on the initial borrowing is maintained, and interest rates at the level of the government's cost of borrowing apply upon graduation, except while earnings remain below the initial threshold. Repayment rates and thresholds are reported in Table 5, along with the tax marginal rates on which the repayment rates for collection of this hypothetical ICL scheme were based.

Table 5: Annual thresholds and repayment rates for the ICL scenarios

#	Annual thresholds		Repayment rate for ICL collection purposes	Rates for taxing personal income
	In 2017 BRL	In 2017 USD PPP		
1	22,847.76	11,288.42	3.75 per cent	7.5 per cent
2	33,919.80	16,758.79	7.5 per cent	15.0 per cent
3	45,012.60	22,239.43	11.25 per cent	22.5 per cent
4	55,976.16	27,656.20	13.75 per cent	27.5 per cent

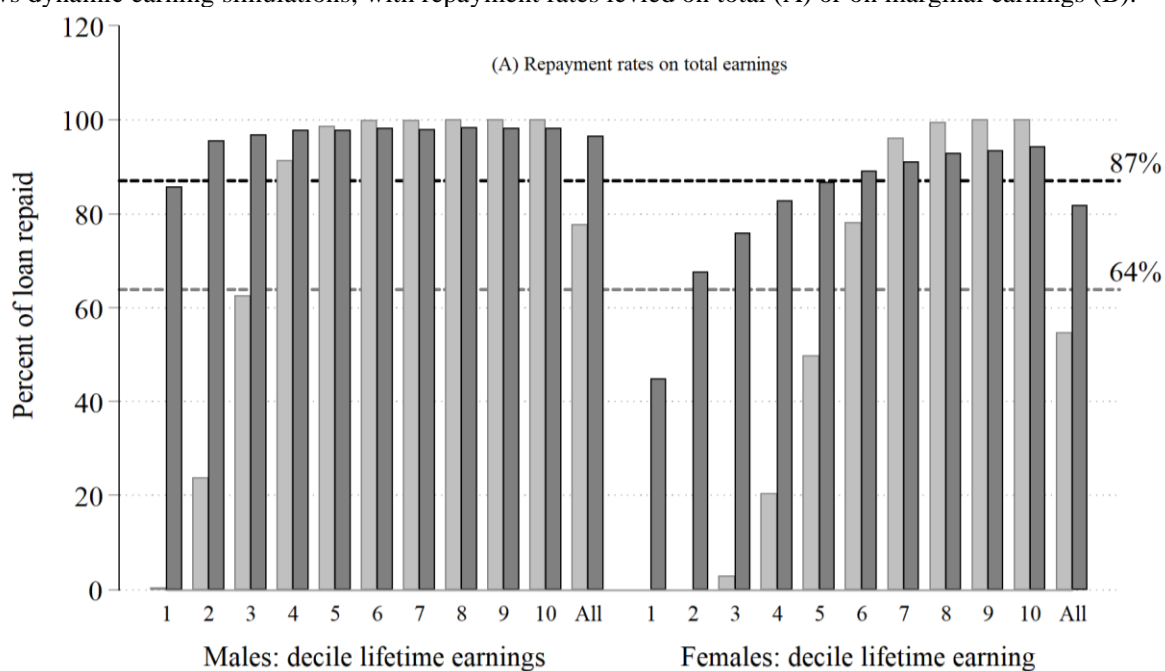
Source: Author's own elaboration.

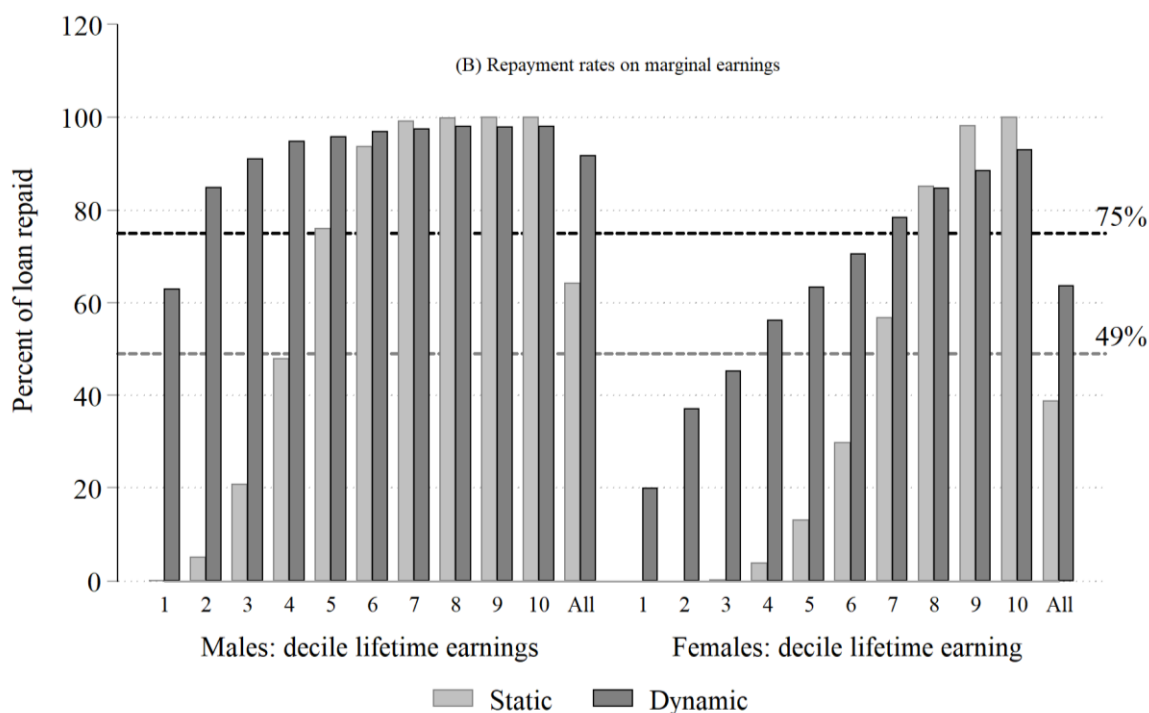
Note: Income tax rates are levied on marginal income in Brazil, and some sources of income are not taxable. Repayment rates in our previous ICL simulations were levied on total (not marginal) pre-tax earnings. For this scenario, we compare results when repayment rates are levied on total gross earnings with results when repayment rates are levied on marginal earnings.

Introducing more thresholds and associating most of them with lower repayment rates than in the previous simulated schemes helps to make the ICL scheme more progressive, although it necessarily reduces revenue. In comparison with results for the previously

preferred ICL design (scenario 4, presented in Figure 17), dynamic simulations for scenario 5 increases the subsidy by three pp if repayment rates are levied on total earnings, or by 17 pp if marginal rates apply, as illustrated in Figure 18. Static simulations increase the overall subsidy by 8 pp if repayment rates are levied on total earnings, or by 23 pp if marginal rates apply. Again, the static simulations overestimate, while the dynamic simulations underestimate, the ICL subsidy, and the higher the discount rate, the higher this difference.

Figure 18: Scenario 5: proportion of ICL loan repaid by decile of male and female lifetime earnings, static vs dynamic earning simulations, with repayment rates levied on total (A) or on marginal earnings (B).





Source: Author's own calculations and elaboration using data from the Continuous PNAD 2014 and 2015.

Opting for marginal rates avoids the sharp discontinuities in graduates' earnings once they reach a repayment threshold. Sharp discontinuities in repayment thresholds are more likely to happen when repayments are required on a percentage of total earnings, as in the scenarios simulated throughout this section. As Barr and others (2017) emphasise, repayment schedules should avoid creating large "cliff edges", because this kind of distortion may lead, for example, to reductions in labour supply and bunching of earnings below the threshold. Fine adjustments in the design, starting with a higher repayment threshold and a lower repayment rate and then scaling them up smoothly, was the final strategy adopted here to reduce such discontinuities. This strategy outlines an ICL scheme requiring repayments on total earnings as a way to increase revenue and keep taxpayer subsidies relatively low, while insuring against temporary and lifetime low earnings as well as favouring progressivity.

Using marginal rates also significantly reduce RBs for all earners; in this scheme, most higher lifetime earners will face RBs significantly below the maximum rate of 13.75 per cent. This scheme waives revenue in exchange for smoothing the discontinuity in taxable earnings around kink points. This might be a desirable feature, but the final choice between one and other designs illustrated in Figure 18 would depend fundamentally on political choices. It would also depend on whether reducing sharp discontinuities is worth an

additional three or 17 percentage points of revenue loss in comparison with our previous preferred design (or even more, considering the static simulations as an upper bound).

In either case, the expected taxpayer subsidies shown in the diagrams of Figure 18 are lower than the expected loss with the FIES TBRLs undertaken from 1999 to 2017. As seen in Chapter 3, the historical average implicit subsidy for the TBRL versions of FIES was 38 per cent, fluctuating from a lower level of 16 per cent (observed in 2009) to a higher level of 60 per cent (observed in 1999). In addition, reports from the Federal Government (Brazil, 2017a; b) estimate a prospective loss of up to 50 per cent with default in the FIES TBRL contracts currently in repayment period. For the ICL designs shown in Figure 18, total taxpayer subsidies (which includes loss due to non-repayment, often called *doubtful debts*) would lie between 12 and 26 per cent (in the dynamic simulations), with an upper boundary of 51 per cent if considering the static simulations. Additional scenarios in the next section will illustrate how the results for these two preferred designs change with modifications in exogenous conditions related to the discount rate (i.e., the level of the government's cost of borrowing and the earnings growth rate).

5.4 IMPLICATIONS WHEN CHANGING EXTERNAL CONDITIONS FOR THE PREFERRED ICL SCENARIO

The ICL simulations reported in this chapter involve four critical parameters:

1. The discount rate;
2. The earnings growth rate;
3. The loan's rate of interest;
4. The repayment rate(s) and threshold(s), which are the rate(s) and level(s) at which earnings are charged to service the debt.

The rate of interest and the repayment rates and thresholds are endogenously determined by the scheme design. In other words, these parameters are defined by the policymaker, subject to the political and institutional constraints affecting the policy choice. The discount rate and the wage rate are exogenous parameters, that is, those who formulate the student loan scheme have little or no control over their course. The implications of variations in the endogenous parameters were illustrated with the ICL scenarios presented in the previous section, both to the loan's recovery and to the

loan's affordability for the borrowers. It is now time to discuss the implications of variations in the exogenous parameters.

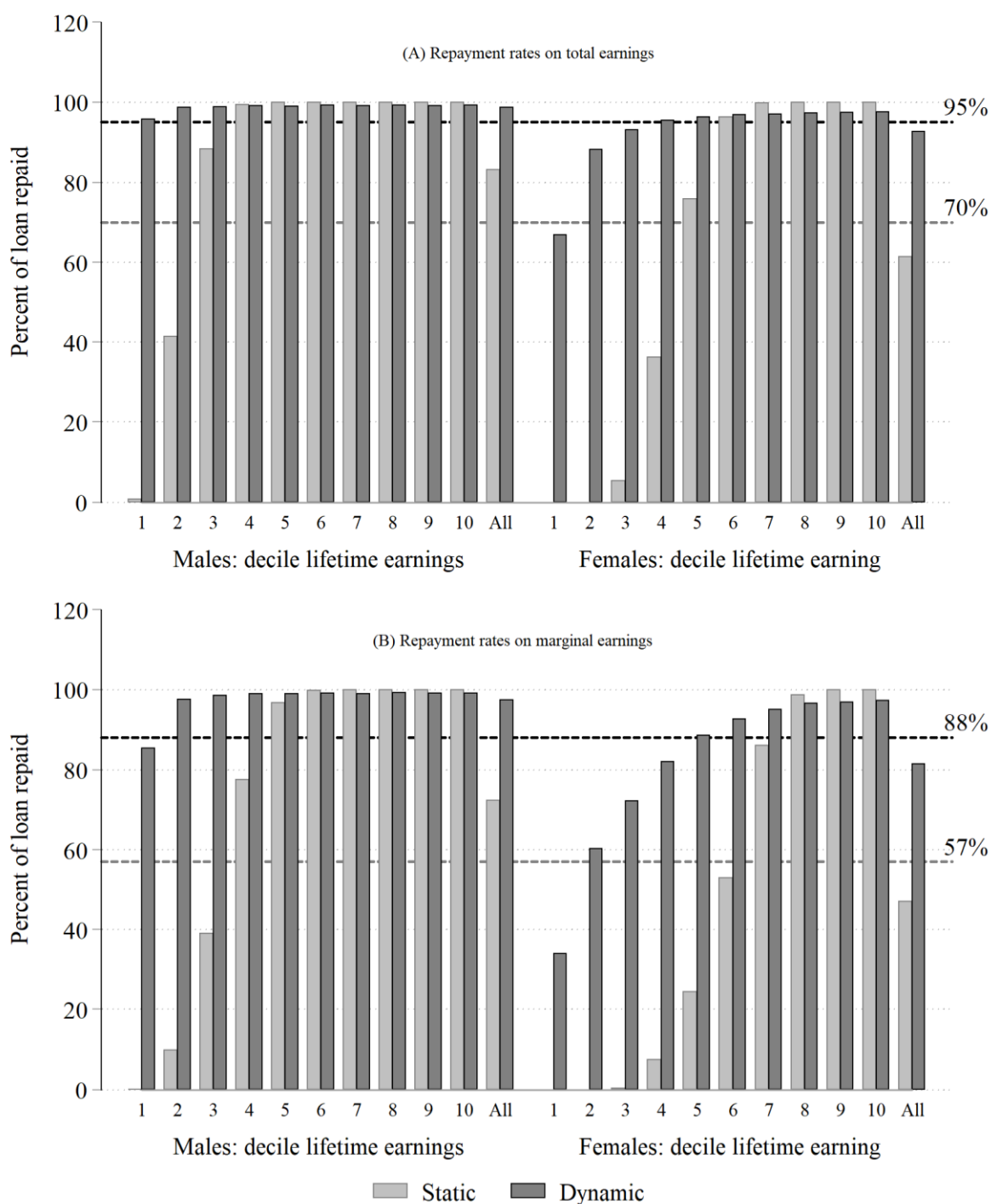
5.4.1 Implications of changes in the discount rate

The discount rate should be related to the government's cost of borrowing, because it is assumed here that the student loans are disbursed by the government, and the same government that exempts or reduces interest rates in student loan schemes pays normal official rates when issuing bonds to raise funds in the market. The discount rate is the critical parameter to calculate the implicit subsidies, because most of these relate to the notional cost to the government through lost interest (when loans are indexed below the government cost of borrowing) and doubtful debts. All the initial simulations applied a real discount rate of 5 per cent p.a.. Additional simulations in this section assume different discount rates, to show how such a change impacts on the repayment prospects of a student loan scheme.

Two alternative real discount rates will be applied: 2 per cent p.a. and 7.4 per cent p.a. Applying a discount rate at 2 per cent p.a. is a way to see the results had the Brazilian Government sustainable access to cheaper money. Applying 7.4 per cent p.a. considers the opposite, and to illustrate this, the average cost of borrowing faced by the federal Brazilian government during the period the FIES was a TBRL (i.e., 1999 to 2017) was chosen. In both cases, outstanding debts are adjusted at the same annual rate as the new discount rate.

Figure 19 shows the potential results when the new discount rate is 2 per cent p.a.

Figure 19: Changes in scenario 5 when a 2 per cent p.a. discount rate applies.



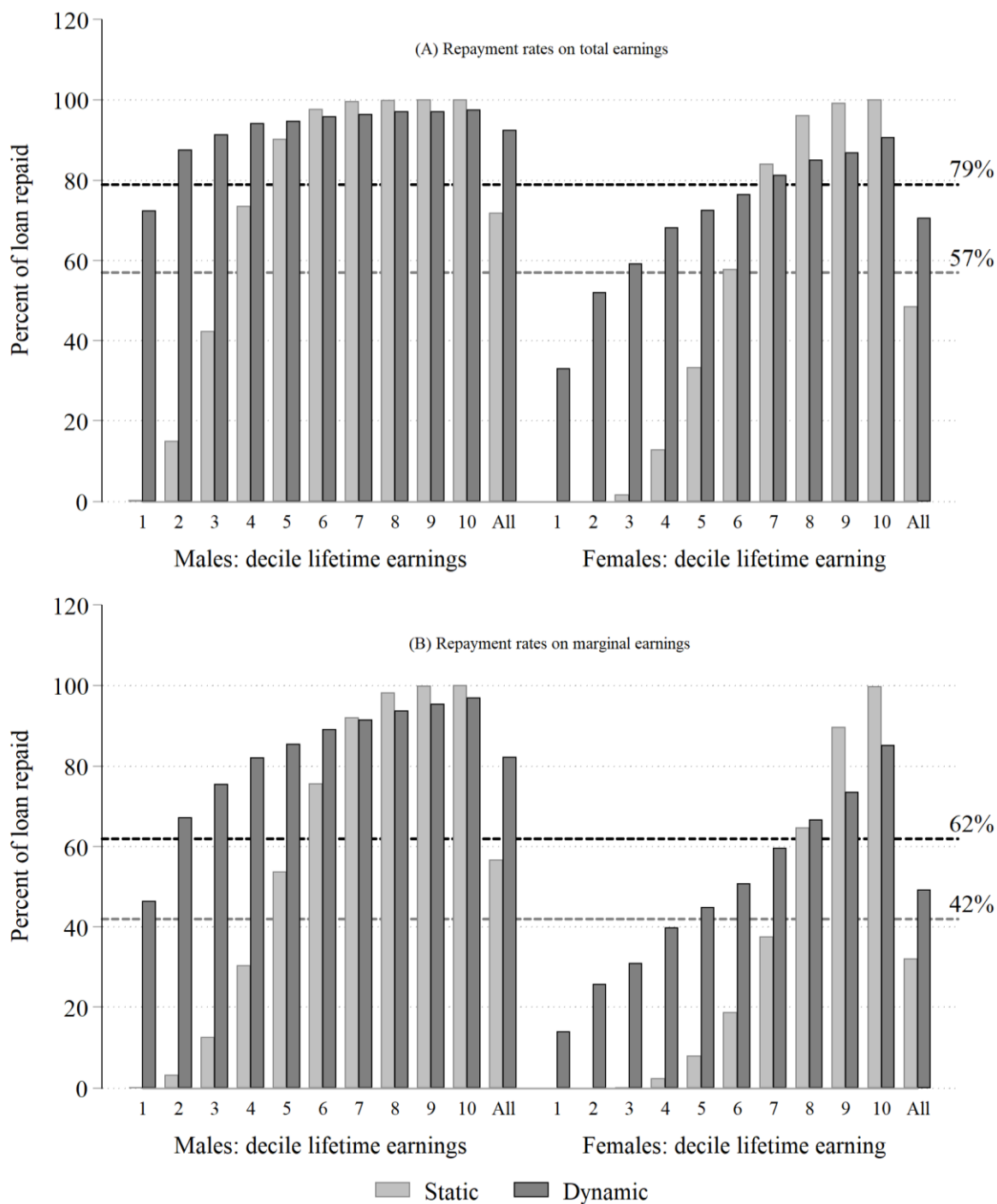
Source: Author's own calculations and elaboration using data from the Continuous PNAD 2014 and 2015.

A lower discount rate implies a scenario with lower cost of borrowing for the government, consequently reducing also the loan's interest rate. More debtors repay in full and faster. A higher proportion of the loan's disbursement is recovered, and the difference is lower in the size of taxpayer subsidies if marginal repayment rates apply. The loan scheme is thus

more sustainable in fiscal terms, as well as more affordable for the debtor, the cheaper the cost of borrowing for the government.

Conversely, taxpayer subsidies rise with increases in the government’s cost of borrowing. Figure 20 shows the results in a scenario with the government’s cost of borrowing (and the discount rate) at 7.4 per cent p.a..

Figure 20: Changes in scenario 5 when a 7.4 per cent p.a. discount rate applies



Source: Author’s own calculations and elaboration using data from the Continuous PNAD 2014 and 2015.

As *Figure 20* illustrates, higher discount rates affect the loan's recovery considerably, besides making marginal repayment rates much more expensive. It is worth noting that, all else equal, the most critical parameter for the calculation of taxpayer subsidies is the gap between the loan's rate of interest and the discount rate. Variations in the earnings growth rate, however, may reduce or enlarge the subsidies.

5.4.2 Implications of changes in the earnings growth rate

The earnings growth rate approximates labour productivity growth over time and affects the debtor's ability to pay in the long term. The faster the pace of earnings growth, the greater the number of people who will repay quickly and in full. All the simulations in this thesis assumed an earnings growth rate of 1 per cent p.a.. This is lower than the average annual wage growth in Brazil for this century: data from PNAD shows that the wage mass in circulation in the Brazilian economy grew at an average annual rate of 1.8 per cent between 2001 and 2015. However, the growth rate of labour productivity in Brazil since 1980 is 0.7 per cent⁶⁶. Canuto (2017) shows that wages systematically grew above labour productivity in Brazil in recent years, an unsustainable trend that is associated in the literature with a circumstantial period of economic growth fostered by the inclusion of large numbers of people in the labour market (DE NEGRI; CAVALCANTE, 2014). Considering the low growth of labour productivity in the last decades in Brazil, the annual rate of 1 per cent of real earnings growth is likely to be an optimistic average figure for the years to come in Brazil. Nonetheless, it is important to highlight that simulations are sensitive to this assumption.

Rises in the earnings growth rate increase the debtor's ability to pay. Consequently, the loan scheme becomes more affordable for the graduates and greater loan disbursement is recovered in NPV terms. Thus, labour productivity gains make a government-provided student loan scheme more sustainable. If education indeed boosts individual productivity, as argued by abundant literature⁶⁷ but also contested by many authors⁶⁸, then further expansion of the Brazilian HE system may in theory contribute to the sustainability of a broad ICL system for the country. The argued link between education and productivity is not the object of this thesis,

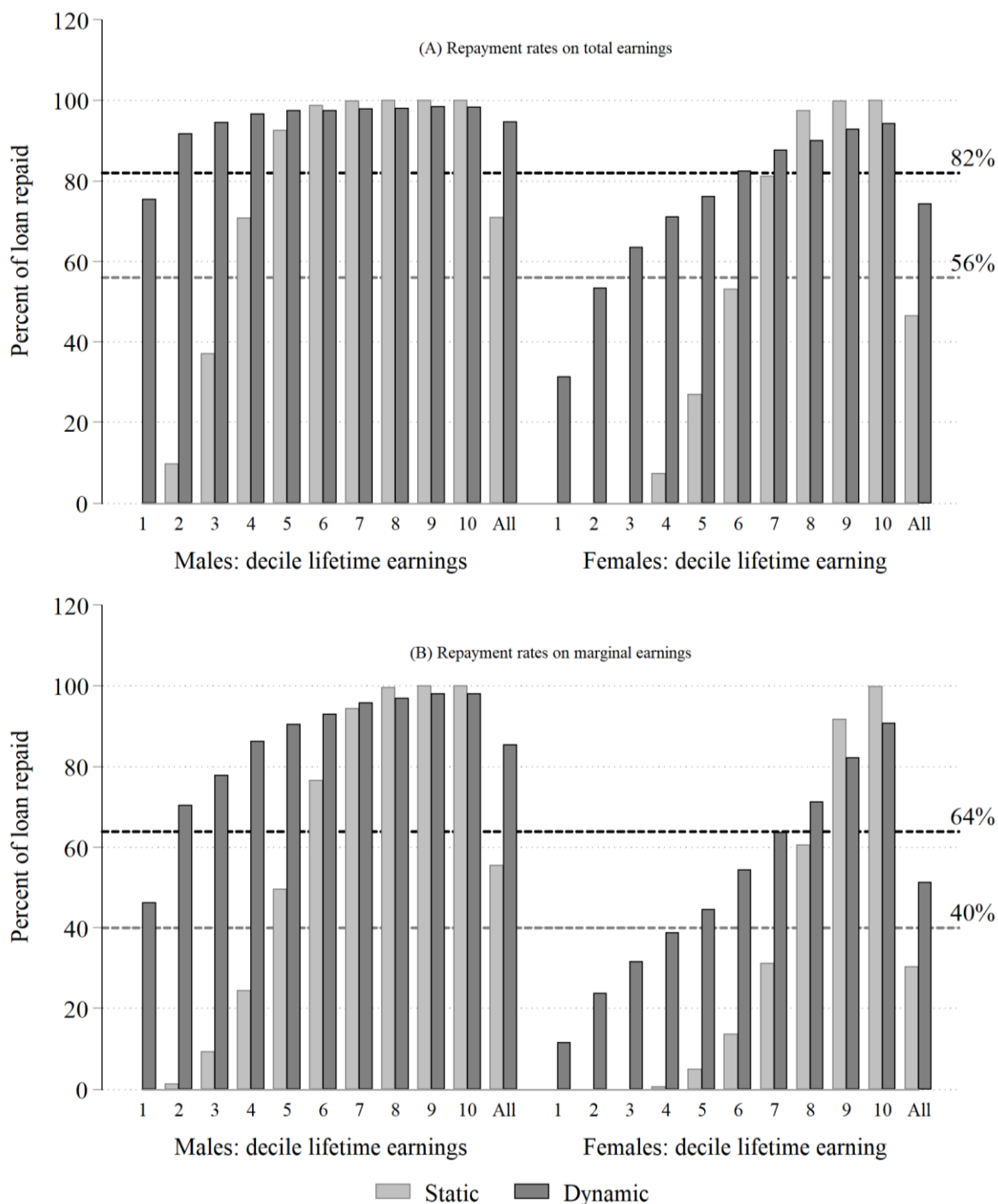
⁶⁶ According to the Conference Board Total Economy database, available at www.conference-board.org.

⁶⁷ See Woessmann (2016) for a literature review on the economic case for education.

⁶⁸ See, for example, Pritchett (2001).

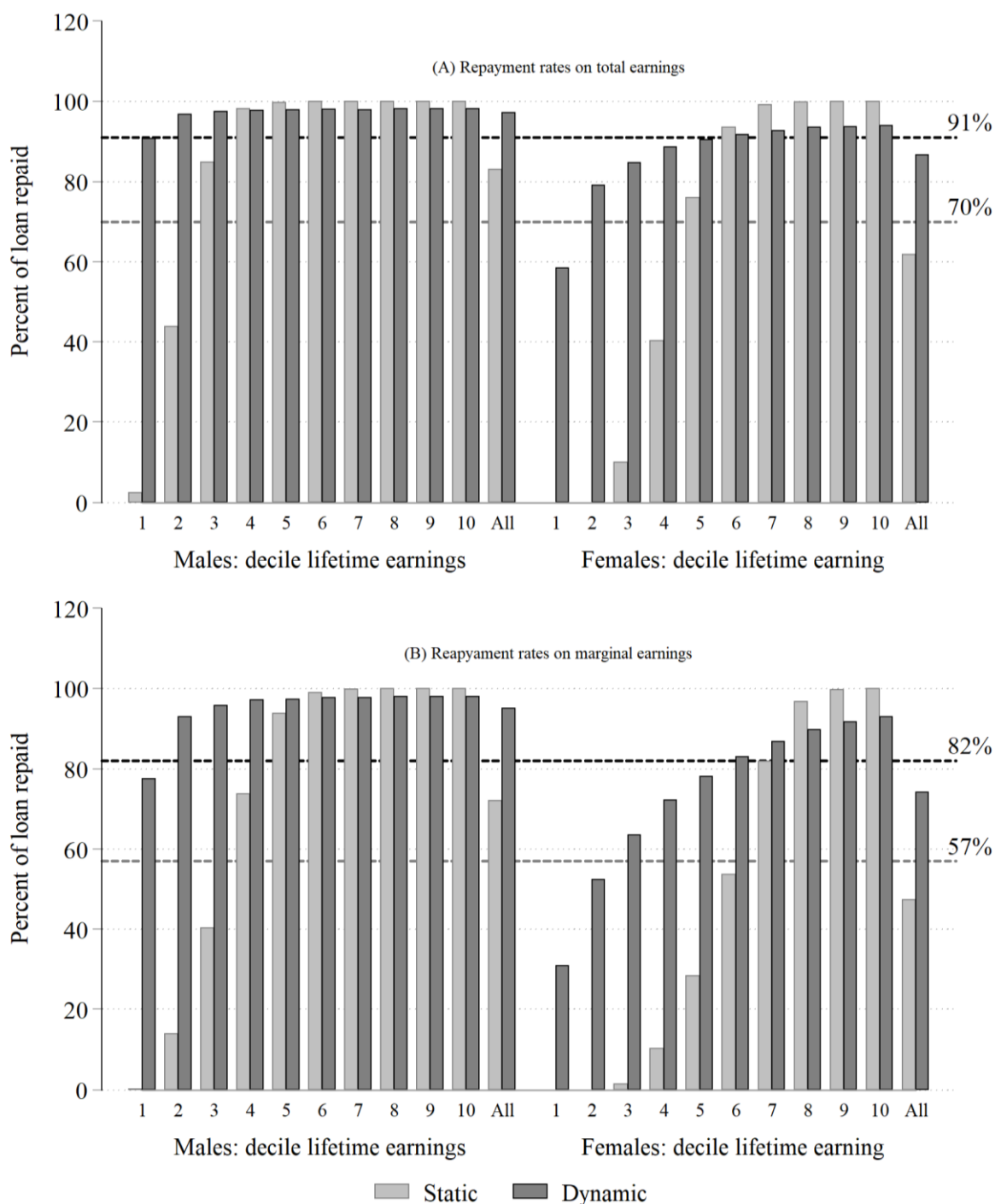
but if wages grow at rates lower than 1 per cent p.a., less people repay the loan in full and thus subsidies increase. If wages grow at rates higher than this, more people repay the loan in full and subsidies fall. To illustrate how such changes impact on the results, Figure 21 illustrates the implications for our preferred ICL scenario if wages grew at an average rate of 2 per cent p.a., while Figure 22 illustrates the implications if wages remained constant in real terms during the entire length of the loan.

Figure 21: Changes in scenario 5 when real earnings grow at 0 per cent p.a..



Source: Author's own calculations and elaboration using data from the Continuous PNAD 2014 and 2015.

Figure 22: Changes in scenario 5 when real earnings grow at 2 per cent p.a..



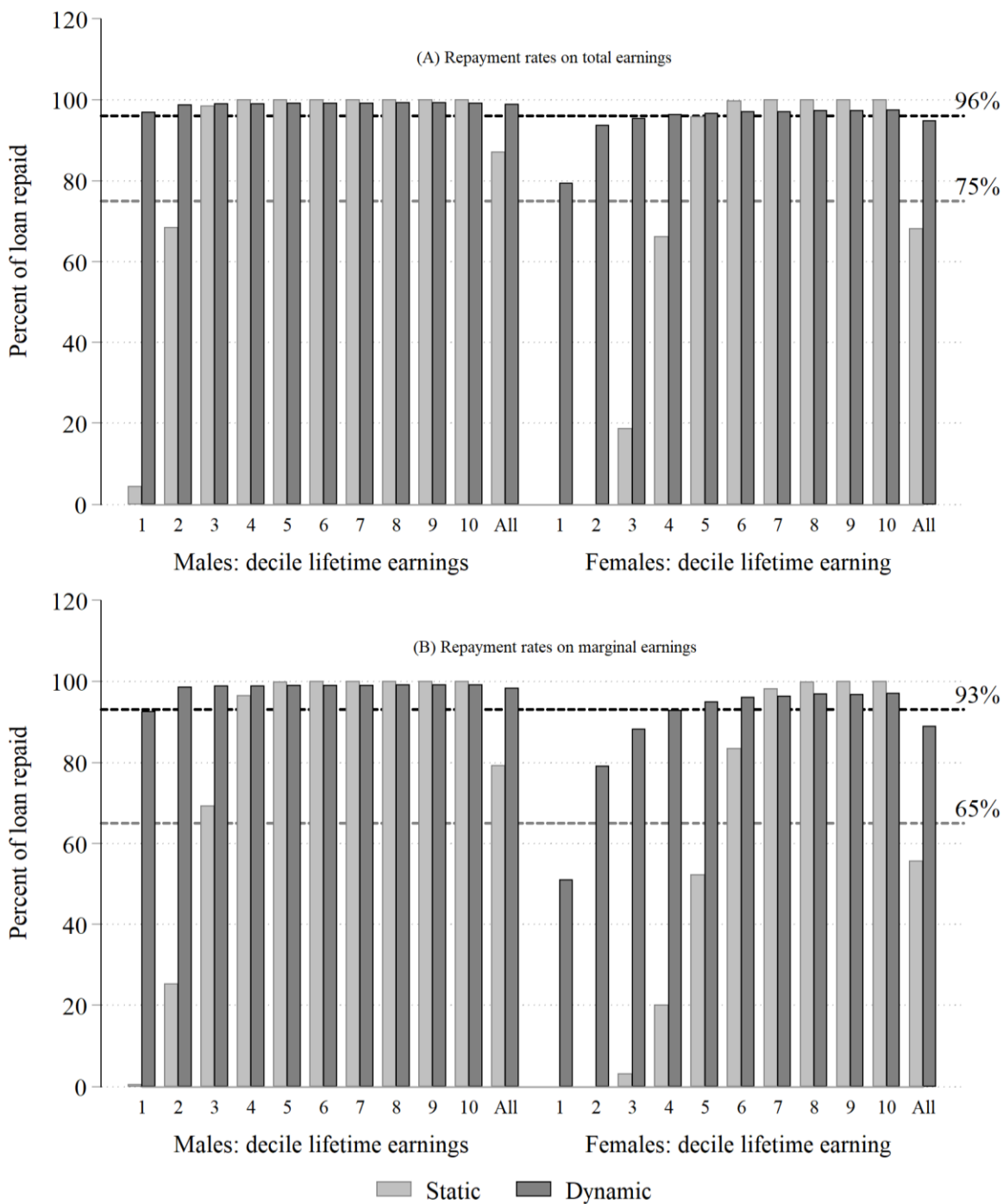
Source: Author's own calculations and elaboration using data from the Continuous PNAD 2014 and 2015.

5.4.3 Best- and worst-case scenarios

Combining the additional scenarios that modify the exogenous conditions affecting the sustainability and the affordability of our preferred ICL scenarios, one can illustrate examples of best- and worst-case scenarios given the chosen endogenous parameters. Figure 23 illustrates the best-case scenario, while Figure 24 illustrates the worst-case scenario involving the

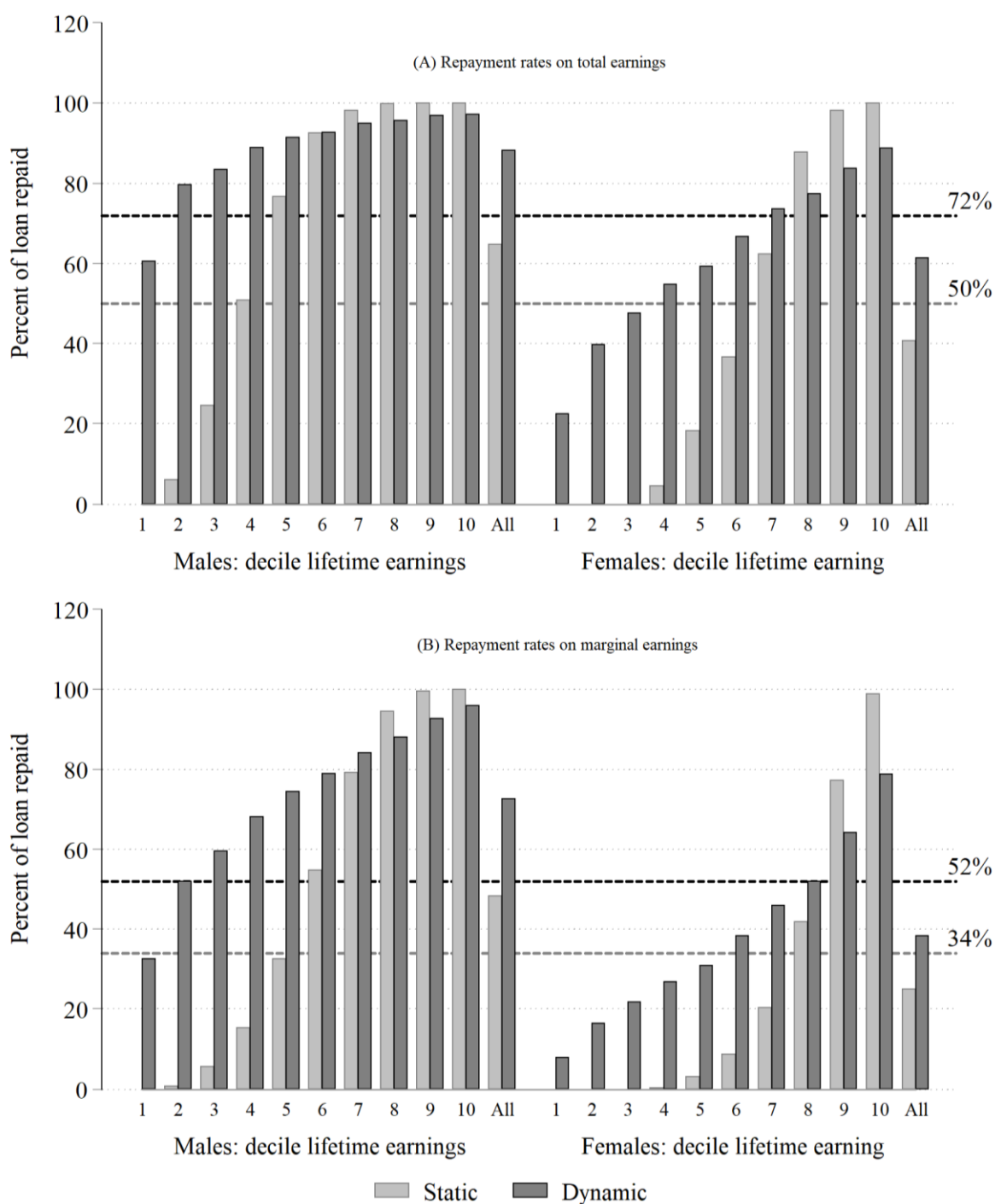
different combinations of discount rates and earnings growth rates simulated in this thesis.

Figure 23: Best-case scenario: discount rate at 2 per cent p.a. and real earnings growing at 2 per cent p.a.



Source: Author's own calculations and elaboration using data from the Continuous PNAD 2014 and 2015.

Figure 24: Worst-case scenario: discount rate at 7.4 per cent p.a. and real earnings growing at zero per cent p.a.



Source: Author's own calculations and elaboration using data from the Continuous PNAD 2014 and 2015.

Note that the best-case scenario combines the lowest prospective discount rate under consideration with the highest prospective earnings growth rate under consideration, while the worst-case scenario reverses the order, assuming concomitantly the higher discount rate and the lower rate of wage growth used in the simulations. This is a tautological observation, but it shows how much the strength of the results reported in this thesis depends on assumptions about conditions that will vary over the time horizon necessary for the recovery

of the loans independently of the scheme's decision-making process. Reporting these scenarios reinforces the importance of calibrating the endogenous parameters, so as to protect the scheme against systemic risks, optimising both costs for the taxpayer and affordability for the debtors.

Figure 23 illustrates that our preferred ICL scenario would be virtually self-financing under conditions of steep growth in labour productivity and maintenance of the government's cost of borrowing at low levels (close to the pattern observed in developed countries). In this hypothesis, there would be little difference in terms of loan, regardless of whether marginal or total repayment rates were adopted. At the other extreme, Figure 24 illustrates that stagnant productivity combined with high costs of borrowing would make the scheme quite costly for the public purse.

As discussed earlier, a well-designed ICL protects the debtors against bad results in the labour market and provides additional sources of funding for educational institutions. Successful ICLs seem to be associated with HE expansion and fund raising in Australia (CHAPMAN; NICHOLS, 2013) and England (MURPHY; SCOTT-CLAYTON; WYNESS, 2017). However, the fiscal sustainability of the scheme is also important, particularly in a middle-income country such as Brazil, and even more so in moments of sharp crisis such as those observed in the country during various periods of its history. Efficiency in collection is thus indispensable.

5.5 WHAT SOURCES OF INCOMES SHOULD BE CHARGED AND THE IMPORTANCE OF FULL INVOLVEMENT OF THE FRS

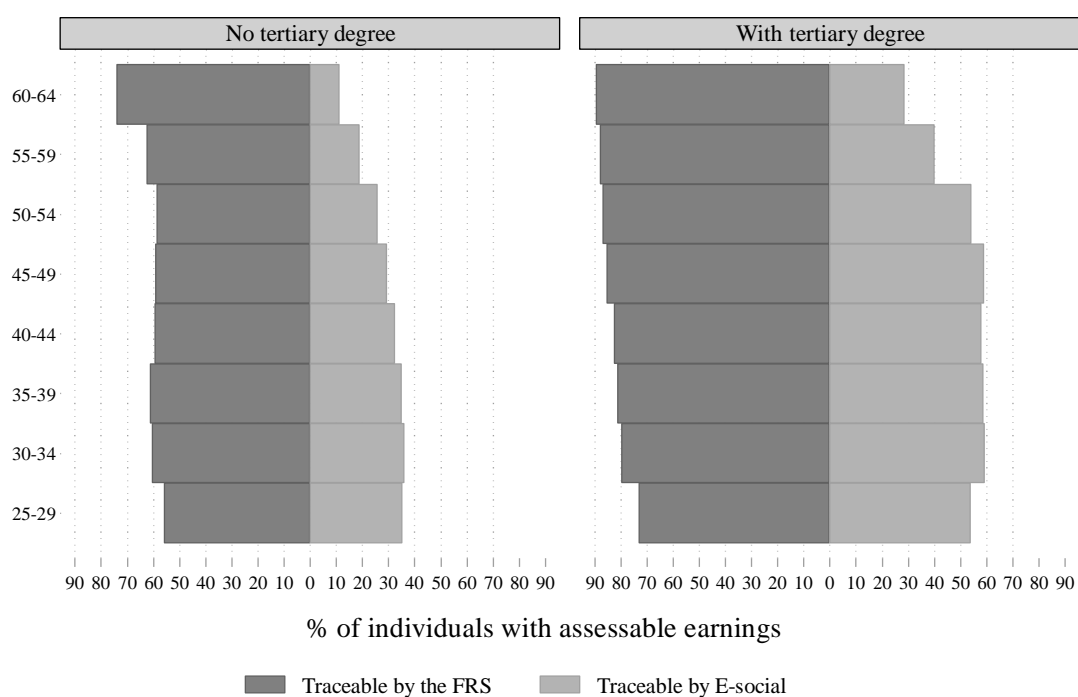
The cost of an ICL depends crucially on the earnings base used. We have assumed repayment rates being levied on gross labour earnings, with repayments being collected in the same way as taxes are collected. This is an essential feature to reach assessable labour earnings beyond wages and salaries. However, that is not the way repayments were planned to be collected when the income-based FIES was introduced, at the end of 2017. The income-based FIES will collect repayments through a platform called Digital Book-keeping of Tax, Social Security and Labour Obligations (shortened in Portuguese by the acronym *E-social*). Among other uses, the E-social is an employer withholding system. As such, it necessarily involves a narrower earnings base.

The limitations of E-social are exacerbated by the loopholes in the Brazilian tax code, which allows many legal mechanisms of tax avoidance, in the form of permissible deductions and credits. It has become usual in Brazil, for example, to see firms replacing employees with independent contractors that are often the dismissed employees themselves (a practice known in Brazil as *pejotização*), transforming individual labour earnings in profits (FERNANDES; CAMPOLINA; SILVEIRA, 2018). This is currently a normal practice because in Brazil the latter is less taxed than the former. ICL designs for Brazil should thus pay attention to this moral hazard problem: the phenomenon of *pejotização* implies that collection exclusively based on wages and salaries would reduce the scheme's revenue and is likely to produce uneven implications across the cohorts of borrowers.

These problems can be easily overcome with legislation requiring ICL repayments to be levied on all sources of income (or at least on labour earnings plus profits) along with full involvement of the federal revenue system (FRS)⁶⁹ in the collection of the ICL repayments. There may be political difficulties in doing this, but not technical ones. The Brazilian FRS collects taxes efficiently. It could also collect ICL repayments. Figure 25 illustrates the additional scope that would exist if the collection of a hypothetical broad ICL system in Brazil would involve all the tax withholding mechanisms under the auspices of the FRS, rather than limiting the collection to E-social.

⁶⁹ which is called *Receita Federal* in Brazil.

Figure 25: An estimation of the proportions by age of adult individuals with assessable earnings traceable by the FRS and the E-social – Brazil, 2017.



Graphs by whether or not holding tertiary degrees

Source: Continuous PNAD 2017. Author's own elaboration.

Using data from the 2017 Continuous PNAD, Figure 25 classifies as “traceable by E-social” the individuals who had a formal job and as “traceable by the FRS” not only the individuals formally employed but also those who had contributed to the social security system and those who had declared other sources of income besides labour earnings. The diagrams plotted in Figure 25 are only an approximation. It is possible that the FRS might be able to trace even greater proportions of individuals than those depicted in Figure 25, as there is empirical evidence of underreporting of income (particularly profits) in household surveys in Brazil (MEDEIROS; SOUZA; CASTRO, 2015). Even so, Figure 25 makes two major contributions: (1) to illustrate that the informal economy is a relatively small problem for collecting repayments from an ICL to finance higher education in Brazil, since something between 70 and 90 per cent of adults with tertiary degrees living in the Country have some source of income traceable by the FRS; and (2) to show that the full involvement of the FRS would substantially increase the number of payers of an ICL in Brazil, additionally implying a larger earnings base.

6 CONCLUSIONS

This thesis simulated several hypothetical student loan schemes for a broad reform in HE student financing in Brazil. In the absence of lengthy panels, earnings mobility in the graduates' earnings distribution was taken into account with smoothed parameters of the t-copula that best fit most of the age transitions observed in a short panel with two consecutive years of the Continuous PNAD. Essentially, this approach projects the lifetime earnings profile of individuals with university degrees based on two data points, in order to evaluate distributional impacts and the subsidies implicit in different alternative designs for student loan schemes. In a future improvement, earnings transitions from both graduates and drop-outs would produce more realistic results and the best estimates for each transition shall be used instead of the smoothed parameters. Further improvements could be obtained if income dependency beyond two waves were considered but this requires access to tax data.

Age-earnings profiles obtained from Dearden's simplified two-wave copula approach were used in this thesis to simulate repayment patterns for time-based and income-contingent alternative loan designs. Reported results allow assessing fiscal and distributional implications related to various loan features, such as rates of interest, repayment rates and thresholds, surcharges and cohort risk premiums. All ICL designs perform better than the TBRL designs in terms of affordability for graduates and implicit taxpayer subsidies. The best design involves loan fees on initial borrowings, interest rates at the government's cost of borrowing upon graduation and above an initial threshold, and progressive repayment rates aligned with thresholds valid for taxing personal income. Given the historical trends of recurrently high cost of borrowing faced by the Brazilian Government, charges on total income might be preferred over charges on marginal income, even considering that the latter option avoids sharp discontinuities in kink points.

Results also provide an initial assessment of the potential of recent reforms introducing, in 2018, income-contingency in the FIES, the large scheme that has been financing fees in private institutions for the last 20 years in Brazil. However, prospects for the new scheme might be substantially different in the future, for two reasons. Firstly, because all the simulations are based on assumptions about earnings paths in Brazil. Any change in rates of return, wage growth or mobility trends is likely to affect the story of the scenarios

presented here. Secondly, the new FIES collects repayments through an employer withholding system, which necessarily involves a narrower earnings base, but simulations assume the full involvement of the FRS, an essential feature to reach assessable incomes beyond wages and salaries. The full involvement of the FRS is critical for maximising the loan's recovery for the chosen scheme. The FIES collects repayments through an employer withholding system, which will necessarily involve a narrower earnings base.

Converting the existing FIES loans into ICLs is likely to enact efficiency and equity gains, but the larger potential for ICLs in Brazil is in the growing need to introduce tuition fees at the currently free-of-charge public HEI. This topic has been discussed in academic and policy-making fora and gained more relevance after the approval of the spending freeze amendment, which will certainly impose new barriers on additional budgetary resourcing for the public HEIs.

As demonstrated throughout this thesis, ICL schemes are superior to TBRL schemes in balancing the trade-off between implicit subsidies and RBs. It has also been seen that a good ICL resorts to the government's power to tax income to automate loan repayments and thus reduce non-repayment risks, but it also insures debtors against the risks of low income by guaranteeing that no payments will be required when individual income lies below pre-determined levels. The ultimate objective is to remove borrowing constraints by introducing transaction efficiencies that minimise risks for both the lender and the borrower.

Considering that: (a) efficiency in collection is essential for the success of ICLs; (b) the cost of borrowing for the government is higher in Brazil than in developed countries; (c) higher interest rates increase the length of the repayment period for an ICL, but not the size of the instalments; (d) moments of instability are not uncommon in Brazil's economic history, there are two central points to consider for promoting the fiscal sustainability of a hypothetical broad ICL system in Brazil. One, implicit subsidies should be minimised. Two, tax withholding mechanisms should also be used to collect loan's repayments. The first central point implies avoiding indiscriminate concessional interest rates and concentrating implicit subsidies on writing remaining debts off after a long period of time or upon retirement or death. The second central point requires the full involvement of the FRS in the collection of ICL repayments.

Amongst developing countries, Brazil has great promise as country institutionally prepared to introduce large-scale ICL schemes. In addition to calculating and collecting income tax and social security contributions, Brazil's federal government annually collects information on every enrolment in HE from the public and private sectors. These mechanisms operate electronically and can be easily combined using an identification key common to all of them: the *cadastro de pessoa física*, which is the individual national fiscal number. Moreover, the country's censuses, household surveys, tax records, and wide range of administrative datasets provide rich information on the key variables to construct evidence-based ICL arrangements, which are earnings, employment, and education.

Future work could discuss in further detail the issue of risk sharing with the HEIs. There is no agreement in the literature on how best to design instruments to inhibit private (or public) HEIs from indulging in rent-seeking in higher education student financing. How governments should address this is fertile ground for future research, as well as for future loan policy reforms.

Another promising field for future work is to simulate other applications for ICLs in Brazil. An extension to finance students' living costs could be introduced to the HE student financing system. Human capital contracts could be tested as a supplementary tool to attract private funds to HE, as well as to boost investments in VET. In the latter case, an ICL could possibly substitute FIES components planned to be integrated in the PRONATEC (the broad VET policy plan introduced in 2011 in Brazil) but never put into practice. These are the FIES *empresa* (business), an alternative imagined for employers to finance the retraining of their employees, and the FIES *técnico* (technical), an alternative for the worker to obtain financing for his or her VET. ICLs could also be planned as an alternative to replace the current bursary system for postgraduate students.

As discussed in this thesis, ICLs have also great potential in other areas beyond HE. Stiglitz (2016) highlights the important social innovation that is likely to emerge in a near future as governments progressively run ICL systems to finance various human needs. Withers (2014) emphasises that ICL systems can be seen as a close substitute to the general taxation system. Libich and Macháček (2017) argue that ICL systems could improve public risk management policies. Provided the country has high-quality institutions and governance, ICLs could go beyond HE and finance, for example, artists, sportspeople, flood victims, small business or collapsing financial institutions. One of the new potential applications of income contingent loans beyond HE student financing relates to insuring individuals against risks such as

unemployment. An optimal provision of loans and insurance against unemployment, health, disability, and other individual risks and needs has been recently modelled by Joseph E. Stiglitz and Jungyoll Yun (STIGLITZ; YUN, 2005, 2013, 2014, 2017).

In the past, technological constraints could hamper the effective implementation of large national ICL systems; by contrast, most of the implementation difficulties at present would be due to political opposition and unfamiliarity with the ICL mechanisms. The advancements in information technology already allow even developing countries to improve their systems for tax collection and income transfers; thus, it is only a matter of time before governments start to provide low-cost credit for the most diverse human needs—ICLs to finance postsecondary studies are only an initial consolidating application in this direction.

With appropriate implementation, income-contingency can make the most of the transactional efficiencies involved in the government monopoly on taxing personal income to implement wide loan systems to finance a variety of individuals' needs. Advanced empirical methods have been developed to allow reliable simulations of the implications of ICL systems for taxpayers as well as for borrowers. It should be noted, however, that income contingency is not a panacea to remove all problems of access to credit, nor of cost sharing in the provision of public services. With or without income contingency, individual incomes are still finite. Applications and limits of access for ICLs should be, therefore, structured with parsimony.

In addition, specifically regarding liquidity problems as a barrier to accessing post-secondary education, it is worth remembering the arguments of James Heckman, for whom short-term credit constraints would be a minor problem of access to HE. In his view, the preponderant factors in educational exclusion are the economic, social and cultural restrictions that, throughout life, widen individual cognitive and non-cognitive differences. Consequently, the likelihood of persons exposed to such restrictions achieving a HE degree is low. Among those who succeed and go to college, completion rates tend to be also low. Those who do complete tend to achieve benefits beneath those of peers who grew up under more favourable conditions. Thus, the underlying role of policies for access to credit is undermined, reinforcing the importance of not losing sight of the removal of barriers to access to economic, social and cultural capital from an early age.

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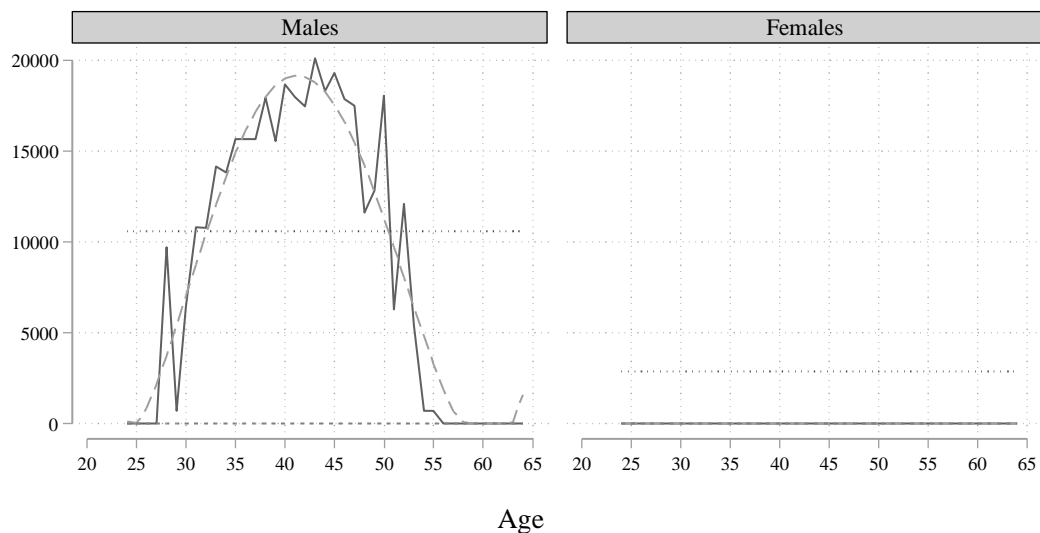
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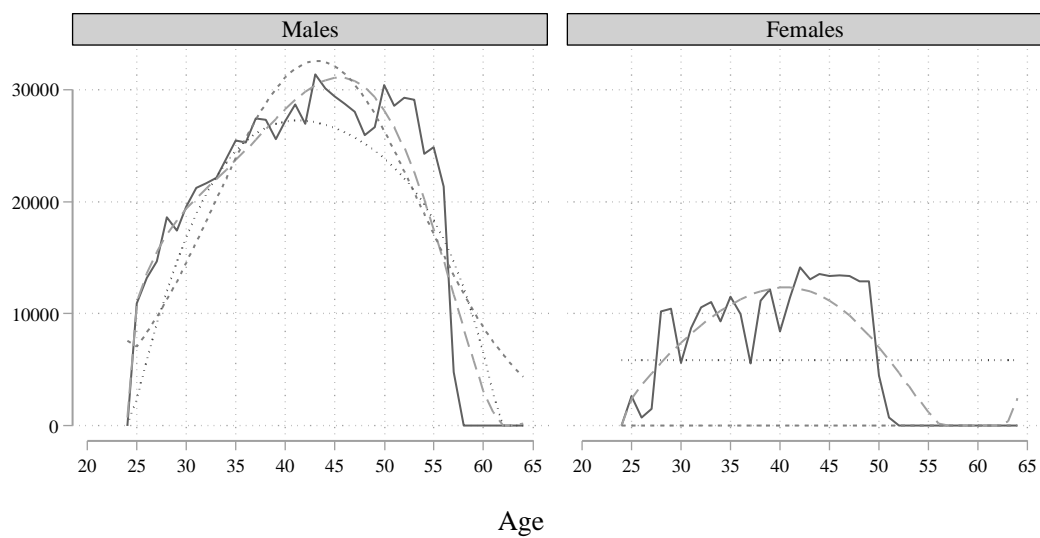
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APPENDIX A: STATIC AGE-INCOME PROFILES FOR MALE AND FEMALE GRADUATES, DECILES 1 TO 9 (COMPARING METHODS)

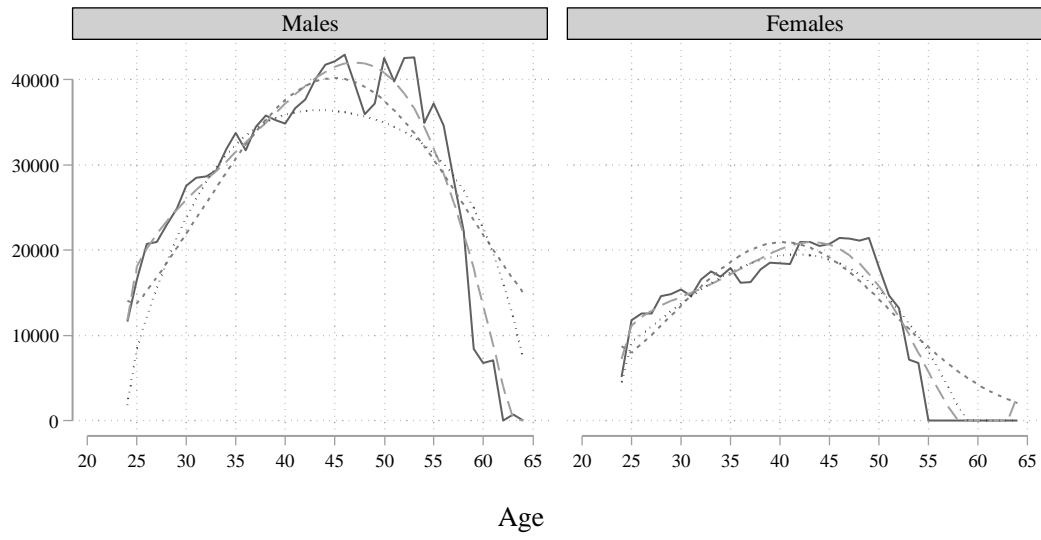
DECILE 1



DECILE 2



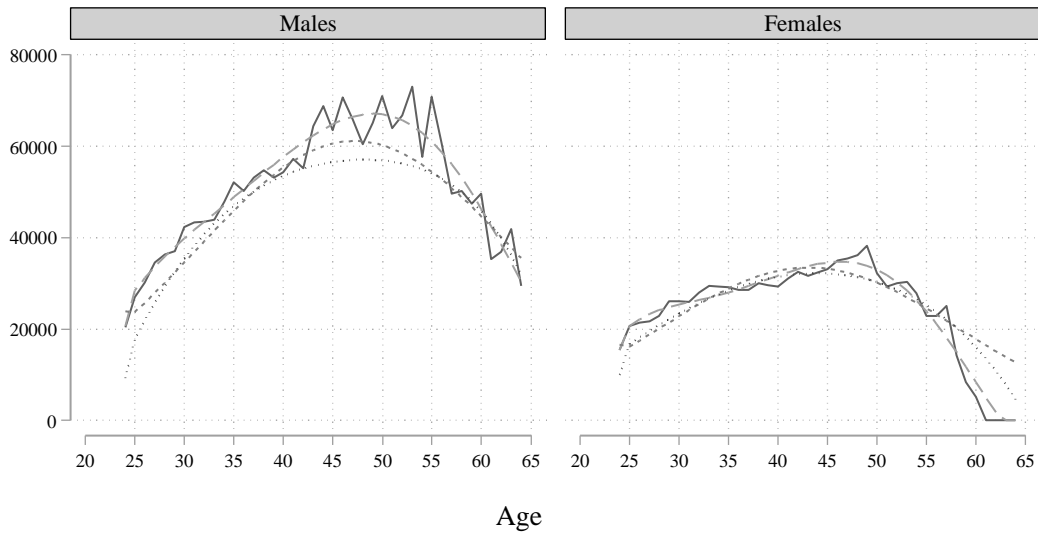
DECILE 3



DECILE 4



DECILE 5



DECILE 6



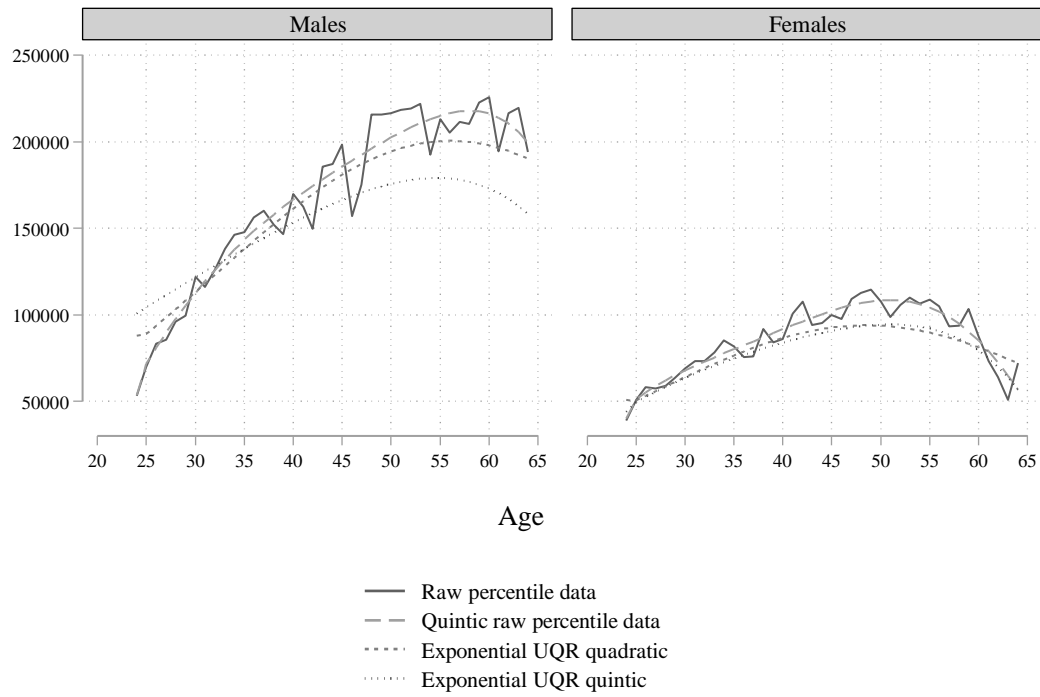
DECILE 7



DECILE 8



DECILE 9



Graphs by person's sex

Source: Author's own calculations and elaboration using data from the Continuous PNAD 2014 and 2015.