INSURANCE BY GOVERNMENT OR AGAINST GOVERNMENT? OVERVIEW OF PUBLIC RISK MANAGEMENT POLICIES

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Abstract.   In what contexts is it desirable that the government, rather than the private sector, takes on the role of an insurer and helps people reduce risks? Our discussion implies that while in a number of areas individuals benefit from well-designed insurance provided *by* their government, ill-designed public policies (for example existing pay-as-you-go pension systems) force individuals to insure *against* their government. It is further discussed how governments could improve their risk managing role in many areas by using *income contingent loans*, provided the country has high-quality institutions and governance. Such loans to artists, sportspeople, flood victims or collapsing financial institutions would replace the existing nonrepayable transfers, grants, subsidies and bailouts. Using a simple efficiency-equity-sustainability framework for comparing income contingent schemes with conventional public and private insurance policies, we document that this would enable governments to extend their insurance assistance to a greater number of people and institutions – in a way that is not only equitable but also efficient and fiscally sustainable.

Keywords. Fiscal sustainability; Income contingent loans; Insurance; Pay-as-you-go financing; Pension system; Risk management; Tertiary education

JEL classification: H75

1. Introduction

Most people are risk-averse. They strive for stability and predictability, and look for a firm anchor in the turbulent ocean of change they experience every day. While they appreciate the importance of risk taking for technological progress and prosperity, they generally prefer to reduce the consequences of various undesirable events by purchasing insurance.[1] Such widespread preferences of individuals give rise to a natural question: Should the act of insuring the various risks be left solely to the markets and the private sector, or is there a useful role for the government to play? And if so, how should public risk-minimization policies be designed? A large amount of literature has been devoted to assessing these questions, including the valuable summaries of Hillman (2009) and Baker and Moss (2009). More generally, economic research, like that of Bertola and Koeniger (2010), has attempted to formally identify the determinants of the optimal mix of public and private insurance.

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Most of the literature, however, only compares existing public risk-minimization policies with their private sector counterparts. Our aim is to contrast three policy types, rather than two, by making a distinction between 'conventional' and 'unconventional' public insurance arrangements. Unconventional policies include various *income contingent loan* (ICL) schemes whereby the government provides loans repayable based on the recipient's income – rather than conventional grants and subsidies that never have to be repaid. The paper's main contribution is: (i) highlighting the advantages of ICL schemes over their public and private alternatives in several existing areas, and (ii) discussing novel contexts in which such schemes may be used effectively by governments in countries with stable institutions and good governance.

To enable a more structured assessment throughout the paper, Section 2 postulates a simple efficiency-equity-sustainability framework for comparing ICLs with conventional public and private insurance policies. It features five criteria: (i) *behaviour efficiency* linked to asymmetric information problems, (ii) *transactional efficiency* reflecting the cost of policies, (iii) *risk-mitigation efficiency* related to the scope for reducing relevant risks and its undesirable consequences, (iv) *equity* denoting the degree of solidarity and (v) *sustainability* referring to the long-term financial viability of the policies.

In order to highlight the main features of an ICL scheme and how it differs from conventional public insurance policies and its private counterparts, Section 3 discusses the government's role in financing tertiary education. An ICL scheme was first implemented in this area in Australia in 1989 (see Chapman and Harding, 1993) and subsequently adopted by a number of countries.[2] We discuss how a government-provided ICL helps students insure the financial risks of tertiary education investment and why it tends to be superior to both loans by private banks (even if these are government-guaranteed) and to the system of 'free' university education.

We argue that in countries with sound institutions governments can be effective insurers using ICL schemes. They can help their citizens reduce the negative consequences of various events substantially, and at a lower cost, due to economies of scale, use of existing infrastructure for administration (for example the tax collection system), better consumption smoothing and more effective default protection. In particular, it is argued – in line with Barr (2001), Moss (2002) and Chapman *et al.* (2014) – that the role of the government as risk manager via the ICL scheme could potentially be extended to many other areas of public policy.

The government could move away from its 'donor' role in which it provides nonrepayable transfer payments, grants and subsidies to individuals and firms. It could instead provide ICLs repayable once the recipient's financial situation improves sufficiently. In the same way that university students only have to repay their loans if their income exceeds some threshold (linked to median or mean income), artists, sportspeople, farmers, exporters and failing banks would have to repay their government support if (and only if) their income or profit reached a pre-agreed threshold. Above the threshold the repayment would be a function of income or profit, not a fixed mortgage-type payment that could bring the loan receiving party to bankruptcy. For example for Australian university students earning above the threshold the 'repayment burden' (repayment over income) is set at 4–8%.

Such a risk-reducing scheme has the additional benefit of extending government assistance to a much greater number of subjects while still ensuring fiscal prudence. In addition, the fairness argument speaks in its favour because recipients of government support pay back their share if they are able to. It is important, however, to understand that government-run ICL schemes do not *per se* solve the information asymmetries to which private insurance markets sometimes fail. Their main benefit is to deliver consumption smoothing and default insurance sustainably and at very low transaction costs compared to privately run systems. Using our framework, the main benefit of ICLs is not necessarily an improvement in *behavioural efficiency*; it is enhanced *transactional efficiency*, *equity* and *sustainability*.

This implies that careful design and implementation of public ICLs are essential, and that these insurance schemes are only likely to be beneficial in countries with high–quality institutions. If ill-designed, badly implemented or poorly enforced, government insurance programs can be

counterproductive and increase (rather than decrease) both the uncertainty people face and the fiscal burden. This means that inappropriately designed public policies may reduce *risk-mitigation efficiency* (and possibly even *equity*) compared to private risk management options. This is not only through the standard channels of corruption and moral hazard.[3] It is also by introducing various government-specific and country-specific risks.

Section 4 discusses three problematic conventional public insurance schemes: natural disaster policies, bank deposit insurance, and the pay-as-you-go pension system. The moral hazard issues of the former two areas are well known, so our emphasis is on a rarely debated problem of the latter scheme. The discussion starts with the observation that many countries have some economic weakness, such as unfavourable demographic trends or problematic banking sector, and argues that a correctly designed pension system can reduce people's exposure to such country-specific risks. The desirable system must include pre-funding and capital accumulation so that foreign assets can be invested into as part of 'international diversification'. Nevertheless, the reality is different. The pay-as-you-go public pension system used heavily in most countries does not allow for capital accumulation, and hence does not enable a reduction of country-specific risks via diversifying investment of pension savings into foreign assets. Instead, the existing pay-as-you-go pension scheme magnifies the domestic risks, and is therefore an example of the government failing in its risk managing role.[4]

The message of the paper can thus be summarized as follows. *Individuals may benefit from well-designed insurance by their government, but in some real-world instances they need the opposite – insurance against their government*. More specifically, we stress the fact that not all public policies are 'created equal', and highlight the benefits of ICLs vis-à-vis the drawbacks of conventional public risk management policies. Section 5 then identifies several innovative areas in which government-run income contingent schemes may improve social welfare in countries with solid institutional design and governance.[5] This includes ICLs for paid parental leave, low-level criminal fine repayments, supporting the unemployed, addressing the 'brain drain' in international labour markets, healthcare financing, drought relief for farmers and elite sportspeople's training.

Section 6 then contains a summary of the pros and cons of income contingent schemes relative to conventional public options and private insurance schemes, separately for each of the five criteria of our efficiency-equity-sustainability framework. The conclusion is that well-designed income contingent schemes may be able to improve the trade-off between efficiency and equity in many policy areas, and do so in a fiscally responsible way. Nevertheless, it is acknowledged that these schemes cannot be used in all areas. For example they are unable to readily rectify the weaknesses of the public pension system due to the absence of an income stream after retirement. In such cases 'resource contingent loans' may offer an avenue by using assets for repayment rather than income, along the lines of reverse mortgages.

2. A Framework for Comparison of Insurance Policies

Economic agents face a large set of risks that vary across individuals and countries as well as over time – both in terms of the probabilities of materialization and expected damage. In addition, economic agents' perception of risks may differ from reality due to informational or cognitive constraints. Given the breadth of the risks facing individuals and the (growing) number of existing government risk-minimization schemes,[6] the rest of the paper only focuses on several selected areas that portray the most relevant private versus public and conventional versus ICL insurance issues.

As Chetty and Finkelstein (2013) argue, the consideration of the desirability of public risk management policies usually has a common starting point. It is identifying a market failure responsible for private sector policies not functioning effectively that would justify the government's interference in the markets. The culprit is commonly adverse selection due to asymmetric information in the tradition of Akerlof (1970). If no market failure is found it is usually concluded that public policies have no role to play in
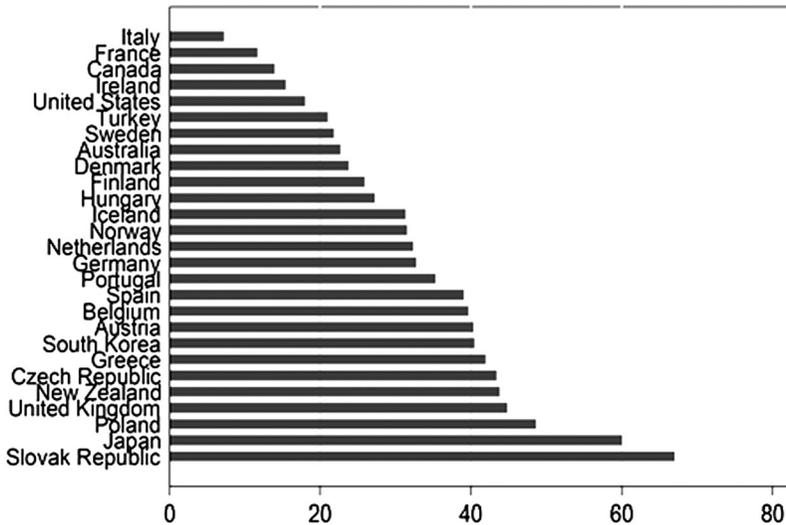
Figure 1. The Cost of Private Nonlife Insurance (Operating Expenses per Claim) in OECD Countries.

Source: Bertola and Koeniger (2011).

that particular area based on efficiency arguments alone, and therefore their desirability has to be justified based on *equity* arguments – taking into account the likely moral hazard problem.[7] Nevertheless, as recent literature forcefully argued, such a view, which essentially only focuses on *behavioural efficiency*, is not well founded because there may exist strong arguments along the *transactional efficiency* and *sustainability* criteria.

For example in their 2014 book, which offers a collection of papers with careful analyses of various aspects of ICL schemes, Bruce Chapman, Timothy Higgins, and Joseph Stiglitz argue: 'A key message from the contributions is that in countries with appropriate institutions for taxation administration, there are considerable transactional efficiencies associated with ICLs. These efficiencies, combined with the improvements in risk and incentives that well-designed ICL programs can provide, suggest that such programs can play an important role in a modern welfare state'. Figures 1 and 2 report data relating to the *transactional efficiency* aspect of the authors' claim.

The figures show a substantial variation in the cost of both private insurance and government tax/transfer systems across OECD countries. Nevertheless, the cost of private insurance exceeds its public counterpart by a factor of 10 or more in all depicted countries. As Bertola and Koeniger (2011) observe: 'On average, production of private non-life insurance costs about one-third of claims, and the administration of taxes absorbs 1% of net revenues.' In order to include these transactional-type effects, and provide some structure to the comparison of government ICLs with conventional public policies and private insurance schemes, let us propose a simple framework for evaluation. It extends the usual efficiency versus equity dimension (Okun, 1975) using the following five criteria.

Behavioural efficiency will refer to minimizing information asymmetries and the resulting undesirable behaviour. It does not only include moral hazard and adverse selection, but also possible effects of the policies on occupational choice and labour supply, as well as a potential distortion of price signals.

Transactional efficiency will refer to all cost type aspects of the policies. This category includes economies of scale, bargaining power, savings due to using existing infrastructure, the cost of information provision, etc.
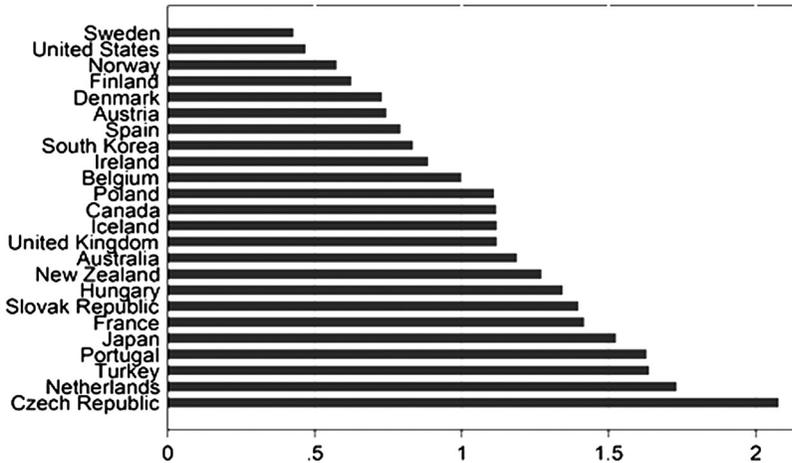
Figure 2. The Cost of Government Tax Collection and Welfare Provision (Administration Cost per Net Revenue Collection) in OECD Countries.

Source: Bertola and Koeniger (2011).

Risk-mitigation efficiency will refer to the scope for reducing the adverse implications of risky events. This category captures the extent of risk sharing given the size of the insured pool as well as possible additional systemic risks generated by the policies.

Equity (distributive efficiency) will refer to the policies' solidarity. This includes reduction in inequality and also the policies' impact on beneficial consumption smoothing and default protection.

Sustainability (generational accounting efficiency) will refer to the long-term effect of the policies on public finances as well as the potential for the insurance schemes collapsing and not providing the promised benefits.

3. When Public Insurance Works Well: ICLs in Tertiary Education

One of the main risks people face is not being able to afford their education due to lower socioeconomic background or health problems. Additionally, prospective students are confronted with the possibility that the returns to their education will not justify the investment in it. Since education is a critical determinant of both personal and social development (see Pissarides, 2000), public education systems have evolved to minimize these types of risks.

As Friedman (1955) argued, to maintain a stable and democratic society it is crucial that its members accept some common set of values and norms. Formal education has traditionally played this 'norm-spreading' role. Moreover, it is well documented that education reduces poverty and crime (Lochner and Moretti, 2004), and by increasing knowledge and boosting human capital it has a significant positive impact on technological progress, labour productivity and economic growth (for underlying theory see Romer, 1990, and for a survey of the empirical evidence see Sianesi and Van Reenen, 2003).

This positive externality argument explains the widespread consensus that the government should support the availability of schooling. However, the specific education externalities are much harder to quantify than they are to list, and they seem to differ across the levels of education. While primary and secondary education are typically considered to have important 'neighbourhood' effects – promoting social cohesion, stability and democracy (Friedman, 1955) – tertiary education is viewed as a source

of technology spill overs and productivity growth. Importantly, since a significant part of the benefits of tertiary education seems to accrue to the individual, the concept of fully publically funded tertiary education has been challenged.[8]

These arguments are, however, independent of the government's potential risk-minimization role, which is the focus of this paper, they only determine the level of the public subsidy to tertiary education students. Specifically, the risk that the qualification may not generate a sufficiently high premium in the labour market and justify the financial investment could discourage too many prospective students. It could therefore, given the positive externality of education, lead to underinvestment into acquiring knowledge; resulting in economic and social stagnation or decline.

How can this scenario be avoided and tertiary education risks mitigated? Let us discuss the answers by outlining the main existing funding schemes: (i) the conventional tax-subsidy system, in which the government fully funds higher education, (ii) student fees accompanied by loans from private financial institutions (possibly with a government guarantee) and (iii) student fees accompanied by ICLs from the government.[9]

3.1 *Conventional Public Financing via a Tax Subsidy*

The tax subsidy system is, for historical reasons, still the most prevalent in post-communist countries as well as in Scandinavia and many other European countries.[10] In this system, public tertiary education institutions receive grants from the government financed from general taxation. University students pay (virtually) no fees – neither upfront nor upon completion. Hence the government insures the individual's financial risk associated with investing into tertiary education (although only partly so, and this does not alleviate the risk of low return to education nor its opportunity cost).

This system of 'free' tertiary education, however, has potential weaknesses along all five of our assessment criteria. First, it suffers from insufficient funding for universities that are almost entirely dependent on government budgets. These have been in a bad shape for quite some time (see De Haan and Sturm, 1997), and are predicted to worsen with the demographic trend of an ageing population (see Razin and Sadka, 2007). Using our framework, this implies that free education performs badly on the *sustainability* criterion. Second, due to limited finances the number of available places is restricted, which often disadvantages applicants from lower socio-economic background. Furthermore, 'free' tertiary education tends to be regressive as it is effectively subsidized by people without a university degree whose lifetime income is much lower than that of university graduates (Chapman, 2014). This implies problematic outcomes along the *equity* criterion. Third, 'free' tertiary education may in principle provide insufficient incentives to study hard with some students taking longer to finish their degree than necessary, or engaging in a study that is not in their best long-term interest. This, combined with the lack of funding, generally leads to a decline in the quality of tertiary education. There are therefore undesirable effects along our *behaviour, transactional* and *risk-mitigation* criteria.

An alternative mechanism for funding tertiary education and managing the associated risks is the system of tuition fees accompanied by student loans. In contrast to the tax subsidy system, students contribute financially to the provision of their tertiary education, and hence its providers have more resources available to offer quality education, and do so to a greater number of people. In addition, students are financially motivated to work harder at their studies and demand high standards from their educational providers. Various schemes exist around the globe depending on who provides the loans (private or public sector) and who assumes the role of the insurer (private or public sector).

3.2 *Tuition Fees with Private Sector Loans*

Fees for university degrees alleviate some of the above financial and quality issues of the public tax subsidy system. There, however, exists a vast literature on the problems with loans from private banks

being used for financing tertiary education (for summaries see Barr, 2004 and Chapman, 2006). The key is that investment in human capital is much more risky than investment in physical capital. This is because students are not well informed about their abilities or future earnings when applying for the loans, and because banks cannot easily sell any collateral (which is in effect the student's knowledge).[11] In the private sector loans scheme graduates are generally required to repay the loan regardless of income – implying positive probability of default on the loan. As a result, private banks are reluctant to provide tertiary education loans and this imperfection in the market tends to lead to underinvestment in human capital. Within our framework, this implies that while a fully private scheme without government involvement is advantageous along the *sustainability* of public finances criterion, there are drawbacks regarding *behavioural* and *risk-mitigation efficiency* as well as subpar *equity* outcomes.

Two types of approaches have been used in attempting to solve the market failure arising from the information asymmetries. In countries such as France, Spain and Finland the government guarantees the repayment of the debt if a loan default occurs, so banks do not demand any collateral from the students applying for the loan.[12] However, government guarantees weaken the banks' incentives to lend prudently and increase the risk of default. In this case the taxpayers must pay for private debts and losses and the *sustainability* advantage of the private financing scheme partly disappears. Bloomberg (2014) reports that tertiary education debt in the U.S. has reached $1.2 trillion, with default rates increasing to close to 15%. Furthermore, it has been argued that government guarantees have been the key driver of rapidly rising university fees (see Vedder, 2014), indicating there are *behavioural* and *transactional efficiency* repercussions.

A lesser known but potentially serious *behavioural efficiency* type problem with standard student loans from commercial banks is that they affect job choice. For example in the early 1990s the then-President Bill Clinton observed that USA graduates of high cost degrees (such as law) with a 10-year loan and fixed repayment amount cannot afford to work in legal aid or for the government – as a prosecutor, public defendant, etc. Chapman (2014) recalls that this was one of the main reasons President Clinton advocated a transition to ICLs in the United States.

3.3 *Tuition Fees with Government ICLs*

Loans with repayments based on income were suggested by Friedman (1955) and Nerlove (1975). The country pioneering ICLs for tertiary education was Australia in 1989 in its Higher Education Contribution Scheme (HECS); for details see Chapman and Harding (1993). Following its success the system was subsequently adopted in New Zealand, South Africa, England, Hungary, Thailand, the Netherlands and South Korea, with many other countries considering it.

The general idea behind an ICL run by the government is that its repayment depends on the borrower's income at the time; and this is the case in two main ways. First, no repayment is required if earnings are below a certain threshold – usually linked to median or mean income. To finance education of graduates with earnings not achieving this income threshold general taxation is commonly used ('risk-sharing ICLs').[13] Second, if income is above the threshold the actual repayment amount retained by the tax office is a certain proportion of the graduate's wage, not a fixed amount as in a mortgage contract.

There are a number of studies assessing the advantages and disadvantages of conventional education loans and ICLs, see García-Peñalosa and Wälde (2000), Chapman (2006), Johnstone (2009), Shen (2010), Eckwert and Zilcha (2012), Migali (2012), Hölzl (2013) or Chapman *et al.* (2014). These studies generally point out that unlike conventional loans by private banks, government-run ICLs protect borrowers from the inability to repay and from default, thus encouraging prospective university students (especially those from disadvantaged groups) to enrol. Besides easing the existing credit constraints and reducing excessive risks, an important benefit of ICLs is to provide better consumption smoothing since they are based on the capacity to pay. As the architect of the Australian scheme Chapman (2014) puts it, the ICL system can be
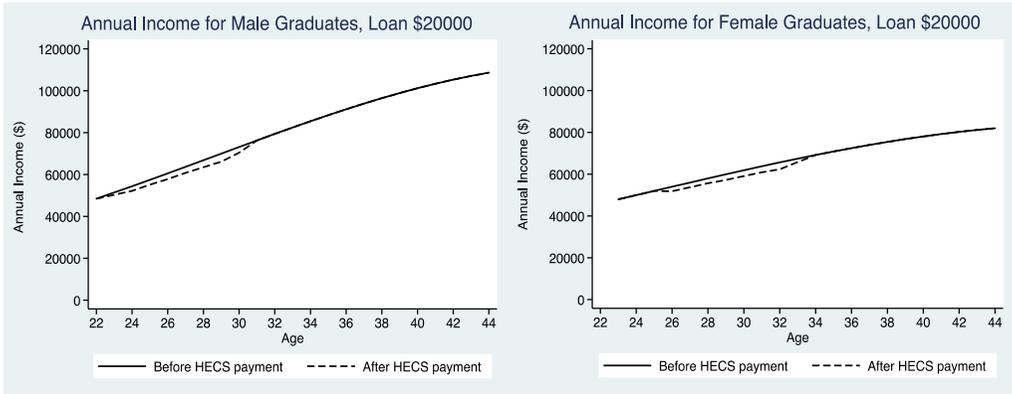
Figure 3. Income Profile in 2014 Dollars of an Australian Male (Left Panel) and Female (Right Panel) with a Bachelor´s Degree and a Typical Student Debt of $20,000 (the Solid Line Shows Gross Income, the Dashed Line Gross Income after ICL Deduction).

Source: Bruce Chapman's Calculations (Obtained via E-Mail).

interpreted as 'pay-when-you-can'. Therefore, borrowers do not suffer from large slumps in consumption when their incomes decrease.[14] All these beneficial features go under our *equity* criterion.

Figure 3 shows an example of an income profile under an ICL in Australia. It makes apparent that the repayment of the student loan, which is 0% below the threshold and between 4% and 8% of gross income above the threshold, is 'hardly noticeable' by the graduate. It does not constitute a major obstacle to their post-study decisions, such as buying a house or having a child. This is in contrast to private bank loan schemes where repayments are dependent on time, not income, and they may therefore amount to a large proportion (even in excess of 100%) of income.

Another (often overlooked) benefit of an ICL scheme is the fact that the government can still directly subsidize education, in addition to the no-repayment threshold and the indirect subsidy via low interest rates on student debt. It can do so by making the deferred loan only a certain proportion of the cost of the degree. Furthermore, the public subsidy can be targeted and differ across disciplines, which gives the government an instrument to encourage enrolment in (more challenging) disciplines that are deemed to have higher social value. For example in Australia the public contribution was, as of end-2015, on average around 55%, so the deferred tuition was only 45% of the actual cost. In particular, in natural sciences the public subsidy was over 80%, whereas in law it was less than 20%.

This implies that, from the perspective of the government's financial contribution, an ICL can essentially reproduce any combination of the 100% tax subsidy scheme discussed in Section 3.1, and the private bank loans scheme of Section 3.2 with as little as 0% public contribution. As such, it can lead to improvements over both of these systems in the *behavioural* and *risk-mitigation efficiency* criteria. It is apparent that an ICL scheme in tertiary education is beneficial also on the *sustainability* criterion since the government recovers a large part of the cost. Finally, as Chapman *et al.* (2014) argue forcefully, probably the biggest improvement compared to the private bank scheme can be achieved on the *transactional efficiency* criterion.

The realisation of these benefits seems to have driven the adoptions of ICLs in many countries, as well as the Earnings Contingent Education Loans Act currently under consideration by the USA Congress.[15] It is, however, conceivable that the ICL scheme may still create behavioural type biases relative to the full-subsidy system under some circumstances. For example this could be due to reducing after tax returns
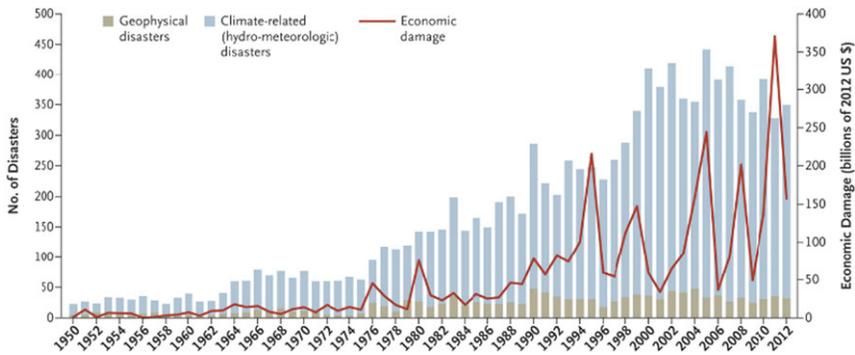
Figure 4. The Number and Type of Natural Disasters during 1950–2015 (Left Axis) and the Resulting Economic Damage (Solid Line, Right Axis).

Source: Leaning and Guha-Sapir (2013).

from tertiary education in the case that its social returns are very high relative to private returns. More research is required to shed light on the relevance of this potential drawback of ICLs.[16]

4. When Public Insurance Is Problematic: Three Conventional Policies

4.1 *Government Natural Disaster Support*

The economics literature on natural disasters is rather recent. It was ignited by the increasing frequency of major natural disasters believed to be linked to global warming. For example Leaning and Guha-Sapir (2013) report that 'there were three times as many natural disasters from 2000 to 2009 as there were from 1980 to 1989 . . . climate-related events accounting for nearly 80% of the increase'. The rise in the associated economic damage is equally dramatic, see Figure 4.

Okuyama (2007) provides a survey of the modelling approaches regarding the economic impact of natural disasters, and Cavallo *et al.* (2013) examine their effect on economic growth. The authors find that 'even extremely large disasters do not display any significant effect on economic growth,' in line with the early findings of Albala-Bertrand (1993).

Despite these society-wide findings, the cost on individuals adversely affected by natural disasters (especially those from low-income households) can be considerable – implying demand for insurance policies based on the *equity* argument. In assessing the existing public insurance measures the literature, dating back to Buchanan's (1975) Samaritan's dilemma, finds a number of problems. Kaplow (1991) examines the effect of various types of public natural disaster relief on people's incentives and decisions. He finds that 'government relief is inefficient; even when its level is less than the private insurance coverage that individuals would otherwise have purchased and even when private insurance coverage is incomplete due to problems of moral hazard.'[17] For similar arguments and findings see Shughart (2011), who questions the often assumed public good nature of disaster relief. There are many other, more narrowly focused studies to that effect; for example King (2011) shows that government compensation of flood victims tends to lead to houses being built in more flood risk areas.

These adverse impacts of moral hazard fall under our *behavioural efficiency* criterion and seem large quantitatively. Kousky *et al.* (2014) provide causal estimates of the effect of the United States' government natural disaster relief on private insurance demand. The authors find that 'a $1 increase in average aid

grants decreases average insurance coverage by about $6.' Furthermore, Wildasin (2008) identifies another type of moral hazard associated with disaster relief, arguing that country-wide schemes usually weaken the incentives for state/local governments to invest in disaster preparations.

It is, however, important to stress that all these findings relate to existing public policies, and do not necessarily imply that the government has no role to play in minimizing people's risk associated with natural disasters. Some actions of the government may still be beneficial, both directly and indirectly. In terms of an indirect effect, Kahn (2005) finds an important effect of quality public institutions in reducing the negative impact of natural disasters such as deaths from earthquakes. The author argues that this may be through channels such as proper enforcement of zoning laws and stricter building codes, a situation where public policies may lead to an improvement in our *risk-mitigation efficiency* criterion.

Similarly, Linnerooth-Bayer *et al.* (2011) examine recent experience with various insurance schemes, focusing on both the prevention side and the recovery side of natural disasters. The authors offer specific examples of public–private insurance programs for individuals and firms including their costs, benefits and optimal design issues. Such joint schemes may be beneficial through enhancing the system's diversity. In relation to that, Hofman and Brukoff (2006) point out that private insurance markets increasingly offer opportunities for the government to reduce its fiscal risks (improve the outcomes along the *sustainability* criterion) by transferring the potential negative impact of natural disasters.

Importantly, novel ICL type natural disaster relief policies seem to be available to governments. They may partly mitigate the moral hazard problem highlighted above, and thus improve social welfare compared to the status quo. For example Botterill and Chapman (2009) advocate the change of financial assistance to farmers from grants to ICLs in the context of drought relief. It is apparent that while the moral hazard problem is not fully solved, the scheme is likely to reduce the incentives for undesirable behaviour of private agents as they have to repay the financial assistance. This conclusion is in line with Kousky *et al.* (2014), who find the crowding out effect of public natural disaster insurance on its private counterpart to disappear when government grants are replaced by loans. The implication is that ICLs in this area may have beneficial effects along our *behavioural* and *risk-mitigation efficiency* criteria compared to conventional public options. This is in addition to benefits along the *sustainability* dimension. Relative to private sector options, an ICL scheme in this area would have *equity* type improvements due to consumption smoothing and *transactional efficiency* improvements through using the tax system.

4.2 *Bank Deposit Insurance*

The 2008 Global financial crisis has, in line with the seminal work of Diamond and Dybvig (1983), highlighted both (i) the motivation for a public deposit insurance system, and (ii) the arguments against such a system. In terms of the pros, public deposit insurance schemes have arguably prevented bank runs and financial collapses in some countries since 2008. In terms of the cons, the scheme's resulting moral hazard seems to have contributed to increased systemic risk prior to 2008, and it was therefore partly responsible for the many problems that have occurred. Put differently, the recent crisis has exposed the trade-off between two public risk management approaches: (ex ante) risk reduction arguing against a deposit insurance scheme, and (ex post) loss control arguing in favour of such a scheme. These fall under our *behavioural* and *risk-mitigation efficiency* criteria.[18]

In Diamond and Dybvig (1983) and the subsequent literature, deposit insurance tends to be an optimal policy as it deals with the threat of self-fulfilling runs on banks – a consequence of incomplete information on the part of some agents. Deposit insurance can thus potentially prevent from a 'domino effect' of financial bankruptcies and severe damage to the banking system, see Iyer and Puri (2012) and Hasman (2013). In addition, Bhattacharya *et al.* (1998) argue that deposit insurance financed by taxation is generally superior to suspensions of bank withdrawals as a bank run prevention tool.
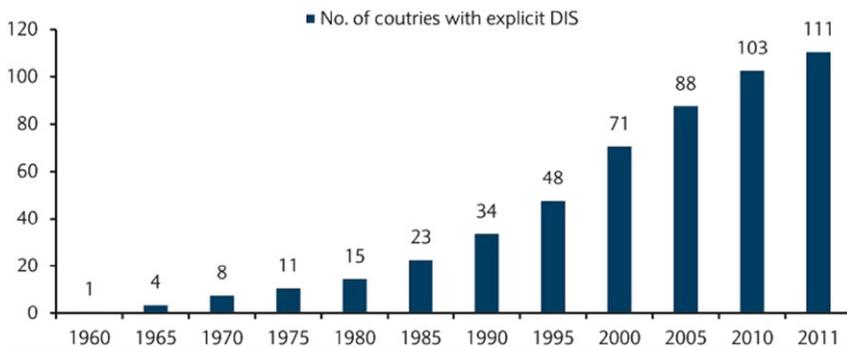
Figure 5. The Adoption of a Formal Deposit Insurance Scheme (DIS) Over Time.

Source: Hayes (2013).

Nevertheless, virtually all authors stress the possible moral hazard arising from deposit insurance. The quality of the bank's portfolio becomes less important in the depositors' choice and hence competing banks have an incentive to take on excessive risk in their investment and lending. Grossman (1992) reports evidence of this in the thrift industry in the United States during the Great Depression of the 1930s. Similarly, Demirgüç-Kunt and Detragiache (2002) find an adverse effect in a sample of over 60 countries during the 1980–1997 period. The authors show that explicit deposit insurance tends to increase the probability of a banking crisis, with the effect being stronger in countries with deregulated interest rates, inferior institutional framework, and greater protection of depositors. They find the undesirable effects to be more pronounced when the insurance scheme is administered by the government rather than the private sector.

Furthermore, Shy *et al.* (2014) show that limited deposit insurance schemes used in most countries incentivize consumers to allocate their liquid financial assets and open accounts with multiple banks to achieve higher insurance coverage. They thus argue that the scheme 'weakens competition among banks and reduces total welfare relative to no or unlimited deposit insurance,' and as such it is likely to reduce *transactional*, *behavioural* and *risk-mitigation efficiency* over the longer term.

Despite a large body of literature examining deposit insurance practices – for surveys see Santos (2006) and Demirgüç-Kunt *et al.* (2008) – the solution to the risk-reduction versus loss control policy trade-off is still an open question. The inconclusiveness and warnings of the literature have, however, not stopped explicit public deposit insurance schemes spreading around the globe rapidly – replacing implicit guarantees. Following the implementation of the first such scheme in the United States in 1934, it was imitated by high-income countries in the 1960s and 1970s, and its worldwide adoption took off in the 1980s. It was then, in some limited form, also embraced by the International Monetary Fund in its Code of Best Practices (see Folkerts-Landau and Lindgren, 1998). The number of countries with an explicit deposit insurance scheme exceeded 100 in 2010, see Figure 5, more than half of whom were members of the International Association of Deposit Insurers (see IADI, 2014).

Despite the problems with conventional deposit insurance, the use of ICLs has not been considered in the literature or real-world policymaking. It is apparent that converting the nonrepayable insurance payment to a loan would have two effects. It would reduce the moral hazard problem, improving *behavioural efficiency* as well as *risk-mitigation efficiency* over the long-term horizon. However, it would also reduce the public protection of the banking system against self-fulfilling bank runs, and thus reduce *risk-mitigation efficiency* from the short-term perspective. It would therefore not solve the

policy trade-off; it would simply move countries away from the status quo in the direction of no deposit insurance. More research is therefore required to assess the likely welfare implications of such a regime change.

4.3 *The Pension System*

Saving up for retirement is one of the key elements of managing personal finances. As the Modigliani and Brumberg's (1954) life-cycle hypothesis posits, people like to smooth their consumption over their lifetime, which highlights the importance of retirement saving and pension systems. In order to discuss the role of governments in managing retirement related risks, let us briefly describe the existing pension schemes using the World Bank classification, see Holzmann and Hinz (2005). There are four main pillars that differ along several dimensions, one of them being the insurance aspect. The 'zero pillar' and 'first pillar' are both public schemes, and both are generally unfunded. While the former has a redistributive role and the latter has a consumption smoothing role, both act as a form of government insurance. They attempt to shelter individuals against the risk of poverty and longevity, respectively. The 'second pillar' is a mandated pre-funded private pension scheme – set up as either defined-benefit or defined-contribution. The 'third pillar' is a voluntary pre-funded scheme, often linked to a person's employment.

4.3.1 *The First Pillar (Pay-As-You-Go System)*

The first pillar has traditionally been the dominant component of most high-income countries' pension systems; see for example country surveys by Whitehouse (2007) or OECD (2013). Does it provide an effective insurance against longevity risk? On one hand, there are factors suggesting that a public pension system may be suitable to insure such risk. For example economies of scale or existence of the required public infrastructure (i.e. *transactional efficiency* arguments) have been put forward to argue for the role of government in helping people minimize their longevity risk.[19] This is in addition to *equity* considerations whereby a public system enables a greater degree of redistribution from higher to lower income earners.

   We agree with these general points. Nevertheless, the rest of this section will argue that the way the first pillar is set up in most countries does not deal with longevity risks effectively. In fact, it introduces additional country-specific and government-specific risks, that is it tends to lead to worsening of the *risk-mitigation efficiency* and *sustainability* measures. A widely debated problem relates to demographic trends and uncertainty arising from the fact that there is no mechanism ensuring sustainability of the public pension system. Specifically, existing first pillars run predominantly on a pay-as-you-go basis, and most feature both defined-contribution and defined-benefit. The trend of an ageing population necessarily implies a widening gap between such pension system's expenditures and revenues, which is covered from general taxation.[20]

   Our focus is, however, elsewhere. Even if the public pension system seems sufficiently funded, i.e. its net expected position is zero (for example through an inbuilt 'balancing mechanism'), its design suggests a problem related to risk management. A pay-as-you-go first pillar breaches the basic rule of finance – risk diversification – as it cannot insure country-specific and government-specific risks. This is unlike the capital accumulation system of the second pillar, in which people's pension contributions can be invested into foreign assets, and thus the country-risk minimized.[21]

   What country-specific risks are we referring to? Most countries arguably have their Achilles' heel. The weak spot of Cyprus, Iceland and Ireland was a poorly regulated banking sector. In the several years prior to the Global financial crisis its size swelled up and banking assets were more than seven times the level of GDP in these countries (for comparison, the corresponding figure for the United States was 1.2 in mid-2008). Greece provides even more recent memories. The country has, like many others, suffered from the effects of an inefficient government. These trends are also characteristic for Qatar, Kuwait and

other oil rich countries, where over 80% of the nationals work in the public sector, and where the danger is excessive dependence on oil revenues. France's major problem is its social welfare spending, which amounts to over 32% of GDP, and is significantly in excess of, for example 9% in South Korea or around 17% in the USA, Canada, Ireland and Australia.[22] Spain's main vulnerability seems to have been an inflexible and highly regulated labour market contributing to the massive unemployment post-2008.

One could continue the list; most countries seem to have a sore spot and recent developments have shown that the negative consequences of a crisis can be considerable. For example Irish debt rose from 25% to almost 120% of GDP over the 2008—2013 period. Greek real GDP per capita fell by 15% over these 5 years. Unemployment in Spain increased from less than 8% to 26% over that period, and 56% among young people. Hand in hand with these catastrophic macroeconomic results, stock market declines have occurred in these countries. The main Greek stock index lost 80% of its value over that period, the Irish did the same in just 2 years, and the Spanish market fell by 50%.

The prosperity of individuals in crisis affected countries tends to be adversely impacted through several channels related to retirement savings. Commentators mainly focus on the fact that people's investments in the domestic stock market are worth a lot less. But the large negative impact through the public pay-as-you-go first pillar should not be overlooked. A financial crisis and/or a severe economic downturn cause deterioration of public finances, and often induce austerity measures in the form of changing the parameters of the pension system to the detriment of the retirees. For example governments are forced to increase the retirement age, reduce the replacement ratio or tighten various eligibility criteria (for the recent Greek example see OECD, 2013). All of these arbitrary adjustments disproportionately hurt the poor, and are in conflict with the *equity* criterion. An implication of this is that the public pension system, conceived as an insurance of retirement risks by the government, may in fact increase retirement uncertainty and reduce *risk-mitigation efficiency*. It may therefore create incentives for individuals to insure against their government's policies.[23]

4.3.2 *The Second Pillar (Capital Accumulation System)*

A pre-funded system, through careful foreign diversification, can largely avoid the need for arbitrary and unequitable adjustments of the retirement parameters. As such, this system can mitigate country-specific risks.[24] There exist several possible schemes. Chile and Australia do not have first pillars at all. They only run a zero pillar; a minimum for pensioners with low incomes and assets, the amount of which is 17% of the average wage in Chile and 25% in Australia. Instead, these countries have put most of the weight of their pension system onto the private second pillar, which is mandatory and features capital accumulation. It thus allows for foreign diversification of related risks. Despite a growing trend, only around 30 countries have such second pillars as of mid-2015, and in many of them these play a fairly minor role, see Holzmann (2012). This is why for many countries' retirees the public pension constitutes almost all of their income (more than 97% in central European countries such as Austria and Slovakia, and 90–95% in France and Italy).

Many people question the feasibility of the transition from a pay-as-you-go system to pre-funding, but recent research suggests that it may be possible to devise welfare improving transition paths to the capital accumulation system. For example McGrattan and Prescott (2015) show that it can be done in the United States in a way that 'increases the welfare of all current and future generations,' because the transition creates a lot of new productive capital.

For sceptics of the privately run second pillar – that often recruit from post-communist countries due to a weaker tradition of property rights and problematic privatizations – it is important to stress that the capital system does not necessarily have to be run through the private second pillar. It can be applied under the auspices of the government within the first pillar, as illustrated by the examples of Denmark and Sweden. And similarly to the case of higher education ICLs, *transactional efficiency* (economies of

scale) may be important here. For example in the Swedish system (see Guardiancich, 2010) the planned cost for the administration of the capital part of the first pillar is only 0.2% of total assets. This is much lower compared to private pension funds' fees, which generally range from 0.5% to 3% of total assets in high- and middle-income countries (with the majority between 1% and 2%, see Tapia and Yermo, 2008).

Another danger put forward by the sceptics of a privately run capital accumulation pension system is that it may be nationalized, i.e. expropriated by the government. The 2011 experience of Hungary is used as an example. This implies that it is imperative for legislative and political constraints to be put in place that prevent this scenario. It must also be acknowledged that large countries, especially the United States, are somewhat constrained in their foreign diversification options. This is not only because global financial markets are strongly influenced by USA developments, but also because the financial markets of countries with favourable demographics could take in only a very limited proportion of high-income countries' pension assets. More broadly, it can be concluded that the relative strengths and weaknesses of the pay-as-you-go pension system are determined by the country specifics as well as the quality of the policy's design and implementation.

In the context of the paper, it is important to add that traditional ICLs cannot alleviate the problems with conventional public pensions as there is no income stream post retirement to pay for the loan. Nevertheless, their variant called 'resource contingent loans' could perhaps be used in such instances. They use a retiree's assets for repayment – in line with the idea of reverse mortgages – and have been recently explored in the literature, see Chomik and Piggott (2014). More research is, however, required to assess their pros and cons.

5. Innovative ICL-type Risk Management Tools for Government[25]

This section shows that income contingent schemes can be used by the government in many other risk management areas. Our discussion will, however, only relate to countries with a good quality institutional framework which should in principle ensure that politicians' interest is in line with social welfare, and enable public ICL-type insurance systems to be implemented effectively and credibly.

5.1 *ICLs for Parents of Small Children*

Paid parental leave is widely considered an important welfare-enhancing device both for individuals and society. However, voluntary corporate schemes based on human resources strategies tend not to be available to all employees. For instance, only 28% of Australian employers provided paid parental leave in 1997 and 39% in 2002. Therefore, paid parental leave systems have been implemented by governments in all high-income countries except the United States. Due to their burden on the public purse, the duration, however, tends to be rather short – commonly no more than 6 months.[26]

Chapman and Higgins (2009) argue that, similarly to the case of tertiary education, the lack of collateral is associated with a market failure whereby the private sector may be unwilling to provide extended funding for parents of new born children. The authors' simulations show that an ICL scheme offering an optional extension of the Australian government's 18-week parental leave grant may be socially desirable. It may in fact have potential benefits along all our efficiency-equity-sustainability criteria.[27] Chapman and Higgins (2009), however, stress that in order to minimize adverse selection and moral hazard the scheme's design has to sufficiently restrict loan duration and size, specify the loan's repayment as an obligation of both parents and set a fairly low threshold for minimum repayment (relative to the one on tertiary education loans).

5.2 *An Income Contingent Scheme for Fines*

The collection of fines for low-level criminal offenses poses a problem worldwide. A substantial part of the fines is unpaid and there is a large cost to the government due to the legal proceedings. This is, however, not the only social cost. Penalty escalation can lead to a small fine turning into much more severe consequences for the individual such as confiscation of a car, personal bankruptcy, impaired credit reputation or even imprisonment. Chapman *et al.* (2004) therefore propose a Fine Enforcement Collection Scheme (FECS). It would automatically collect fines for low level offences that remain unpaid after a certain period – using the tax (or welfare) system. The repayments of the debt would be a function of income, but both the no-repayment threshold and the percentage of income above the threshold would be lower than in tertiary education to make the scheme viable.

Chapman *et al.* (2004) argue that the proposed FECS scheme may, if well implemented, lead to a reduction in financial risks for both the taxpayer and the offender. In terms of the individual, the scheme significantly reduces the danger that a minor fine will have costly consequences in the future, i.e. it is beneficial along the *equity* and *risk-mitigation efficiency* criteria. It must be acknowledged that elimination of these risks may reduce the desirable deterrence effect of the fine, but this may be (at least partly) offset by the fact that the scheme lowers offenders' chances of avoiding paying the debt. The judges and magistrates would arguably welcome the scheme as it is likely to reduce the uncertainty regarding the payment of the imposed fine, and thus make the punishment more credible. This would imply greater *behavioural efficiency*. There would also be improvements in the *transactional efficiency* and *sustainability* criteria since the payment of the fines would be maximized and the administrative burden of 'chasing' the offenders largely reduced.

5.3 *Income Contingent Schemes in Other Areas*

The past two decades have seen a large amount of research considering ICL schemes in areas not mentioned above. This includes 'brain drain' in international labour markets, whereby many people educated in low-income countries resettle in high-income countries. Clarke and Chapman (2014) demonstrate how an international ICL scheme may be able to undo some of the associated regressivity detrimental to the development of the low-income country. The scheme would 'require the emigrating graduate to take out an ICL repayment obligation in line with their remaining student debt at the time they are issued with an employment visa to the destination country. The ICL could then be repaid on the same terms as domestic students and the collected funds transmitted back to the country of origin, potentially to support higher education.' The extent to which this proposal can feasibly address brain drain and improve *equity* in international labour markets, however, needs to be explored further.

In an important line of research, Stiglitz and Yun (2014) consider the use of ICLs for the unemployed – vis-à-vis conventional unemployment benefits and private sector loans. Their formal analysis shows that when the risk associated with unemployment is small enough, there is no room for an ICL scheme. But when risks are rather large then the unemployment program should include both conventional unemployment benefits and ICLs, whereby their optimal mix is shown to 'vary over the individual's lifetime, and depend on the individual's work history and on the elasticity of search.' The latter expresses how much individuals change their search intensity in response to incentives, and thus captures the size of the moral hazard problem.

Other areas in which potential ICL applications have been found useful are healthcare financing (Vaithianathan, 2014), financial support in old-age (Chomik and Piggott, 2014), legal aid assistance (Denniss *et al.*, 2012), global warming adaptation measures (Dobes and Chapman, 2012), investments

in research and development (Denniss *et al.*, 2009), policies in the farming sector dealing with weather cycles (Botterill and Chapman, 2009), community projects of social value (Chapman and Simes, 2006), housing costs assistance for low-income people (Gans and King, 2004), insider trading and similar white collar crimes (Chapman and Denniss, 2005) and training of professional athletes (Denniss, 2003).

6. Summary of the Pros and Cons of ICLs Relative to Other Public and Private Options

This section offers a summary of the discussion in Sections 3–5 by providing an overview of the advantages and disadvantages of income contingent schemes vis-à-vis conventional public and private insurance (the relevant references appear above and will not be stated again to avoid duplication). In our comparison we will use the framework postulated in Section 2. Naturally, potential pros and cons of any policy depend on the quality of its design and implementation. We will therefore focus on countries with quality institutions, and assume as a starting point 'state-of-the-art' design and implementation. Nevertheless, we will also discuss how the desirability of government ICLs as well as the corresponding conventional public and private insurance options may change if they are ill-designed and/or badly implemented.

6.1 *Behavioural Efficiency*

Income contingent schemes may lead to some improvements in behavioural type of efficiency. But before summarizing them it should be stated clearly that this is *not* their key benefit; in fact, they may have some drawbacks compared to existing schemes. For example ICLs as well as conventional public schemes tend to lead to distortions of the private insurance system and prevent it from working effectively. Such arguments get linked to short political cycles and potentially time-varying preferences of politicians, even in the most institutionally developed countries. Furthermore, compared to private schemes, ICLs may lead to two types of moral hazard. Ex ante, they may incentivize overconsumption by those (with low expected incomes) who anticipate never having to repay the loan. Ex post moral hazard is associated with increased effective marginal tax rates, which may lead some people to decrease their work effort or even emigrate to avoid the debt.

In terms of the possible behavioural benefits of ICLs over conventional public schemes, various examples were discussed above. One related to the fact that the recipient of government funding repays it when their income is above the pre-agreed threshold. This means that the recipient (for example a university student) will, compared to a standard grant system of 'free' tuition, think more carefully about going ahead with the activity (university studies), about choosing the right activity (appropriate qualification) and about completing it efficiently (not stretching the degree duration unnecessarily and applying themselves academically). Arguably, private schemes without government involvement may have even better properties on the behaviour front, and may eliminate adverse selection more effectively.[28]

Nevertheless, such private schemes may fail in some areas such as tertiary education financing. For example Quiggin (2014) shows formally that under asymmetric information and sufficiently high default probability, private loan contracts are not feasible. And in such areas they are usually supplemented by government guarantees, which introduce a host of new behavioural problems such as moral hazard on the part of private banks.[29]

Another potential behavioural benefit of ICLs is a reduction of the adverse impact on occupational choice compared to private schemes. For example ICLs may enable graduates of high cost degrees such as law to work in the public or not-for-profit sector. Finally, as the government's tax office is entitled by law to obtain information about people's income, unlike private banks, this may in principle help reduce various information asymmetries and undesirable misreporting behaviour.

6.2 *Transactional Efficiency*

Chapman *et al.* (2014) argue that the low cost is a very important advantage of government-run income contingent schemes (as well as some conventional public schemes) compared to their private counterparts. For example Figures 1 and 2 in Section 2 showed that in countries with sound institutions such as Sweden, Denmark, Finland, Norway and the United States, the cost of private nonlife insurance (expenses per claim) is more than 30 times higher relative to the cost of government tax collection and welfare provision (per dollar collected).

This statistic obviously does not capture the full extent of the various costs, but it indicates that well-run governments may be able to inexpensively provide certain types of insurance.[30] This is primarily due to economies of scale and savings achieved by using existing infrastructure – for example the tax office for automatic collection of ICLs. To demonstrate, the Australian Tax Office estimates costs of collection from university graduates at approximately $40 million per year (in 2013 dollars), which is less than 3% of annual receipts. Nobel laureate Joseph Stiglitz, an advocate of the transactional efficiency of ICLs, estimates that the 2010 move from private bank loans to direct government financing of tertiary education in the United States 'will save approximately $68 billion from 2010 to 2020' (see Stiglitz, 2014).

Similarly, the analysis of Hock-Eam *et al.* (2014) shows that adopting an ICL scheme for tertiary education in Malaysia could substantially reduce the amount of government subsidies, while keeping the repayment burdens manageable (subject to the problems with debt collection). The same is shown in Grave and Sinning (2014) for Germany, where the current repayment burdens for women in the East part of the country that are in the bottom 25% of the graduate income distribution are around 70%, see Chapman *et al.* (2014). This is in contrast to the ICL schemes in Australia, the United Kingdom and New Zealand where the maximum repayment burdens are 8%, 9% and 10%, respectively.

An additional advantage of public schemes compared to private ones is the greater bargaining power that the government can exert in reducing the cost due to a larger pool of insured people. This may be desirable as many of its counterparties possess a fair degree of monopolistic power.[31] Finally, as the tax office is legally entitled to know a person's income, ICLs cut on the cost of information provision relative to private schemes.

6.3 *Risk-Mitigation Efficiency*

The outcomes along this efficiency criterion crucially depend on the quality of the policies' design. Well-designed ICL schemes (as well as other public schemes) may be able to reduce risk (of default, for example) to a larger extent when compared to private schemes since the government can pool risks across a greater number of people.[32] However, one can find numerous real world examples of well-intentioned government policies that failed miserably due to poor design or implementation, or due to arbitrary policy adjustments driven by political economy factors, lobby groups or corruption. For example Chapman (2014) discusses the design of ICLs for tertiary education in Columbia, and why the scheme as proposed by the government could never work effectively and was never implemented.

Nevertheless, this point of criticism seems to apply even more strongly to conventional public risk management policies due to greater behavioural problems. For example in Section 4 we discussed the issues with natural disaster policies, deposit insurance and pay-as-you-go pension systems. The regulation of the financial system in the lead-up to the 2008 Global financial crisis is another case in point.[33]

6.4 *Equity (Distributive Efficiency)*

The usual narrative is that public schemes are more equitable compared to private schemes due to active redistribution from high- to low-income earners. For example it is generally accepted that

quality government-run primary education reduces the consumption gap between low- and high-income individuals over the long term (but not necessarily over the short term, see Glomm and Ravikumar, 2003).

An important benefit of government ICLs, compared to private schemes, is providing better consumption smoothing and protection against default. As Section 3 discussed, in some instances (for example tertiary education loans) insurance seekers cannot provide 'liquid' collateral, which limits their access to insurance and an ability to smooth consumption over their life time. Since the government has information about individuals' incomes it can be more sensitive to their financial circumstances by making the repayments evolve with income. In private schemes, repayments are generally a fixed amount which can cause substantial consumption hardship or even a personal bankruptcy. As Quiggin (2014) demonstrates using a formal model, ICLs are superior to conventional tax financing when there exists a positive correlation between the initial funding and future income. This is the case in most of the potential ICL applications we have discussed above.

Nevertheless, it should be mentioned that ICLs may have *equity* type benefits even compared to conventional public options. For example, the introduction of an ICL scheme in Australia was driven by the realization that 'free' tertiary education is regressive, whereby low-income people without tertiary education subsidize the university studies of those who will, upon graduation, have much higher incomes. A similar undesirable situation tends to occur with conventional public paid parental leave, whereby low-income singles and childless couples may end up subsidizing high-income families. As explained in Section 5, this can be largely rectified if the policies are converted or supplemented by an ICL scheme. Furthermore, ICL schemes allow extending government assistance to a greater number of individuals and companies, which can be considered a fairer system, also because the more successful ones pay back a larger share. Relatedly, ICL schemes generally benefit females to a larger extent than males and hence reduce the gender wage gap. This is because women have lower and more variable expected incomes due to taking time off work to look after small children.[34]

6.5 Sustainability (Generational Accounting Efficiency)

Many countries face long-term fiscal sustainability challenges, partly due to the demographic trend of population ageing. Public insurance programs are therefore under increased scrutiny based on cost–benefit considerations, also because raising additional taxes may be associated with an economic contraction and work disincentives.[35] It is apparent that income contingent schemes are superior over conventional public options in this respect. This is because a large part of the funding is repaid to the public purse; in fact they can be designed to be fully self-financing if needed.

In contrast, it is becoming increasingly apparent that even private schemes may become unsustainable with possible fiscal implications, for example in the area of employee pension plans or financial market insurance instruments. They may therefore have undesirable consequences not only for their beneficiaries, but also for the budget should the government attempt to bail out such private schemes.[36] In summary, the optimal choice between ICLs, conventional public and private insurance schemes largely depends on the specific type of public insurance as well as a number of country-specific factors. But we have argued in this paper that in countries with quality institutions, in which policies are (at least in principle) well-designed and implemented, income contingent schemes are likely to outperform the alternatives along several dimensions.

Our discussion in Sections 3-5 implied the following. Compared to conventional public options, ICLs are commonly superior not only along the *sustainability* and *transactional efficiency* criteria, but commonly also along the *behavioural efficiency* criterion, and sometimes even along the *risk-mitigation* and *equity* criteria.[37] Compared to private insurance schemes, well-designed ICLs tend to fare well along the *equity*, *transactional efficiency* and *risk-mitigation efficiency* criteria, and under some circumstances also along the *sustainability* criterion. While ICLs may still lack behind on the *behaviour efficiency* measure compared to some private options, future improvements in the design of ICL schemes may be

able to reduce the potential problems. Put differently, ICLs may, in some areas, improve the efficiency-equity trade-off the policymakers are facing. In line with that, the World Bank has endorsed the adoption of income contingent schemes in countries that are capable of collecting the debt efficiently, see Salmi (2003).

It should, however, be stressed that in countries with a poor institutional setting the range of public insurance options is limited – ICL schemes are unlikely to work effectively and may in fact turn to be counterproductive. This is because their proper functioning seems even more sensitive to quality design and implementation than conventional public schemes. In such countries the ranking of the insurance options is therefore likely to be reversed, and ICLs may be inferior to both conventional public and private alternatives along most of our five criteria. It is also important to note that 'system diversity' tends to be beneficial in a range of areas. It may therefore be optimal to have some combination of private and public (ICL and conventional) schemes in order to maximize the *risk-mitigation efficiency* measure. An example of this is healthcare, where the best performing systems include both private and public health insurance schemes (for comparisons see Davis *et al.*, 2014). Furthermore, the fact that institutional quality varies substantially across countries and time seems to be an argument in favour of mixed systems potentially featuring a combination of all three types of schemes – achieving a more robust and diverse system.

7. Summary and Conclusions

The topics of risk and insurance have been of interest to researchers and policymakers due to their major implication for people's wellbeing. Can government policies enhance social welfare by insuring various risks of the citizens? Or is it the opposite, and people actually need to insure against the risks arising from ill-designed government policies? This paper argues that it is both. We use tertiary education income contingent student loans as an example of the benefits of public insurance, and the pay-as-you-go pension system as our main example of its potential failure.

The paper discusses how public insurance may be improved, highlighting the applicability of income contingent schemes in a number of standard as well as novel areas. Our broader message is that governments in countries with sound institutions may enhance social welfare by moving away from their current role of providers of funds to the role of risk managers. Using ICLs could go a long way towards reducing uncertainty of individuals as well as ensuring more equitable outcomes without compromising efficiency. Importantly, such policies could prove to be a much needed step in the direction of fiscal sustainability.

Acknowledgements

Notes

1. For estimates of risk and ambiguity aversion across genders see Borghans *et al.* (2009), for underlying theory Chetty (2006).
2. This includes New Zealand in 1992, South Africa in 1994, England in 1997, Hungary in 2003, Thailand in 2006, the Netherlands in 2012 and South Korea in 2012. There has been a keen debate on this policy in other countries such as Germany, Colombia, Chile, Malaysia and the United States.

3. For example flood victims compensation tends to induce more houses in flood risk areas (King, 2011), unemployment benefits may discourage people from seeking work (Wang and Williamson, 1996) and bank deposit insurance may induce more risky behaviour by depositors and banks (Diamond and Dybvig, 1983).

4. A similar failure to manage risk on the part of the government, highlighted during the 2008 Global financial crisis, occurs in the financial sector. Implicit and explicit government guarantees (to too-big-to-fail institutions) have been identified to lead to moral hazard and potentially to a large cost to the taxpayer (see for example Stern and Feldman, 2004).

5. An earlier version of the paper connected this discussion to the real world by calculating countries' institutional quality based on the World Bank's Worldwide Governance Indicators. This section has been removed due to the space constraint but is available, together with the data, from the authors upon request.

6. Chetty and Finkelstein (2013) show that the fraction of GDP devoted to various public insurance programs tends to increase sharply with GDP per capita.

7. In addition to more equal income distribution and possible market failures, Diamond (1977) also highlights 'paternalism' as a reason for the existence of public insurance programs.

8. Leigh (2008) estimates that in Australia each year of a Bachelor degree raises annual earnings by about 15%.

9. Their combinations are also possible, see Del Rey and Racionero (2010). There exist other (less common) schemes such as graduate taxes and human capital contracts, see Hanushek and Welch (2006) and Bearse *et al.* (2013).

10. For a detailed survey see European Commission (2013).

11. This problem is partly mitigated under the human-capital contracts scheme whereby individuals and firms invest in students selectively by buying shares in their future earnings. A classic example is legendary boxer Muhammad Ali signing a human capital contract to support the initial stage of his career, committing to pay half of his earnings to investors.

12. Until 2010, this system of government-backed private loans was typical for the United States. Then the US Department of Education took over the provision of student loans under The William D. Ford Federal Direct Loan Program, and a similar change took place in Canada in 2000.

13. It is in principle possible to have graduates with higher earnings rather than all taxpayers cover the unpaid debts ('risk-pooling ICLs'), but such a scheme is virtually non-existent in practice. To understand why, it is instructive to recall the risk-pooling ICL scheme implemented at Yale University in 1971. Under the Tuition Postponement Option program, the University provided its students with income contingent loans to cover the tuition fees and the graduates were responsible for repaying not just their individual loans, but the aggregate amount of loans of all students graduating that year. However, this self-financing scheme with collective responsibility was soon discontinued as those prospective students expecting high future salaries were motivated to apply to other universities (see Nerlove, 1975). By implementing the risk-pooling ICL scheme at a country-wide level (as per Hungary's example, see Del Rey and Racionero, 2010) this adverse selection problem is largely (but not fully) mitigated.

14. Eckwert and Zilcha (2012) and Migali (2012) argue that the desirability of ICLs vis-à-vis conventional loans depends on the combined effect of students' income uncertainty and risk aversion. In particular, the ICL system is favourable for risk-averse individuals with high income uncertainty and low prospective incomes, while the conventional loan system is attractive for risk-neutral individuals with low income uncertainty and high prospective incomes. As a consequence, the implementation of the ICL funding scheme may in principle lead to over-investment in tertiary education due to greater participation of students with worse income prospects. But this issue is nowhere near as pronounced as under the conventional tax-subsidy scheme, and ICLs may in fact work in the desired direction by correcting the underinvestment in human capital arising from its positive externality.

15. Findeisen and Sachs (2015) and Stantcheva (2015) argue that the feedback between optimal income taxes and optimal human capital policies over the life cycle requires that these two areas be analysed jointly. The latter paper shows that optimal allocations can be achieved through an ICL scheme, but the repayment schedules need to reflect the full history of human capital investments and earnings.

16. Similarly, it has been argued that shares are private counterparts of government-run ICLs. This is true in the sense that by buying equity, investors provide companies with money in the expectation that there will be a return in the form of dividends and/or higher share prices. But shares do not have the main features of ICLs, which are motivated by the existence of credit constraints and incomplete capital markets.

17. The underinvestment in private insurance due to public protection has also been highlighted in other areas, for example foreign aid (Svensson, 2000), terrorism (Brown *et al.*, 2004), and long-term care (Brown and Finkelstein, 2008).

18. The trade-off is also apparent in relation to implicit government guarantees to large financial institutions deemed 'too-big-to-fail' (for example Farhi and Tirole, 2012). As an example of the adverse effects in this area, out of the 10 largest depository banks in the United States four failed or received a bailout post-2008, whereas only about 6% of smaller banks did so. For an empirical analysis in this regard see Afonso *et al.* (2014).

19. De Walque (2005) explains emergence, size and political viability of pay-as-you-go pension systems within a small overlapping generation model.

20. Most high-income countries are projected to experience a major increase in public expenditures on pensions, for example Belgium from 11% to 16.2% of GDP over the 2010–2035 period (OECD, 2013). It should be noted that a true pay-as-you-go system in which outflows strictly equal inflows at any point in time would not be vulnerable to the ageing population trend, but this is not how most public pension schemes are designed (although the situation differs in private systems, for example the French scheme ARRCO).

21. Whether private pension funds in the second pillar carry out foreign diversification in a sufficient manner is a separate issue, studied as the 'equity home bias puzzle' by French and Poterba (1991) and the subsequent literature.

22. For a recent in-depth discussion of the reasons behind the 20th century expansion of the welfare state see Congleton *et al.* (2013).

23. There is no comprehensive comparison of the risks associated with funded and unfunded schemes; more research is required to identify which system is superior in terms of risk management in any particular context.

24. It should be noted that foreign diversification is associated with other risks, for example movements in the exchange rate that need to be carefully considered. Nevertheless, if a country is hit with a domestically induced crisis its exchange rate tends to depreciate, so investments in foreign assets work in the desired counter-cyclical fashion by increasing in value and reducing the negative wealth effect. Furthermore, there are additional advantages of the capital accumulation system in terms of increased flexibility that have risk-management implications, for example Van Vuuren (2014) argues in his survey that: 'Institutional reforms facilitating flexible retirement opportunities are desirable from an insurance perspective'. For an overview of the impact of the private second pillar on labour markets, financial markets and economic growth see Thomas and Spataro (2015).

25. We acknowledge Professor Bruce Chapman's contribution in writing this section.

26. There are some exceptions, for example in the Czech Republic it is up to 4 years, but the cost of the PPL per child born exceeds 90% of GDP per capita there (compared to 15–30% in countries such as Belgium, Canada, France, Japan, Germany or the United Kingdom, see OECD, 2013). Out of non-OECD countries only a handful of them, such as Liberia, Papua New Guinea and Suriname, do not have a PPL system (MIHSP, 2014).

27. The estimates of Chapman and Higgins (2009) demonstrate that even if there was substantial adverse selection the government's aggregate subsidy would be fairly small. Take their case of 26 weeks' leave as an example. Even in the unlikely scenario in which single parents represent 50% of participants in the scheme (as opposed to an actual population proportion of 15%), and half of these parents are in the lowest income quartile, the aggregate subsidy is estimated to be only 12%, $65 million.

28. Palacios (2014) shows that the size of the market distortion of ICLs is determined by whether leisure affects predominantly people's contemporaneous consumption or rather their lifetime utility from future consumption and leisure. He demonstrates that standard models' assumptions in this respect overstate this distortion and thus the extent of the moral hazard problem associated with ICLs.

29. In fact, there is a growing empirical literature documenting adverse selection in a number of private insurance markets, for a summary see Chetty and Finkelstein (2013). Unfortunately, as these authors argue, 'the empirical techniques developed to identify the existence of selection do not, by themselves, permit even qualitative comparisons of the welfare costs of selection across markets, let alone quantitative welfare statements'. For a comprehensive review of the empirical literature on adverse selection, reporting mixed results, see Cohen and Siegelman (2010).

30. For a survey of the government's efficiency in outsourcing public services to the private sector see Jensen and Stonecash (2005).

31. For example, Morgan (2013) reports that the single-payer healthcare system in the United Kingdom is able to negotiate drug prices with pharmaceutical companies that are, for both brands and generics, approximately 30% lower than in the decentralized system in Canada. There exists evidence of non-negligible loading factors in a number of other markets such as long-term care, annuity and automobile insurance, for the references see Chetty and Finkelstein (2013). Unfortunately, the literature generally lacks the data that could identify the extent to which the loading factors result from market power as opposed to administrative costs.

32. Naturally, the policies do not reduce the likelihood of the underlying adverse scenarios (such as a graduate's unemployment), but reduce the negative financial impact of these scenarios on the individual.

33. In terms of the protection against short-term swings in the economy, all three types of insurance seem to lack traction. ICLs as well as conventional public and private policies are adversely affected by a prolonged economic downturn.

34. This area shows that the insurance and redistribution aspects of ICL schemes may often be interconnected.

35. Campbell and Bond (1997) estimated that in Australia: 'For every $100 raised in [tax] revenue, around $20 is lost in decreased work effort and entrepreneurial activity'.

36. For example the Guardian (2014) reports on the £3 billion shortfall in the Tesco supermarket chain's pension scheme. As another example, the rescue of the insurance giant AIG brought down by insuring mortgage-backed financial instruments prior to 2007, constituted the biggest bailout of a private company by US government to date.

37. Findeisen and Sachs (2015) quantify the welfare consequences of 'moving from a third-best scenario where the government optimally sets the income tax and offers a loan system with non-contingent repayment to the system with contingent repayments.' The paper finds large increases in social welfare of around 0.2–0.6% of lifetime consumption, depending on risk-aversion.

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