DEMOGRAPHIC SCALES FOR EX-ANTE RISK EQUALISATION IN THE AUSTRALIAN PRIVATE HEALTH INSURANCE MARKET

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Demographic scales for ex-ante risk equalisation in the Australian private health insurance market

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Abstract

In April 2007, as part of the Private Health Insurance Act, a ‘Risk Equalisation’ scheme was introduced in the Australian private health insurance (PHI) market. The ‘Risk Equalisation’ scheme replaces the ‘Reinsurance’ arrangements, in place since 1956, with the objective of protecting funds with riskier-than-average populations. Although several changes were made to the reinsurance scheme, the new ‘Risk Equalisation’ scheme maintained the feature of a de facto ex-post (retrospective) claims-equalisation (CE) rather than an ex-ante (prospective) risk-equalisation (RE) scheme, which is common in most countries (e.g. Belgium, Israel, The Netherlands). In competitive markets for PHI, the main problems with ex-post CE are the lack of incentives for efficiency and the presence of incentives for selection. A similar level of equalisation transfers across competing health insurers can be achieved by means of a system of ex-ante prospective risk-adjusted subsidies (i.e. RE) with higher incentives for efficiency and lower incentives for selection compared to ex-post CE. This paper examines the prospect of demographic scales for ex-ante (prospective) RE and its implications on the actual financial transfers (i.e. risk-adjusted subsidies flows) across funds. The findings of this paper serve as an information-basis for future policies, aiming to improve efficiency and prevent selection in the Australian PHI market.

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1. Introduction

The main problems with the current risk equalisation scheme, which is de facto an ex-post (retrospective) claims-equalisation scheme (CE), are the lack of incentives for efficiency and the presence of incentives for selection in the Australian competitive market for private health insurance (PHI). A similar level of transfers across insurers can be achieved with higher incentives for efficiency and lower incentives for selection by replacing the current CE scheme with a system of ex-ante (prospective) risk-adjusted subsidies (i.e. risk equalisation (RE) scheme) or payments across insurers. In fact, most countries which have introduced a centralised-finance/decentralised-delivery health system have based their RE scheme on a prospective risk-adjusted subsidies supplemented, if at all, by a retrospective risk sharing arrangements (van de Ven et al., 2007; van de Ven et al., 2003; van Barneveld et al., 2001).

The construction of ex-ante prospective RE scheme by the regulator consists of three phases: (a) the choice of risk-adjusters, namely, the characteristics of the enrollees and of the insurers which best predict future health care expenditures. This choice is shaped by statistical considerations, data availability, social norms regarding responsibility (e.g. smoking) and discrimination/affirmative action (e.g. minorities’ health), and the need to minimise the information asymmetry between the insurers and the regulator; (b) the creation of optimal cost groups, namely, where the variance in cost between groups is maximised and variance within groups is minimised; (c) setting the prospective capitation rates (relative risk scale) for the (exhausting and mutually exclusive) groups defined by the set of the risk adjusters chosen.

Ideally, the set of risk adjusters includes socio-demographic and health status characteristics of the enrollees, which are risk factors likely to be used by insurers for
risk-selection or to risk-rate premiums in the PHI market,\(^1\) modified, maybe, by public health considerations. In reality, this set is unknown to the regulator, and the risk-based grouping of the population for the calculation of the risk-adjusted subsidies depends on the availability of data, the statistical skills and the sophistication of the regulator. In most countries, the set of risk adjusters adopted by the regulators includes demographic characteristics (such as age and gender), and in some countries health status indicators (e.g. Diagnostic Cost Groups and Pharmaceuticals Cost Groups in the Netherlands). The prospective rates are ideally calculated from actual costs of a representative sample of the enrollees as reported by the insurers using individual claims data. At least during the first years after the introduction of a risk equalisation scheme, the insurers’ individual claims data are not readily available in most countries — either because of technical and IT difficulties or because of the insurers’ reluctance to provide commercial data. In such cases, other sources reporting on health care utilisation by the population together with individual characteristics can be used.

The aim of this paper is to construct an *ex-ante* (prospective) risk-equalisation scheme and to analyse its consequences on the distribution of risk (cost and benefits) in terms of the financial RE transfers across private health insurers in Australia. Demographic scales represent the first step towards the implementation of morbidity-based *ex-ante* risk equalisation. The key research questions addressed within this paper can be summarised as follows:

1. How to construct an *ex-ante* risk-equalisation scheme in the absence of available insurers’ individual claims data?

2. What are the consequences in terms of inter-funds RE transfers (i.e. risk-adjusted cross-subsidies) of modifying the current *ex-post* retrospective age-

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\(^1\) Although premium rate restrictions (i.e. community-rating per product per insurer) have been applying already for a long time as a regulatory tool to prevent insurers’ from risk-rating in the Australian private health insurance market, there is anecdotal evidence of premium differentiation via product differentiation (Paolucci et al. 2008).
based CE into an *ex-ante* prospective demographic (i.e. age/gender) RE scheme within the Australia PHI market?

This paper is organised as follows. Section 2 provides an overview of how the Australian private health insurance market is currently regulated and examines the case for *ex-ante* risk equalisation as an alternative to the current *ex-post* CE scheme. The data and the methods adopted in our analysis are discussed in sections 3 and 4. Section 5 presents the results of several demographic scales for *ex-ante* (prospective) risk-equalisation scheme and the implications of a transition from an age-based CE to an age/gender-based RE on the inter-funds subsidies flows (i.e. financial transfers). The conclusions and the policy implications are summarised in section 6.

2. *The case for prospective risk equalisation in the Australian private health insurance market*

2.1. Regulations and subsidies in the Australian PHI

For many years following the introduction of Medicare in 1984, the proportion of PHI-holders diminished from about 50% to about 30% in 1997, with increasing evidence of regulation-induced (i.e. community-rating with open enrolment) selection spiral (Butler, 2007; Connelly and Brown, 2006; Lu and Savage, 2006; Brown and Connelly, 2005; Vaithianathan, 2004; Butler, 2003 and 2002; Hall, 1999). Although the aim of community-rating (with open enrolment) has been to realise implicit cross-subsidies between low- and high-risk groups, it actually creates incentives for risk-selection and in competitive markets for voluntary health insurance (like the Australian PHI market) does not adequately address adverse selection (van de Ven and Ellis 2000, Schut 1996). Since 1997, the Government has intervened in the Australian competitive market for PHI by introducing several forms of explicit subsidies with the aim of providing incentives to (low-risk) consumers to buy PHI and to support community-rating. Explicit subsidies include the 30-35-40% premium
rebate (i.e. premium-related subsidy) to individuals who purchase PHI; a tax penalty of 1% of taxable income payable by single individuals with taxable incomes in excess of $70,000 p.a. ($140,000 p.a. for couples) if they do not hold PHI (i.e. the Medicare levy surcharge); and an *ex-post* (retrospective) CE scheme (i.e. previously referred to as reinsurance, renamed in 2007 risk-equalisation). While collectively these measures finally stabilised PHI coverage at around 43% of the population since 2005, they are not optimal. In particular, the complex mix of subsidies (i.e. community rating, combined with *ex-post* (retrospective) risk-equalisation and *ad valorem* premium subsidies) in the Australian PHI market leads to the trade-offs between affordability, efficiency and selection (van de Ven and Schut, 2007; Paolucci et al., 2006, van de Ven and Ellis, 2000; van de Ven et al., 2000). As pointed out by van de Ven and Schut (2007), the only escape from the trade-offs between affordability, efficiency and selection is *ex-ante* (prospective) risk-equalisation. To the extent that some high-risk individuals are insufficiently subsidised, the *ex-ante* risk-equalisation payments can be complemented by one or more of the above mentioned forms subsidies: premium-based subsidies, *ex-post* claims-equalisation and implicit cross-subsidies enforced by premium rate restrictions for a specified insurance coverage. The better the subsidies are adjusted for relevant risk factors, the less these complementary strategies are needed, and the less severe is the trade-off (Paolucci et al., forthcoming; van de Ven and Schut, 2007; Paolucci et al., 2006).

2.2. *The risk equalisation scheme since 2007*²

In April 2007, the reinsurance scheme introduced in 1956 has been replaced by a risk-equalisation scheme. The reinsurance scheme in place until 2007 functioned as an *ex-post* claims sharing arrangement (i.e. claims equalisation) among insurers. In

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² For a detailed overview of the previous reinsurance and current risk-equalisation schemes in Australia we refer to Connelly et al., forthcoming.
particular, 79% of insurers’ hospital claims costs for individuals 65+ years old and for all members (including those younger than 65) with more than 35 days in hospital during the year. The Private Health Insurance Administration Council (i.e. the regulator/sponsor) received quarterly information from the health funds, calculated an average claims cost for each State\(^3\) and calculated an average claims cost for each fund operating in each of those States. Where funds had higher than the average claims they received money from the reinsurance pool, and where they had lower than the State average they paid money into the pool. The pool is a quarterly zero sum calculation.

Although the so-called risk-equalisation scheme has replaced and modified the reinsurance scheme in many ways (see below), _de facto_ it maintained the features of an _ex-post_ (retrospective) claims-equalisation (CE) rather than an _ex-ante_ (prospective) risk-equalisation (RE) scheme. The current CE is ‘a system to share the hospital costs and some general treatment costs of high risk groups among private health insurers’, with the purpose of allowing ‘a more equitable treatment of health funds with different coverage of high risk groups to support community rating’ (PHIAC, 2007). First the Age-Based Pool (ABP) has been introduced with the purpose of matching more closely the increase in claims by age, and in particular it replaces the two age-bands (+/- 65 years old) of the reinsurance scheme with a set of 8 age groups with varying proportions of the claims cost increasing with the age of the claimant (see Table 1.).

\(^3\) Note that the Australian Capital Territory is included in New South Wales.
Table 1. From the ‘old two age-bands system’ to the ‘new ABP’.

<table>
<thead>
<tr>
<th>Age</th>
<th>Old % pooled</th>
<th>New % pooled</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–54</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>55–59</td>
<td>0%</td>
<td>15%</td>
</tr>
<tr>
<td>60–64</td>
<td>0%</td>
<td>43%</td>
</tr>
<tr>
<td>65–69</td>
<td>79%</td>
<td>60%</td>
</tr>
<tr>
<td>70–74</td>
<td>79%</td>
<td>70%</td>
</tr>
<tr>
<td>75–79</td>
<td>79%</td>
<td>76%</td>
</tr>
<tr>
<td>80–84</td>
<td>79%</td>
<td>78%</td>
</tr>
<tr>
<td>85–89</td>
<td>79%</td>
<td>82%</td>
</tr>
<tr>
<td>90–94</td>
<td>79%</td>
<td>82%</td>
</tr>
<tr>
<td>95+</td>
<td>79%</td>
<td>82%</td>
</tr>
</tbody>
</table>

The pooling of claims costs for all individuals with hospitalisation in excess of 35 days in a 12 month period was replaced by the a High Cost Claims Pool (HCCP), where benefits in excess of $50,000 in a 12 month period are pooled (after the operation of the age-based pooling). In practice, the HCCP shares the costs of high cost claimants where they are not otherwise shared by the ABP. The HCCP was implemented to protect small funds from large claims in lieu of genuine “excess” or “stop loss” compensation schemes (van de Ven and Schut, 2007; Paolucci et al., 2006). Risk equalisation transfers about $50 million per quarter among the health funds. PHIAC expects this to grow as the insured population continues to age (PHIAC, 2007).

The reinsurance scheme only included hospital costs whereas from 2007 the following claims costs are eligible for pooling within the ex-post (retrospective) CE scheme: hospital benefits, hospital substitute benefits, chronic disease management program benefits, and high cost claimants’ benefits (Division 69, Private Health Insurance Act 2007).

2.3. The operation of ex-ante risk-equalisation vs. ex-post claims-equalisation
The introduction of ex-ante (prospective) risk-equalisation and the improvement of the current formula (i.e. by adding to age other sensitive risk-factors such as gender), even without using insurers’ individual claims data, would be largely beneficial in terms of reducing insurers’ incentives for risk selection and overall increase efficiency and affordability compared to the current ex-post (retrospective) risk-equalisation. In this section, we illustrate the operation of ex-ante RE vs. ex-post CE.

Suppose there are two insurers – a and b – and two age groups y and o. Total cost (benefit paid) of insurer i on age group j is denoted by \( c_{ij} \) and the population in age group j of insurer i is denoted by \( n_{ij} \) (i=a, b and j=y, o).

*Ex-ante* risk equalisation is based on the notion of “standardised person”. Let the mean cost among the young age group be 1 (standardized person). The scale assigning the number of standardised persons to each member of the old age group is defined as the ratio of the means in the population, namely:

\[
\frac{\left(\frac{c_{ao}+c_{bo}}{n_{ao}+n_{bo}}\right)}{\left(\frac{c_{ay}+c_{by}}{n_{ay}+n_{by}}\right)} = \frac{\left(\frac{c_{ao}+c_{bo}}{n_{ao}+n_{bo}}\right)}{\left(\frac{c_{ay}+c_{by}}{n_{ay}+n_{by}}\right)}.
\]

The total number of standardised persons in the society is:

\[
(n_{ay}+n_{by}) + (n_{ao}+n_{bo}) \left[\frac{(c_{ao}+c_{bo})/(c_{ay}+c_{by})}{(n_{ay}+n_{by})/(n_{ao}+n_{bo})}\right] = (n_{ay}+n_{by}) \left[\frac{1+(c_{ao}+c_{bo})/(c_{ay}+c_{by})}{1+(c_{ao}+c_{bo})/(c_{ay}+c_{by})}\right].
\]

The total budget \( B \) for allocation among the two insurers, determined *ex-ante* according to society’s priorities and definition of acceptable costs (i.e. costs to be reimbursed, Schokkaert et al., 2006), is allocated among the two insurers according to the insurers’ shares in total standardised persons:

\[
B_{xa} = B \left\{ \frac{n_{ay}+n_{ao}}{(n_{ay}+n_{by}) + n_{ao}/(n_{ao}+n_{bo}) \left[\frac{(c_{ao}+c_{bo})/(c_{ay}+c_{by})}{(n_{ay}+n_{by})/(n_{ao}+n_{bo})}\right]} \right\} = \frac{B}{n_{ay}+n_{by}} \left[\frac{1+(c_{ao}+c_{bo})/(c_{ay}+c_{by})}{1+(c_{ao}+c_{bo})/(c_{ay}+c_{by})}\right], \text{ and}
\]

\[
B_{xb} = B \left\{ \frac{n_{by}/(n_{ay}+n_{by}) + n_{bo}/(n_{ao}+n_{bo}) \left[\frac{(c_{ao}+c_{bo})/(c_{ay}+c_{by})}{(n_{ay}+n_{by})/(n_{ao}+n_{bo})}\right]} \right\} = \frac{B}{n_{ay}+n_{by}} \left[\frac{1+(c_{ao}+c_{bo})/(c_{ay}+c_{by})}{1+(c_{ao}+c_{bo})/(c_{ay}+c_{by})}\right].
\]
According to the Australian ABP, a certain percentage of the benefits paid is given to the pool (the percentage is increasing with age), and the pool is allocated to the insurers according to their market shares. Using the above notation, the \textit{ex-post} share of insurer \(a\) is (assuming that the percent contribution to the pool is \(p_y\) for the young, and \(p_o\) for the old):

\[
B_{xa}^{ex} = (1-p_y) \left[ c_{ay} + \frac{(n_{ay}+n_{ao})}{(n_{ay}+n_{ao}+n_{by}+n_{bo})} \right] \left[ p_o \left[ c_{ao} + c_{bo} \right] + p_y \left[ c_{ay} + c_{by} \right] \right] + (1-p_o) \left[ c_{ao} + \frac{(n_{ao}+n_{bo})}{(n_{ay}+n_{ao}+n_{by}+n_{bo})} \right] \left[ p_o \left[ c_{ao} + c_{bo} \right] + p_y \left[ c_{ay} + c_{by} \right] \right] =
\]

\[
(1-p_y) \left[ c_{ay} + \frac{(n_{ay}+n_{ao})}{(n_{ay}+n_{ao}+n_{by}+n_{bo})} \right] p_o \bar{y}_o + (n_{ay}+n_{ao}+n_{by}+n_{bo}) p_y \bar{y}_y,
\]

\[
B_{xb}^{ex} = (1-p_y) \left[ c_{by} + \frac{(n_{by}+n_{bo})}{(n_{ay}+n_{ao}+n_{by}+n_{bo})} \right] \left[ p_o \left[ c_{ao} + c_{bo} \right] + p_y \left[ c_{ay} + c_{by} \right] \right] + (1-p_o) \left[ c_{bo} + \frac{(n_{by}+n_{bo})}{(n_{ay}+n_{ao}+n_{by}+n_{bo})} \right] \left[ p_o \left[ c_{ao} + c_{bo} \right] + p_y \left[ c_{ay} + c_{by} \right] \right] =
\]

\[
(1-p_y) \left[ c_{by} + \frac{(n_{by}+n_{bo})}{(n_{ay}+n_{ao}+n_{by}+n_{bo})} \right] p_o \bar{y}_o + (n_{ay}+n_{ao}+n_{by}+n_{bo}) p_y \bar{y}_y,
\]

where \(\bar{y}_y\) and \(\bar{y}_o\) are the population mean cost among the young and the old respectively.

The fundamental difference between \textit{ex-ante} risk equalisation and \textit{ex-post} claims equalisation (i.e. current Australian RE scheme) is that in \textit{ex-ante} risk equalisation the total budget \(B\) is set \textit{a priori} according to society’s priorities, and is allocated to the insurers according (and only) to the age structure of their populations. \textit{Ex-post} claims equalisation re-distributes a “budget” \textit{a posteriori}, mainly made of the age-based contributions of all insurers, which are derived from the actual claims (costs) according to market share. The age structure of the populations determines the contribution rather than the transfer. The percent contributions \(p_y\) and \(p_o\) define quite arbitrarily the socially “acceptable costs” out of total costs (benefit paid) which flow in the pool to be re-distributed across funds.

Some further insight into the functioning of \textit{ex-ante} RE vs. \textit{ex-post} CE can be gained if we use the shares \(B_{xa}^{ex}\), but set the budget \(B^{ex}\) to be the total cost (benefit paid) which actually occurred. The shares of the two insurers become simply:

\[
B_{xa}^{ex} = \left[ \frac{n_{ay}}{(n_{ay}+n_{by})} \right] \left[ c_{ay} + c_{by} \right] + \left[ \frac{n_{ao}}{(n_{ao}+n_{bo})} \right] \left[ c_{ao} + c_{bo} \right] = n_{ay} \bar{y}_y + n_{ao} \bar{y}_o,
\]

\[
B_{xb}^{ex} = \left[ \frac{n_{by}}{(n_{ay}+n_{by})} \right] \left[ c_{ay} + c_{by} \right] + \left[ \frac{n_{bo}}{(n_{ao}+n_{bo})} \right] \left[ c_{ao} + c_{bo} \right] = n_{by} \bar{y}_y + n_{bo} \bar{y}_o,
\]
It can be easily seen that the shares $B^{xx}$ and $B^{xp}$ differ, and only by chance (i.e. a certain combination of the parameters $p$, market shares and the population structure) can result in the two being equal. If, on the other hand, we assume in the \textit{ex-post} CE scheme that the contributions to the pool cover all benefits ($p_y=p_o=1$), the shares become:

$$B^{yp}_a = \frac{(n_{xy}+n_{ao})(n_{ao}+n_{bo})}{(n_{xy}+n_{ao}+n_{by}+n_{bo})}\{[c_{ao}+c_{bo}] + [c_{ay}+c_{by}]\} =$$

$$\frac{(n_{xy}+n_{ao})(n_{ao}+n_{bo})\bar{y}_o + (n_{xy}+n_{by})\bar{y}_y}{(n_{xy}+n_{ao}+n_{by}+n_{bo})}, \text{ and}$$

$$B^{yp}_b = \frac{(n_{by}+n_{bo})(n_{ao}+n_{bo})}{(n_{xy}+n_{ao}+n_{by}+n_{bo})}\{[c_{ao}+c_{bo}] + [c_{ay}+c_{by}]\} =$$

$$\frac{(n_{by}+n_{bo})(n_{ao}+n_{bo})\bar{y}_o + (n_{by}+n_{by})\bar{y}_y}{(n_{xy}+n_{ao}+n_{by}+n_{bo})}.$$

In this case, the $B^{xx}$ shares are the sum of the shares of each insurer in the age-specific pools, and the $B^{xp}$ is the insurer’ market share in the total pool.

\section{Data}

Since insurers’ individual-claims data are not publicly available and individual records on the use of public health care are segmented between Medicare, the States and the Commonwealth, preventing linkage on the individual level in the near future, risk equalisation in Australia can be improved at present only using scales derived from available breakdowns of utilisation of health services and benefits by State, age and sex. While it is agreed that demographic scales are not sufficient to remove the incentives for selection (van de Ven and Ellis, 2000), international experience shows that for reasons related to data availability and social and political acceptance, the implementation of a new \textit{ex-ante} risk equalisation scheme should begin with (socio-) demographic scales (van de Ven et al., 2003). After the accumulation of some experience and the development of IT and individual level databases, one can search for sophisticated health-based scales (Stam et al., 2010; Lamers et al., 2002).
In the following sections, we derive the demographic scales of an *ex-ante* RE system based on three public data sources (i.e. PHIAC, 2007; AIHW, 2005-2006; and the NHS 2004-2005) with the purpose of selecting the “preferred” scales to adopt in further elaborations of the current risk equalisation scheme in Australia. While the AIHW and the NHS data refer to the entire Australian population, PHIAC data refer to the insured population (i.e. about 45% of the Australian population voluntarily chooses to purchase PHI). Although the most relevant population for the purposes of risk equalisation among insurers is represented by PHI-holders, it is also subject to changes in insurance ownership patterns over time, and therefore the derived scales would need to be verified and updated often. Since at present CE is done by State, we present the scales by State as well. The NHS data, however, is too small to derive State-specific scales.

To simulate the implications of replacing the current *ex-post* (retrospective) age-based CE scheme with an *ex-ante* (prospective) RE scheme on the financial transfers across funds (i.e. inter-funds risk-adjusted subsidies payments based on age and gender), we use PHIAC aggregate data (2007) on health insurers’ actual benefits (i.e. claims costs).

### 4. The construction of the demographic *ex-ante* risk equalisation scales: the standardised person

Demographic scales (i.e. age-sex) can be derived, first, by calculating the age-sex specific means (“the cell method”) of the measure of cost (utilisation), and then by dividing them by the overall mean. The “standardised person” (SP) is the average which is indicated by 1 (SPs). The scale values indicate to how many SPs every

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5 Most insurers (i.e. 30 out of 39) formally authorised PHIAC to allow us to access aggregate (i.e. age-gender groups) health expenditures data per insurer for hospital care and general treatment services. The remaining 9 insurers were treated as 1 insurer to cover the entire market.
person is equivalent, according to her age and sex. This approach is convenient for policy purposes, since it separates between the size of the budget and the budget (“voucher”) per SP, on the one hand, and the risk-adjusted allocation of the budget among the insurers, on the other hand.

In some cases, ‘total medical care costs’ are unavailable while the available data includes utilisation of specific services (e.g., visits to the dentist, to GPs, inpatient hospital nights etc.). An overall scale is calculated in the following way. Suppose there are two health services covered by PHI – hospitalisations and GP-visits. Denote the unit cost of an inpatient day by $p_s$ and the unit cost of a visit to GP by $p_b$. If the yearly mean number of hospitalisation days in risk equalisation group $i$ is $s_i$ and the mean number of visits to GPs is $b_i$, the mean total cost in group $i$ is given by $c_i = p_s s_i + p_b b_i$. Similarly, the grand mean cost in the population is $c = p_s s + p_b b$, where $s$ and $b$ are the mean yearly hospitalisation days and visits to GPs in the population. The total relative scale is $c_i / c = (p_s s_i + p_b b_i) / (p_s s + p_b b) = v_s (s_i / s) + v_b (b_i / b)$, where $v_s = p_s s / (p_s s + p_b b)$ and $v_b = p_b b / (p_s s + p_b b)$. In other words, the scale is a weighted average of the service-specific scales in physical quantities, with the weights being the relative share of the cost of the service in total cost.

5. Results

5.1. Risk equalisation scales in Australia using publicly available data

Scales derived from PHIAC data (2007)

The data available from PHIAC includes: the number of hospital days, episodes (separations), fees and benefits, and the number of services used, fees and benefits for the general treatment policies. For the overall scale we used the sum of benefits for hospitals and treatments policies. Doing so we introduced a slight inaccuracy to the calculation, since the owners of hospitals policies and of general treatments policies
do not match exactly. Data on ownership of each type of policy by age and sex and state are not available, but using total population data from 2007 indicates that the inaccuracy is small: out of 10.8 million insured, 9.0 million have both policies, 0.4 million own hospital policy only, and 1.4 million person own general treatments only. We used the number of hospital policy owners (9.4 million) as the relevant population size.

Figure 1 presents the four hospitalisation-scales for men and women.

*Figure 1 about here.*

Up to age 75, all the scales are approximately similar. Above age 75, the days-scale increases rapidly, while the episodes-scale stabilises on 4 among men and 2.5 among women. The fees and benefits-scales are in between. We note that if inpatient care is paid for by prospective per case methods (DRG), the benefits should follow closely the episodes scale. If reimbursement is based on per-diem, the benefits should follow the day-scale. A possible explanation for the gap is that “days” include long term hospitalisation which is not covered or covered only partially by the private insurers.

Figure 2 presents two hospitalisation scales – days and benefits – for the individual states.

*Figure 2 about here.*

In some cases, age groups should have been combined because of small number of insured. The NT scale is clearly above those of the other states and that of TAS –
below, indicating variations in the relative scales (beyond differences in absolute values).

Figure 3 presents the three general treatments scales: number of services (episodes), benefits and fees.

**Figure 3 about here.**

The scales are quite similar below age 80, in particular for women. The higher scale for fees indicates the relatively higher copayments paid by elderly persons. We chose to focus subsequently on the benefits scale.

Figure 4 presents the state-specific general treatments benefit scales. NT and WA have the highest scales, while QLD has the lowest. Figure 5 presents the overall benefits scale for men and women by states. The variation across states is similar to the variation identified above.

**Figure 4 & 5 about here.**

*Hospitalisation scales derived form AIHW 2005-2006 data*

The AIHW data includes separations (episodes) and days in public and private hospitals by age, sex and state, including one day admissions. The scales for TAS, ACT and NT includes public hospitals only (the AU scales include all hospitalisations, however). The NT scales are unreliable due to small cells and were disregarded. As was observed for the PHIAC hospitalisation scales, the days-scale takes off rapidly after age 70, while the separation-scale is much flatter.
Figure 6 presents the days- and separations-scales for men and women by states. Up to age 75, the states’ scales are quite close. Above age 75, the differences increase, in particular among men. The highest scale belongs to ACT, while the lowest belong to TAS and SA.

Figure 6 about here.

Scales derived from Medicare-MBS 2005-2006 data

The MBS data includes benefits such as medical and surgical care and services, X-rays, laboratory tests, electro-cardiograms etc. Unfortunately, the PBS data is not available by age and sex. Figure 7 present the state-specific age-sex scales. All the scales have a similar shape, and their values increase up to age 85, dropping for the age group 85+. The reason is that relative to the mean, these elderly persons use relatively more inpatient care and less MBS services. The scale of NT is the higher, indicating a rapidly increasing relative use by age. The SA’s scale is the lowest.

Figure 7 about here.

Scales derived from NHS 2004-2005 data

Although suffering from recall problems and other biases, population surveys on use of services have been used extensively for risk adjustment (Stam et al. 2010). The relatively small number of persons prevented the calculation of state-specific scales, and the age groups were enlarged to 10 year intervals. We built service-specific scales for dental care visits, visits to GPs and specialists out of hospitals, in hospital outpatient visits (ER, same day admissions), and inpatient overnights. In order to
combine these scales into an overall one, we used cost weights that were obtained from AIHW (2004) and were modified to the services discussed as indicated:

*Table 1 about here.*

Figure 8 presents the scales for men and women separately using weighted data.

*Figure 8 about here.*

**Comparisons: Hospitalisation-days scales**

Figure 9 brings together the inpatient-days scales calculated from PHIAC, AIHW and NHS. The AIHW and NHS scales were ‘stretched’ to fit the PHIAC’s detailed age groups. Up to age 75, the scales are remarkably close. For some reason, women aged 25-40 in the NHS report more inpatient days. Above age 75, among men, the PHIAC and AIHW scales are quite close, considering the truncation of the AIHW scale. Among women aged 80+, the AIHW scale is much higher than that based on PHIAC data. As discussed previously, the gap might be explained by long term care days for uninsured women.

*Figure 9 about here.*

**Overall scales**

Four overall scales emerge: the PHIAC scales which are based on benefits, the NHS scales which are based on aggregating service-specific use scales, the MBS-INPATIENT DAYS scales and the MBS-INPATIENT SEPARATIONS scales. The latter two are based on aggregation of the MBS scales with the AIHW inpatient scales.
of days and separations respectively. The weights used in this aggregation are 65% for inpatient care, and 35% for the MBS care (AIHW, Health expenditure by area of expenditure, 2005-2006). Figure 10 presents these scales, together with a fifth overall scale, which is taken from Table 8.10 of Australia Health 2008.

**Figure 10 about here.**

This scale is based on ‘allocated expenditures by diseases’ that covers about 65% of total health expenditures (excluding hospital non-admitted patient care, community health, public health, administration, other health practitioners, transport, aids and appliances).

Up to age 60, all scales for both men and women are quite close. Above age 60, the NHS scale is quite below the others. Up to age 75, the four remaining scales are quite similar, but above age 75 – the MBS-INPDAYS scale takes off rapidly, while the PHIAC, MBS-INPSEPS and HEALTH AU 08 scales remain close to each other.

The critical question is therefore, if inpatient days or inpatient benefits or separations represent more accurately the resources devoted to inpatient care. If it is inpatient days, the MBS-INPDAYS scales should be adopted. Alternatively, any of the two remaining scales (PHIAC or MBS-INPSEPS) is appropriate and can be used for as demographic scales for prospective RE in Australia.

Figures 11-12 presents the state-specific MBS-INPDAYS and MBS-INPSEPS scales respectively. (the state specific PHIAC scales were presented in Figure 5). For NT, the scales could not be computed. The state-specific scales are quite close to each other up to age 75, especially among women. ATC has the highest relative use of health care resources.
5.2. *The effects of the introduction of ex-ante risk equalisation on inter-funds transfers*

Based on the above overall age-gender scales and the current ABP (Age Based Pool, i.e. RE using age as the only risk factor) allocation of benefits (i.e. claims costs), we simulate the effect of moving towards *ex-ante* RE on the benefits share for selected insurers in each State and in total Australia. Specifically, we use the overall scales based on PHIAC data (2007) to calculate the number of standardised persons for each insurer in each State. The post-RE benefits-share is the share of standardised persons per insurer on the total of standardised persons in each State and in Australia, and the pre-RE benefits-share is the original distribution of benefits across the insurers. The post-RE ABP-based benefit share is the pre-RE benefits-share modified by the ABP transfers. The gain or loss for each insurer is the difference between the *ex-ante* RE size of benefits and the benefits resulted from the ABP distribution. We note that the total budget (the sum of the original benefits across insurers) remain always constant. From Table 2 it is clear that a transition from the current *ex-post* CE to an *ex-ante* RE scheme will result in gainers and losers among insurers. The identity of these gainers and losers differ across States.⁶ In total Australia, about 2/3 of the funds would loose from the transition from CE to RE and the financial losses at the fund level would range from $ - 1.781 (I₁₅), i.e. 0.01% of the total budget (= $ 21.156.000), to $ - 548.222 (I₁₈), i.e. 2.6% of the total budget. The remaining 1/3 of the funds would gain from the transition and the financial gains would range from $ 2.823 (I₂₉), i.e. 0.013% of the total budget, to $345.725 (I₃₀), i.e. 1.63% of the total budget. The main gainers (among the insurers included in this simulation) will be insurers I₃₀ (= $ 345.725), I₁₇

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⁶ For reasons of space we haven’t included the transfers at the State level, which might be made available upon request to the authors.
(= $ 321.303) and I_{14} ($ 92.565). The main losers will be I_{18} ($ - 548.222), I_{13} ($ - 137.748) and I_{4} ($ - 93.285).

**Table 2 about here.**

The ‘new’ redistribution based on *ex-ante* demographic RE matches the age-gender structure better than under the current *ex-post* CE, reducing the incentives for selection. Also considering that according to RE, the total benefits are taken as an ex ante budget, also incentives for efficiency will be increased.

6. **Conclusions**

In this paper, we examine several options for an *ex-ante* (prospective) risk-equalisation scheme and its implications on the inter-funds subsidies flows. Since individual claims data are not publicly available, we analyse aggregate age-sex based scales derived from PHIAC data; and scales derived from the National Health Morbidity Data (AIHW), the Medicare (MBS) and the National Health Survey (NHS). From these sources we calculate several risk adjustment demographic scales, to derive the ‘preferred’ scales to use in further elaborations of the risk equalisation scheme in Australia. The choice of preferred scale depends on whether inpatient days or inpatient benefits or separations represent more accurately the resources devoted to inpatient care. If it is inpatient days the preferred scale is MBS-INPDAYS, otherwise any of the two remaining scales (PHIAC or MBS-INPSEPS) are equally appropriate and can be used for a prospective risk equalisation in Australia. Although risk equalisation in Australia can be improved at present only using demographic scales derived from publicly available data on health services’ utilisation, it is clear that demographic scales are not sufficient to remove the
incentives for risk selection by the insurers (van de Ven and Ellis, 2000). The next crucial step is to derive the scales for other potential relevant risk factors, such as health-based scales. These scales could be derived by linking state hospital data and expenditure data with federal medical and pharmaceutical expenditure data at the individual level. For instance, Donato and Richardson (2006) report on an exploratory inquiry into the Australian application of the US version of the diagnostic cost groups (DxCGs) risk adjustment method to a large Australian hospital inpatient data set (1996-97 and 1997-98) for the New South Wales. Their study focuses on the potential usefulness of individual-level risk adjustment methods for validating measurement of performance across health care providers and for allocating resources efficiently and equitably across population groups of different area health services (AHS) in New South Wales. In line with studies performed in other countries, they find that diagnosis-based risk adjustment offers the potential to refine measure of case-mix adjustment of population groups, providing a more reliable assessment of efficiency of different AHS (in NSW) compared to age-sex demographic methods.

The combination of inpatient hospital diagnostic information with pharmaceutical and self-assessed health status information has shown to perform significantly better than demographic and/or inpatient-only models only, e.g. the Netherlands (Stam et al., 2010; van de Ven et al., 2004; Lamers and van Vliet, 2004).

In particular, the introduction of ex-ante (prospective) risk-equalisation and the improvement of the current formula (i.e. based on more sensitive risk-factors than the currently adopted such as gender), even without using insurers’ individual claims data, would be largely beneficial in terms of reducing insurers’ incentives for risk

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7 Although Donato and Richardson (2006) has been the first study on risk adjustment in Australia based on a large hospital data set, previous studies on the topic have been conducted by Duckett and Agius (2002) and Anthioc and Walsh (2004).
selection and overall increase efficiency compared to the current \textit{ex-post} (retrospective) CE.
Figures and Tables

Figure 1: PHIAC hospitalisation scales (1=mean)

Source: PHIAC (2007)
Figure 2: PHIAC State-specific hospitalisation days and benefits scales (1=mean)

Source: PHIAC (2007)

Figure 3: PHIAC general treatments scales (1=mean)
Figure 4: PHAIC State-specific general treatments benefits scales (1=mean)

Source: PHIAC (2007)
Figure 5: PHIAC overall benefits-scales (1=mean)

Source: PHIAC (2007)
Source: PHIAC 2007
Figure 6: AIHW (2004-2005) State-specific hospitalisation days and separations scales (1=mean)

Figure 7: MBS, State-specific scales (1=mean)

Figure 8: NHS (2004-2005) State-specific and overall scales (1=mean)

Figure 9: Inpatient-days scales (1=mean)

Figure 10: Overall scales (1=mean)
Figure 11: MBS-INPDAYS State-specific scales (1=mean)
Figure 12: MBS-INPSEPS State-specific scales (1=mean)
Table 1. Adapted costs weights (AIHW, 2004-2005).

<table>
<thead>
<tr>
<th>Service</th>
<th>Weight (%)</th>
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<tbody>
<tr>
<td>Dental care</td>
<td>9.9%</td>
</tr>
<tr>
<td>Out of hospital services (GPs, specialists,</td>
<td>22.6%</td>
</tr>
<tr>
<td>other medical)</td>
<td></td>
</tr>
<tr>
<td>In hospital outpatient visits (ER, same day</td>
<td>35.2%</td>
</tr>
<tr>
<td>admissions)</td>
<td></td>
</tr>
<tr>
<td>Inpatient overnights</td>
<td>32.3%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.0%</strong></td>
</tr>
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Table 2: Effect of switching from *ex-post* CE to *ex-ante* RE on inter-funds transfers at the national level in Australia (population and benefits are for 30.6.08, PHIAC data).

<table>
<thead>
<tr>
<th>FID</th>
<th>Pre RE benefit shares (%)</th>
<th>Post RE ABP benefit shares (%)</th>
<th>Post RE Ex-ante benefit shares (%)*</th>
<th>Gain / Loss (000 AUS)**</th>
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<tbody>
<tr>
<td>I1</td>
<td>0.141</td>
<td>0.154</td>
<td>0.107</td>
<td>-10.057</td>
</tr>
<tr>
<td>I2</td>
<td>0.159</td>
<td>0.195</td>
<td>0.082</td>
<td>-24.089</td>
</tr>
<tr>
<td>I3</td>
<td>1.361</td>
<td>1.011</td>
<td>1.280</td>
<td>56.965</td>
</tr>
<tr>
<td>I5</td>
<td>0.057</td>
<td>0.069</td>
<td>0.042</td>
<td>-5.741</td>
</tr>
<tr>
<td>I6</td>
<td>0.476</td>
<td>0.537</td>
<td>0.379</td>
<td>-33.524</td>
</tr>
<tr>
<td>I7</td>
<td>0.168</td>
<td>0.192</td>
<td>0.116</td>
<td>-16.177</td>
</tr>
<tr>
<td>I8</td>
<td>1.353</td>
<td>1.259</td>
<td>1.610</td>
<td>74.194</td>
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<tr>
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<td>0.250</td>
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<tr>
<td>I10</td>
<td>0.073</td>
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<tr>
<td>I11</td>
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<tr>
<td>I12</td>
<td>0.415</td>
<td>0.363</td>
<td>0.352</td>
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<tr>
<td>I13</td>
<td>16.839</td>
<td>17.987</td>
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<tr>
<td>I14</td>
<td>27.954</td>
<td>28.615</td>
<td>29.053</td>
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<tr>
<td>I15</td>
<td>1.687</td>
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<td>1.458</td>
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<tr>
<td>I16</td>
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<tr>
<td>I17</td>
<td>5.481</td>
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<tr>
<td>I18</td>
<td>10.533</td>
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<tr>
<td>I19</td>
<td>1.940</td>
<td>1.699</td>
<td>1.830</td>
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<td>I20</td>
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<td>0.188</td>
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<tr>
<td>I21</td>
<td>0.559</td>
<td>0.537</td>
<td>0.422</td>
<td>-24.334</td>
</tr>
<tr>
<td>I22</td>
<td>0.423</td>
<td>0.521</td>
<td>0.261</td>
<td>-54.996</td>
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<tr>
<td>I23</td>
<td>0.082</td>
<td>0.104</td>
<td>0.058</td>
<td>-9.645</td>
</tr>
<tr>
<td>I24</td>
<td>0.347</td>
<td>0.285</td>
<td>0.245</td>
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<tr>
<td></td>
<td>I25</td>
<td>I26</td>
<td>I27</td>
<td>I28</td>
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</tr>
<tr>
<td></td>
<td>1.976</td>
<td>0.428</td>
<td>0.085</td>
<td>0.630</td>
</tr>
<tr>
<td></td>
<td>1.784</td>
<td>0.453</td>
<td>0.087</td>
<td>0.598</td>
</tr>
<tr>
<td></td>
<td>1.994</td>
<td>0.397</td>
<td>0.062</td>
<td>0.803</td>
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<tr>
<td></td>
<td>44.439</td>
<td>-11.744</td>
<td>-5.206</td>
<td>43.369</td>
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* Population=Treatment policies holders
** PHIAC scale based benefit share - ABP benefit share
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