

**Development Research Group  
World Bank**

# **Annuity Markets in Comparative Perspective**

**Do Consumers Get Their Money's Worth?**

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**Private annuity markets are not well developed even in the most advanced OECD countries. But they are growing rapidly in some countries in response to mandatory retirement savings plans. Preliminary results show that in these countries the cost of annuities is lower than might be expected.**

The views expressed in this paper are entirely those of the authors.  
They do not represent the view of the World Bank, its Executive Directors, or the countries they represent.

## Abstract

Pension reforms normally focus on the accumulation phase, plus term insurance that provides benefits for the disabled and for dependent survivors, all of which are immediate concerns. Decumulation of the capital in workers' retirement savings accounts appears to be far off in the future. But in the second generation of reforms, countries have begun to pay attention to eventual decumulation, either through gradual withdrawals or through annuitization which provides longevity insurance. At this point, it becomes important to learn whether annuity markets exist and how they operate.

This paper summarizes preliminary results of a continuing research project that attempts to analyze annuity markets in some countries around the world. These include Australia, Canada, Chile, Israel, Singapore, Switzerland and the UK. The main focus is on understanding whether annuity markets can be relied upon to provide reliable retirement income at reasonable prices. One way to approach this question is to explore whether the expected pay-outs and the "money's worth ratio" differ across countries, if so why, and what light can be thrown on the existence and size of adverse selection.

Annuity markets are poorly developed in these countries, as elsewhere. This phenomenon may be due to a variety of reasons: worker myopia, the precautionary and bequest motives for saving, which are not served by most annuity products, a general distrust of insurance companies and unwillingness to turn over to them a large accumulation of savings, adverse selection, and a crowding-out effect by social security, which automatically annuitizes the largest share of peoples' retirement wealth.

Preliminary findings suggest that the cost of annuities is lower than might be expected. When using the risk-free discount rate, MWR's of nominal annuities based on annuitant mortality tables exceed 97% (in some cases they are over 100%) and even when using population mortality tables they exceed 90%--neither the industry "take" nor the effects of adverse selection appear to be as large as anticipated. But real annuities (in Chile, Israel and the UK) have MWR's that are 7-9% lower than those of nominal annuities. And when the more "risky" corporate bond rate is used for discounting purposes, there is a further 7% reduction.

The main policy issues include public versus private provision, the role of insurance companies in term and risk intermediation, the level of compulsory annuitization, and the need for robust regulation of annuity providers.

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## Introduction

Pension reforms normally focus on the accumulation phase, plus term insurance that provides benefits for the disabled and for dependent survivors, all of which are immediate concerns.<sup>1</sup> Decumulation of the capital in workers' retirement savings accounts appears to be far off in the future. But in the second generation of reforms, countries have begun to pay attention to eventual decumulation, either through gradual withdrawals or through annuitization which provides longevity insurance. At this point, it becomes important to learn whether annuity markets exist and how they operate.

We have undertaken a project that attempts to analyze annuity markets around the world. We are particularly interested in understanding whether these markets can be relied on to provide reliable retirement income at reasonable prices and what kinds of market failure can be anticipated. One way to approach this question is to explore whether the expected pay-outs and the "money's worth ratio" differ across countries, if so why and what light we could throw on the existence and size of adverse selection. In this paper we present some preliminary results.<sup>2</sup>

In our project we included studies of annuity markets in Canada, the UK, Switzerland, Australia, Israel, Chile and Singapore—a variety of high and middle income countries.<sup>3</sup> Not surprisingly, annuity markets are poorly developed in these countries, as elsewhere. This phenomenon may be due to a variety of reasons: worker myopia, the precautionary and bequest motives for saving which are not served by most annuity products, a general distrust of insurance companies and unwillingness to turn over to them a large accumulation of savings, adverse selection, and a crowd-out effect by social security, which automatically annuitizes the largest share of peoples' retirement wealth (James and Vitas 1999, Vitas and Skully 1991). But annuity markets are growing

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<sup>1</sup> For a discussion of how countries have dealt with disability and survivors insurance see James and Vitas 1999.

<sup>2</sup> The numbers we present should not be quoted because they will probably be further refined and modified. However, we expect that the general tendencies will remain. Numbers on Singapore will be added later. Preliminary results indicate that their payouts and money's worth ratios are very high.

<sup>3</sup> The country studies were done by David Knox-Australia, Hyan Tae Kim and Keith P. Sharp-Canada, Jonathan Callund-Chile, Avia Spivak-Israel, Chiu-Cheng Chan-Singapore, Michael Breuer and Peter Zweifel-Switzerland and Mamta Murthi, J. Michael Orszag and Peter Orszag-U.K.

rapidly in some cases, such as the UK, Australia, Chile and Singapore, that have decided to rely on mandatory retirement savings accounts to provide security in old age.

The underdevelopment of the industry manifests itself in many ways: its small size relative to other kinds of insurance, the absence of mortality tables which are a prerequisite to sound pricing and funding policies, and the relative paucity in most countries of long term financial instruments with which to match assets and liabilities, thereby creating substantial reinvestment risk. One might expect, in view of these signs of an undeveloped industry, that it would not provide good service to consumers and its “money’s worth ratio,” the present value of the expected stream of benefits divided by its initial cost, would be low. We might also expect to find substantial adverse selection, as only small proportions of the population are in the market. However, we find just the opposite.

A money’s worth ratio (MWR) of 1 indicates that the consumer is getting back, in present expected value, exactly what he put in. This would be surprising, in view of the fact that the annuity company is incurring some administrative expenses and is providing investment and longevity insurance, which are not cost-free. Normally, therefore, we would expect the MWR for people who purchase annuities to be less than 100%. We would also expect a substantially lower ratio for the average member of the population, most of whom have decided not to purchase annuities. What did we find?

When using the risk-free discount rate, MWR’s of nominal annuities based on annuitant mortality tables exceed 97% (in some cases they are over 100%) and even when using population mortality tables they exceed 90%--neither the industry “take” nor the effects of adverse selection appear to be as large as anticipated. However, real annuities (in Chile, Israel and the UK) have MWR’s that are 7-9% lower than those of nominal annuities. And when we use a higher “risky” discount rate, we get another 7% reduction.

Where do the companies get the money to cover their expenses, including sales commissions that are reputed to be high, given these seemingly high pay-outs? Why do real annuities appear to be a “worse deal” for consumers than nominal annuities? And which is the correct discount rate? We believe that the answer to all three questions lies in the nature of the insurance company as a institution for term and risk intermediation.

Insurance companies take the premiums that people pay when purchasing an annuity and invest the money at rates that include a long term premium, a risk premium and an equity premium (in corporate bonds, equities, real estate as well as some government bonds)—then turn these long term medium risk investments into a risk-free annuity which is sold at a price that is actuarially fair at government bond rates, for a mixture of short and long term pay-outs. The company covers its costs and earns a profit on the investment spread. Later, we discuss the issue of whether annuities really are risk-free and whether consumers really want a risk-free annuity (as opposed to a riskier annuity that pays a higher return). The question of whether people get their money's worth depends in large part on how efficiently insurance companies perform this term and risk intermediation function and whether people want them to perform it.

Part I of this paper presents some background information about the growth of the annuity industry under new multi-pillar systems. Part II describes our data, methodology and results with respect to the money's worth analysis. Part III discusses policy implications, including the cost-effectiveness of public versus private provision of annuities, how to provide inflation insurance, and whether adverse selection makes compulsory annuitization desirable.

## **I. The Annuity Industry**

The annuity industry is minuscule in most countries. But in countries that have instituted mandatory retirement savings plans, it is growing rapidly. Typically these countries constrain the kinds of pay-outs that people can choose upon retirement, making annuities one of a very limited set of choices.

For example, the Australian annuity business is developing only now, as a consequence of its new superannuation scheme, which requires workers to accumulate large retirement savings that they can then use either in gradual withdrawals or in annuity purchases. In Australia in 1994, when this scheme started, assets backing life annuities were only A\$1.3 billion or 4% of non-superannuation assets in life insurance companies, whereas by 1998 they were \$3 billion, over 10% of non-super life insurance assets.

In Chile there was no annuity business prior to the new AFP system, but that has changed drastically. Currently, when workers retire in Chile they are required either to leave their money in their AFP for programmed withdrawals, to take an immediate annuity, or to purchase a deferred annuity with programmed withdrawals in the meantime. Keeping money in the AFP allows it to earn a risk premium but the annuity option provides investment and longevity insurance. Annuities have other advantages: if a worker has enough savings to purchase an annuity that exceeds 50% of his average wage over the last 10 years, he can “retire” early and stop contributing to the mandatory system, while continuing to work. If the annuity exceeds 70% of his average wage, the rest can be taken out as a lump sum—he can get immediate access to his retirement savings. Insurance companies can buy the workers’ “bono” (a compensation bond for work under the previous system) at a discount, thereby helping him to retire early. As a result of these incentives, the annuity business has grown dramatically in Chile. Its reserves have risen from US\$1.5 billion in 1988 to \$7.7 billion in 1998 and are expected to reach \$37 billion in 2010. Annuities, especially early retirement annuities, are now 2/3 of total life insurance sales.

Likewise, Singapore’s annuity market started in 1987 when annuities became one of the allowable options for the retirement savings that workers were required to accumulate in their retirement savings accounts (the Minimum Sum Scheme). At the age of 55 workers must set aside \$55,000 (now \$60,000) to buy a deferred annuity, to deposit with a bank or to leave with the Central Provident Fund (CPF). If they buy an annuity they acquire longevity and investment insurance that they would not have otherwise. Additionally, insurance companies have tried to offer consumers a better initial rate than they could get under the other options, which pay low interest rates. As a result of this Scheme, the annuity business is growing rapidly in Singapore and new annuity premiums are now 15% of total new insurance business.

The industry appears to start out concentrated, gradually grow less concentrated as it expands in size, and is international in scope. In 1988 the life insurance industry in Chile (mostly annuities) consisted of 9 companies, of which the top one had 47% of the market and the top three had 87%. By 1998 there were 23 companies, the largest one

having only an 11% market share and the top three 30%. All except four are foreign owned or joint ventures, and seven have close ties with specific AFPs.

## **II. Do Consumers Get A Good Deal?—the Money’s Worth Ratio**

Do these annuity companies provide good value for money? Are private annuities a good way to provide old age security? We proceed now to analyze empirical evidence that bears on this issue. We assembled a team of economists and actuaries from seven countries and asked them to analyze the annuity markets in their countries. We also asked them to calculate the MWR for several annuity products. We followed the same procedure for measuring the MWR that was followed in Friedman and Warshawsky 1990 as modified by Mitchell et al 1997 and Brown et al 1999, three of the seminal papers on this topic. This procedure was described in a manual that was prepared by Brown and shared with all team members.

The original Warshawsky, Brown and Mitchell papers were written about the US and UK. So it is not surprising that when we tried to apply it to other countries where financial markets were less developed, implementation problems soon developed. The main issues concerned the relevant interest rate and mortality tables.

### **Data and methodology**

**Mortality tables.** Since annuitants collect benefits as long as they will live, we need to know what the probabilities are of life and death for each remaining year to ascertain the expected present value of the benefit stream. Cohort mortality tables are needed for this purpose. Such a table shows, for a given cohort such as all those who are 65 year old today, year-by-year survival probabilities. Because of improvements in health and medical technology, these probabilities will be higher for people who are currently 50 years old, and even higher for their children.

To develop a cohort mortality table, we might start out with a period table that gives current age-specific mortality rates on a cross-sectional basis, but a longevity improvement factor must be built in to turn it into a cohort life table. When projecting the



pricing and funding policies of a company, or when consumers are deciding what is the expected value of an annuity to them, it is important to have such a table.

In addition to the need to project longevity improvements—which is always difficult—account must be taken of the differences between the group of annuitants and the population at large. Often, only population-wide data are available, but we really want to know about the annuitant group, whose mortality rates may be lower than average (see discussion of adverse selection below). However, especially in the early years of an annuity market, such data may simply not be available. That is exactly what we found.

Of all the countries in our sample, the UK has the most developed financial market and annuities-pension industry. The UK has long offered occupational pensions but only recently began offering personal pensions. As might be expected, it has collected considerable data on mortality of occupational pensioners, but until this year did not have data on retirees with personal pensions. A new table indicate that this group, too, may have greater longevity than predicted and therefore our MWR's may be understated by the occupational data that we used.

The lack of a previous life or annuity business means that no annuitants' mortality table has been developed in Australia; instead they use a table based on UK annuitants in 1980, with an allowance for mortality improvements. Our calculations (as well as rules of Australian regulators) assume that the current cohort of retirees in Australia will have a mortality rate 60% that of the 1980 table. This seems to fit recent Australian experience with males but may understate the longevity and therefore the MWR of females.

In Singapore too, companies have little data on which to base their pricing. They also use UK data, this time from 1967-70, with mortality improvements projected to 1990 and with a two year setback to account for future mortality improvements (a very crude adjustment factor). The scanty evidence available thus far suggests that actual deaths are far less than expected.

In Israel we used data collected by a single large pension fund, supplemented by new actuarial tables that are about to come into use. Insurance companies have been using UK life tables—these are obviously serving as a public good around the world. Israel has no carefully developed cohort life tables of its own. In Switzerland the first population cohort tables were published in 1998 and no annuitants' tables are publicly

available. Our team was granted confidential use of the tables of the Swiss Life Insurance Association for the MW calculations. Only now is Chile developing and up-dating its annuitant and population mortality tables.

Even in the presence of public accurate mortality information, it is difficult to know how to value annuities because future life expectancy remains an unknown. When public accurate information is unavailable, the task becomes much more difficult. It is probable that lacking this information, people consistently underestimate their life expectancy, basing their guesses upon the death rates of people around them now, rather than what is likely to happen in the future. That could be one reason for the low voluntary purchase of annuities, in unconstrained situations. It is also possible that the tables we have used underestimate future increases in life expectancy and therefore the MWR received by the average annuitant<sup>4</sup>. If so, this will also mean that future costs and obligations of insurance companies will be higher than they expect.

**Interest rates.** Ideally, the term structure of interest rates should be used to discount future annuity payments, and these were available for long durations in the US and UK. The reason for using the term structure is that the relevant interest rate is often different in the short run and the long run, and annuity payments are received in both periods, hence different discount rates should be used.

If the annuity is viewed as guaranteed and risk-free, the government bond rate is usually appropriate. Alternatively, if some risk is perceived to be involved, the discount rate should be higher. Earlier papers on this topic used the AA corporate bond term structure as the alternative “risky” rate.

However, in most of the countries in our study government bonds of long duration were not available and the corporate bond market is thin. For example, in Australia, which has one of the better developed financial markets, the longest government bond duration is 12 years. In Singapore 10 years is the limit on government bonds; in Chile 18 years. In Israel government bonds have a maximum duration of 15 years and the yield curve has virtually no slope (in contrast to Switzerland and Singapore which have steep

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<sup>4</sup> Blake (1999) notes that mortality forecast errors of up to 20 percent over intervals as short as ten years are not uncommon.

slopes). In cases where duration was limited, we extrapolated forward the last government bond rate into the future.

The corporate bond market is even more limited and with even less duration. In Australia, Israel, and Singapore, where the corporate market is too thin to yield a term structure, 1% was added to the government bond rate to get a “risky” rate. In Switzerland, where corporate bonds have only a 10 years’ duration, .9% was added to the government bond rate after 2008. In the UK where the corporate market is well developed, the government-corporate rate differential of .69% was derived from the first 10 years of experience and extrapolated forward; in Canada a similar procedure led to a differential of .8%. In Chile mortgage bonds were used as the substitute for corporate bonds, and a constant differential of 1.09% was maintained after 15 years.

How are we to interpret this procedure? Non-existent rates cannot be interpreted as the rate of return consumers can get on comparable investments. Indeed, consumers, like insurance companies, cannot make long term investments in economies where these do not exist. Under these circumstances, the purchase of an annuity may have greater value to consumers than these MW ratios indicate, because it fills in a market gap in allowing them to make a long term investment. (The existence of a demand for this long term financial instrument may also create a supply of other long term instruments. For example, in Chile, AFP’s and insurance companies whose main product is annuities, are the major holders of medium term home mortgage bonds).

We interpret these rates simply as hypothetical indications of peoples’ time preferences and government policies in these countries. We note that, despite global capital markets, interest rates do vary across countries, and these variations may indicate time preferences and policies which would continue to obtain over longer durations. One question we investigate is whether these variations in interest rates have systematic effects on annuity payouts and MWR’s. The term structure data we used are presented in Table 1.

## **Results**

**Payouts.** Table 2 presents average monthly pay-outs available for a variety of annuity products in our sample of countries. Pay-outs begin at age 65; for ages 55 and 75

see the Appendix. Focus first on row 1, Panel A, which deals with nominal annuities for men. We see there that a single premium individual annuity (SPIA) that an individual buys for \$100,000 at the age of 65 will yield varying amounts ranging from \$590 in Switzerland to \$754 in Canada, with Australia and the UK in the middle. How can we explain this difference?

Part of the explanation may lie in the international differences in interest rates. Insurance companies invest the premium that they receive, and if they expect to get a higher return on their investments they are willing to offer a better benefit to consumers. Indeed, we find a close correspondence between the ranking of countries by interest rates and their ranking by pay-outs on the nominal SPIA. (The only exception is Singapore, which may be overpricing its annuities, as discussed below).

Moving toward other annuity products in Panel A, the data from Australia, Canada and the UK allow us to measure the trade-offs between different types of insurance that a worker might want to buy. In Australia, a consumer can get \$700 per month for a SPIA, but if he wants a 10 year guaranteed payment (which would be paid to his beneficiaries in case of his death) to provide a bequest to his family in case he dies relatively young, he must forego 6% of that monthly benefit, and will get only \$658. If he wants a joint annuity that will cover both him and his wife (who is assumed to be 5 years younger in this example) he must forego another \$105 which is an additional 15% of the original price. In Canada and the UK the numbers are not identical but they are similar. In most countries, the majority of annuitants choose to purchase guaranteed payments or joint annuities in order to provide a survivors' benefit, but they pay an opportunity cost in terms of a lower initial benefit. In Chile a joint annuity is required. This should be taken into account in projecting the retirement savings that will be needed to finance an acceptable income level in old age. Because survivors' insurance and bequests through guaranteed payment periods and joint annuities are ordinarily part of the package, the amount of savings and contributions required to provide a given replacement rate is greater than it would otherwise be.

Panel B shows that if gender-specific mortality tables are used women get lower pay-outs than men because of their greater expected longevity, but the above relationships hold for them as well.

Finally, looking at Panel C which presents real annuity pay-outs for the four countries where they are available, we observe that the rankings by pay-outs again correspond to rankings by interest rates. (The interest rates given for Chile and Israel are real while those for Australia and the UK are nominal; the corresponding real rates would be about 2 percentage points lower). For the UK and Australia, which offer level nominal, indexed and escalating annuities (escalating annuities rise at a fixed rate each year), the initial pay-out for the level nominal is much higher than for the others although their relative positions might be reversed 10 years later. Peoples' choices here depend in part on their time preferences, suggesting that it is important to offer a range of products that will satisfy differing tastes to encourage annuitization.

Table 3 presents evidence of price dispersion in Australia, Canada and the UK. We see there that pay-outs are tightly clustered, especially in Canada where price dispersion is less than 5% from top to bottom. The ready availability of on-line information in Canada may lead to clustering for any company that wants to stay in the market. Unfortunately we do not know the quantities that go along with these prices, nor do we understand the forces that lead one company to offer better rates than others—factors such as a desire to increase sales at a particular time, or to offset life insurance risk, or to take advantage of good investment opportunities may be involved. In Switzerland prices are uniform, set by the Life Insurance Association, and in Israel they are also reputed to be uniform given a tradition of cartel-like behavior in the insurance industry, but that may change in the future due to pressures for greater competition.

**The high money's worth ratio of nominal annuities.** Table 4 presents the money's worth ratio for annuities that begin at age 65 for our sample countries, using the government bond risk-free rate. (MWRs beginning at ages 55 and 75 are shown in the Appendix). We observe, first, that among nominal annuities, and using the annuitant mortality tables, the MWRs exceed 96% for every annuity type and country and 100% for Canada, Singapore and Switzerland. The MWR is highest in countries with a steep term structure, which allows insurance companies to earn higher long term rates (some of which makes its way into pay-outs) while the MWR is discounted at the lower short term rate for many years; this probably accounts for the exceptional MWRs in Switzerland and Singapore. Another reason may be that Swiss annuities include a "bonus"--about 10% of

the total pay-out--which has been given regularly but is not guaranteed, hence investment and cohort mortality risk are effectively shared with annuitants in Switzerland (In Singapore the guaranteed annuity that we are working with must compete with variable “participating” annuities that are offered and popular).

Although pay-outs were much lower for women, the MWR is the same for both genders, once life expectancy is taken into account. With the exception of Australia, these numbers are higher than those found in earlier studies for the UK and UK (Mitchell et al 1997, Brown et al 1999, Poterba and Warshawsky 1999, Finkelstein and Poterba 1999). If people want a risk-free annuity and if these annuities are indeed risk-free, they have gotten a good deal, paying virtually nothing for longevity and investment insurance.

**The average worker and adverse selection.** However, if we use the mortality tables for the entire population, the MWRs drop by 6-9%. For example, an Australian worker with an expected lifetime that is average for the population as a whole, who wants to buy a SPIA, will only get a MWR of 91.4%. She is paying about 1.5% for general expenses and 7% in “adverse selection costs. Earlier studies have also found evidence of adverse selection, although usually somewhat larger.

One of the reasons for adverse selection is well known--asymmetric information. Consumers know more about their health status and life expectancy than insurance companies, but “good” risks (who will die young) are unable to signal this to insurance companies to secure a better rate, so they withdraw from the market, leaving the companies only with the “bad” risks, with greater than average longevity—which is exactly what we find. Annuitants have greater longevity than the population as a whole. Therefore, when we measure the MWR using the average population-wide life tables, we get a lower MWR. The inability of the “average” worker to get insurance on actuarially fair terms (which may discourage him from purchasing it) is a classical market failure and has sometimes been used as an argument for mandatory annuitization.

Of course, asymmetric information is not the only reason for the appearance of adverse selection. Another reason may be that voluntary annuities are a “luxury” good with a high income elasticity of demand so wealthy people, who have greater longevity, are disproportionately buyers. Insurance companies could charge these people a higher

risk premium, since their higher income and wealth is readily observable. But they don't—or do they?

Each annuity contract has a fixed cost attached and this will be a smaller percentage of a large policy. Rich people tend to buy larger policies. Implicitly, annuity companies may be charging a higher risk premium with a smaller expense ratio to wealthier people who buy larger policies and a lower risk premium with a higher expense ratio to poor people who buy smaller policies. In this case, the higher fee charged to low earners may dissuade them from purchasing annuities but it is not an example of market failure since it reflects real costs. Additionally, even if low earners were not charged a higher fee (given a lower MWR), many of them might have chosen not to buy an annuity given the constraints on their income. The adverse selection stemming from the correlation of income with longevity and annuity purchases is not an example of market failure although it clearly has policy implications (for a further discussion of selection issues see Finkelstein and Poterba 1999).

In some countries “adverse selection” is due to government regulations. For example, in Chile, the annuity option is only open to workers who can afford to buy an annuity that is at least 110% of the minimum pension guarantee. Low and transient earners—who tend to have lower longevity—are left out by definition. Moreover, the annuity market is effectively part of the AFP system, which primarily serves the upper half of the income distribution and urban residents, who have longer life expectancies.

Thus, at least three possible reasons account for the fact that the MWR is lower for the average member of the population than for the group that purchases annuities. And we don't know what proportion is due to asymmetric information. But perhaps the most striking observation is that, in all of our sample countries, even the average population member loses less than 10 cents on the dollar if he or she decides to purchase a nominal annuity, and only 6-7 cents are lost due to adverse selection, broadly defined.

**Self-selection as an antidote to adverse selection.** One reason why asymmetric information may not play a larger role is that insurance companies and their customers have an incentive to find self-selection techniques that will lead good risks into their own segregated groups. A person who expects to live a long time might purchase a level SPIA, but a person who expects to die young is more likely to purchase an annuity with a

guaranteed payment period or a joint annuity with a beneficiary who will continue collecting after the primary annuitant dies. So, we would expect adverse selection (as measured by the difference in MWR between the annuitant group and the entire population) to be smaller for joint annuities and guaranteed period annuities. Indeed, that is exactly what we find.

Taking Australia as an example, the difference between the two MWR's for the level simple annuity is 7.2%, but the difference for the annuity with a 10 year guarantee is 5.6% and for the joint annuity only 4.1%. In Canada the 10 year guarantee cuts the differential from 8.9% to 6.7%, in Switzerland from 20.3% to 16.9% and in the UK from 6.9% to 4.8%. Signaling mechanisms apparently do exist and they cut adverse selection costs (including those due both to asymmetric information and income elasticities of demand) in most cases. Most people who purchase annuities avail themselves of these signaling devices, as only a minority of annuity purchases are a simple SPIA. At the same time, the majority of the population is unwilling to buy annuities at these prevailing prices (and therefore probably at the actuarially fair price too).

**Using the “risky” corporate discount rate.** Not surprisingly, when we examine the MWR using the corporate rate of discount, we find lower MWR's (Table 5). The reduction varies from 8% in Australia where the imputed corporate rate premium is 1%, to a 5% reduction in the UK where the rate differential is lower. While annuitants in Singapore and Switzerland still get more than 100%, in other countries the MWR has dropped to 90-97%. And if an average population member want to purchase longevity insurance, he or she would have to lose 10-15 cents on the dollar in most cases. Adverse selection (broadly defined) still accounts for only 5-7 cents of that total, but the higher discount rate accounts for the rest and it is substantial.

**Which is the appropriate discount rate?** This depends on peoples' degree of risk aversion as well as the safety of the promised annuities. On the second point: Even though insurance companies offer “guaranteed annuities” they may not be able to honor their guarantees in the distant future. Insurance companies, like countries, do not have reliable mortality tables, especially in the early years of the industry. They do not know what interest rates will prevail in the future, or what their rate of return will be on equity and real estate. While the annuity business is small and immature, these questions are



disregarded. But eventually, if the annuity business should grow large, and if mortality improves at a faster rate than expected, the company may find itself unable to keep its promises. In that case, “guaranteed” annuities are not completely risk free, the higher risky rate applies, and annuities become a less desirable purchase.

On the first point: Even if annuities were risk-free, many people may prefer to accept higher risk on investments in order to get higher return. If they are forced to accept a risk-free annuity, because that is the only kind that is offered, their utility will not be maximized. The higher corporate discount rate is appropriate for them and it correctly informs us that they are receiving a lower MWR because of their lack of access to riskier annuities. We will discuss below some of the ways this situation might be remedied.

**Real annuities.** While increasing the discount rate has a large impact on the MWR, an even larger impact comes from the use of real (indexed) rather than nominal annuities. In Chile and Israel the entire economy is indexed, so annuities must be too. In Australia and the UK indexed annuities are available, albeit not very popular. When we look at the MWR ratios we understand why.

As noted above, the pay-outs for real annuities are consistently and substantially less than for nominal annuities and, perhaps more interesting, the MWR is also consistently less. Using the risk-free discount rate, in the UK a real annuity yields 88%, which is 9% less than an equivalent nominal annuity. The MWR in Israel and Chile are higher—92-94%--but this is lower than for any nominal annuity in our sample. Using population mortality tables, these numbers become still lower--80%-87%. Using the corporate discount rate of course depresses the MWR further, to 82-86% for annuitants and 74-80% for the average member of the population. A person who is not averse to taking investment risk but wants to be protected against inflation risk will have to pay a large premium--of 15-25 cents on the dollar--to obtain inflation insurance. (The only exception is the new mandatory pension system in Israel, where indexed annuities are subsidized by the government in the form of high interest bonds that are issued to the pension funds. For this subsidized group, the MWR exceeds 100%).

The same picture was found earlier for the UK by Brown et al 1999 and by Finkelstein and Poterba 1999, who offered several possible explanations, chief among them being greater adverse selection among purchasers of indexed annuities whose

benefits are back-loaded. That explanation does not fit another fact, however: In both Australia and the UK, where we have data for escalating annuities whose value increases at a fixed rate (5% in Australia, 3% in the UK) ever year, their MWR is about the same as for other nominal annuities and much higher than that for real annuities. If adverse selection induced by backloading were the culprit, that should lead to a lower MWR ratio among escalating as well as indexed annuities.

Rather, we suggest that the explanation for the lower MWR of real annuities is that insurance companies cannot engage in risk intermediation as freely when they sell an indexed annuity, because the only investment that will allow them to hedge against inflation risk is indexed bonds, primarily government bonds, and if they do this they forego the spread from higher yielding investments. If they try to avoid inflation risk, they get lower yields. If they invest in higher yields, they face inflation risk. Even if they choose the lower yield route, indexed annuities expose them to higher reinvestment risk and consequently to higher reserve requirements, since the longest duration for indexed instruments is shorter than for ordinary bonds. Thus insurance companies that offer real annuities face a trade-off between inflation risk and low returns—they must face one or the other or both. In any case, the consumer is stuck with a higher price. It is interesting in this respect that Chile, which has the broadest range of indexed instruments of the three countries, also has the best terms for indexed annuities.

### **III. Policy Implications**

#### **Annuities and risk intermediation**

It is difficult to separate out the expenses and investment returns of the annuity business versus other business of the same insurance companies. In Canada, total insurance expenses are estimated to be 5.5% of premiums, including sales commissions that are 3% for the first \$100,000 in premiums, falling to 1% for larger amounts. In Singapore expenses are estimated to be about 4%, including a 1% sales commission, plus a large management fee. In Australia and Chile sales commissions are as high as 4 and 5%, respectively. How do insurance companies cover these costs, if the risk-free MWR

for their nominal annuitants is in the vicinity of 1? The answer to this question has broader implications for the way annuity markets should be organized.

We have argued that annuity costs are covered by the spread between the risk free rate on which the high MWR was based and the riskier portfolios in which they invest. Moreover, insurance companies can invest their reserves in long term assets which may earn a higher return, while individuals still get some of their returns in short term pay-outs. For example, in Chile 50% of insurance company investments are in corporate bonds, mortgage bonds, real estate and equity. During the 1990's their annual real portfolio return ranged between 4.7 and 10.7%, with a simple annual average of 7.3%. In Singapore, a third of all investments were in equities and another quarter in real estate and loans. Annuity companies in the UK, Canada and Switzerland also invest in a mixture of corporate bonds, equity, real estate and foreign assets, in addition to government bonds. The Swiss insurance companies may earn a high enough return on its diversified, long term and foreign investments (despite the low short term interest rate in the economy) to allow it to offer the very high MWR that we have reported above.

Under this version of the world, annuities can be backed by long term investments because the insurance company has a multi-generational life in which earlier investments can be used to finance near-term pay-outs. And annuities are "safe" because they are guaranteed by the insurance company. The company turns risky investments into "safe" annuities by investment diversification, by sharing risk across several different product lines including life insurance and annuities whose risk is negatively correlated, and by paying a premium to stockholders whose profits (positive or negative) act as a buffer between unexpected events and their insured customers.

### **Public versus private provision**

This view has implications for the relative efficiency of private versus public provision of annuities in a funded system. Some people have argued that the provision of all annuities in a multi-pillar system should be turned over to a single public monopoly that the worker must use upon retirement. But if insurance companies can cut their costs by providing risk intermediation, this is an argument for private rather than public provision. A public monopolistic annuity company should not invest in a broadly

diversified portfolio since this will lead toward public control of a large share of assets in many economies, it should not offer a wide range of insurance products or it will crowd out the private insurance sector, and it does not have stockholders whose function it is to buffer some of the risk. Instead, taxpayers at large become the buffer, and this may have undesirable efficiency as well as equity consequences.<sup>5</sup> For these reasons, a public monopoly does not have the same ability to turn high risk investment into low risk annuities efficiently that a private company has.

Of course, the opposite side of the coin is that the incentive system may lead private insurance companies to price over-optimistically in order to sell policies. Each annuity involves a large premium, all of which is paid, with a commission, up front. It will be many years--perhaps 20 or more--before the company knows for sure whether it has made a profit or a loss on that class of policies. When the annuity business is only a small part of the total insurance business, the company will be able to cover any annuity losses out of its other income, and with the annuity business growing, the cash inflow will exceed the out-flow for many years. Furthermore, companies may deliberately run a temporary loss on new products in order to establish a market position. Singapore may be in that position now, which may be one explanation for its exceptionally high MWR's. But this situation is obviously not sustainable in the long run. If the annuity business is underfunded as it grows, this will eventually come back to haunt. This possibility is one reason why the higher risky discount rate may be appropriate and, as we have seen, this rate yields a lower MWR.

This is also a reason why heavy government regulation of insurance providers is essential, to keep risk down and MWR up, by setting rigorous reserve and matching requirements. It is especially essential for providers of long term insurance such as annuities where the market cannot be counted on to provide immediate feedback.

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<sup>5</sup> Between 1906 and 1968 the Canadian government dominated the annuity market in that country. Out-dated mortality tables were used and government subsidies became necessary. Finally, during the period of volatile interest rates in the 1960's, the public company was unable to keep up with interest rate changes and the rapid price changes that this required. The public monopoly went out of business and the private annuity industry began to develop.

### **How to combine longevity insurance with investment risk?**

Many people may wish to insure themselves against an unexpectedly long lifetime, fearing that they will run out of money in old age. But they may be willing to accept some investment risk to increase their incomes, especially during “young” old age. The experience of Switzerland indicates that this strategy may indeed yield a high return. For people who are less risk averse, the high discount rate may be relevant and they are getting a lower MWR than those who want to avoid investment risk.

We might wonder, then, why more companies don’t offer profit-sharing or participating annuities, in which payments vary with investment earnings. These are rare in most countries. A basic reason is the principal-agent problem: workers may not trust insurance companies as investment managers enough to turn over a large premium on an irrevocable basis to them. Once a company had a large amount of committed money, it might choose not to maximize returns, to the detriment of the worker. In Singapore participating annuities are very popular and the largest issuer is an insurance company that is run by the trade unions with which many workers are affiliated, which they may consequently consider “trustworthy.”

Most schemes allow some kind of “gradual withdrawal” and these are very popular among workers who want to earn a higher risk premium and control their own investments rather than turning that responsibility over to a third party. In Australia “allocated annuities” which are not really annuities but are constrained withdrawals, are the most popular pay-out technique for that reason. In Chile about half of retirees select programmed withdrawals, keeping their money in diversified portfolios in AFPs. But in doing so they forego longevity insurance. It would be useful to develop instruments that allowed workers to insure against unexpectedly high longevity while still retaining some control over the investment of their money. The relatively low MWR using the corporate discount rate suggests that some workers would be made significantly better off in this case.

Valdes has suggested such a scheme: it would allow a group of companies to pool their longevity risk, while workers could choose and switch amongst them as investment managers (Valdes 1998, Valdes and Edwards 1997). This would operate similarly to TIAA-CREF, which offers variable annuities and allows workers to shift across

portfolios during retirement, but with several different companies rather than only a single one. Under this scheme, workers would be placed into pools according to their risk classification and several asset managers would be associated with each pool. Upon annuitizing, workers would receive a fixed number of annuity units, but the value of the unit would fluctuate according to the investment success of the asset managers, much as the value of a share of a mutual fund varies. Longevity risk would be shared within the entire pool, so money would be transferred if some asset managers had above average longevity and others below average.

Of course, if workers earned the higher rate of return from higher risk investments, insurance companies would no longer be able to cover their costs out of the interest rate spread (e.g. the equity premium) and would have to charge explicitly for their expense and profits. Thus, if such annuities developed, expected pay-outs and MWRs would increase but transparent expense ratios would also increase.

### **Inflation insurance—can it be provided by the private sector?**

We have seen that real annuities are often not available and when available they are relatively expensive—their MWR is 9% lower than that of nominal annuities and (at risk-free rates) consumers tend to lose 6-12 cents on the dollar. This cost is not prohibitive, but it is noticeable. We have argued that this is due primarily to the lack of indexed investment instruments in most economies. Indeed, in Chile, where they are more broadly available, the MWR of indexed annuities is higher than elsewhere. One type of instrument that is generally not available, for example, is very long term indexed government bonds.

The relatively high cost of indexed annuities has been pointed to by some people as a rationale for public provision. However, if the government issues an annuity, e.g. in the form of an indexed DB PAYG pension, this is also costly. It is effectively issuing implicit indexed long term debt. If it is willing to issue long term indexed debt, it could do so in the form of an explicit bond, which is much more transparent. And insurance companies would then have an easier time offering annuities, including indexed annuities. The fact that many governments are not willing to offer long term indexed explicit debt but are willing to offer generous long term indexed implicit debt suggests

that they may prefer the nontransparent nature of the implicit debt. But transparent debt is more amenable to good governance and citizenship than nontransparent debt. Inflation insurance is costly, whether publicly or privately provided, but governments can take steps to make private provision less costly than it currently is by issuing long term indexed bonds. Insurance companies can make inflation insurance more affordable by arrangements that index partially or with caps and floors, thereby cutting off the tails of the cost distribution. Some governments have also instituted such arrangements in their public pension plans.

### **Adverse selection and mandatory annuitization**

Some people argue that annuitization should be made mandatory to alleviate adverse selection. We believe there are good reasons for mandating a modest level of annuitization through the first or second pillar—reasons primarily stemming from myopia and moral hazard problems—but the evidence does not support the idea that many people would be made better off if a higher level of annuitization were mandatory.

Adverse selection is an argument for mandatory annuitization if we believe that a large number of people who would want to buy annuities at actuarially fair price are kept out of the market by asymmetric information. But we have just seen that this is unlikely to be the case. Adverse selection, broadly defined, raises the cost about 7%. This cost can be and often is reduced to 5-6% by utilizing a guarantee period or a joint annuity, which are more likely to be priced according to population mortality tables. Part of the remaining difference between population mortality and annuitant mortality is probably due to income correlated with both with a demand for annuities and longevity—which is not a source of market failure.

Suppose that cost were to decrease by 5-6% (MWR increase by 5-6%), making the system actuarially fair for the average member of the population. How many people would enter the market? This is the same as asking what is the cost elasticity of demand.<sup>6</sup> Assuming a neutral elasticity of 1, quantity demanded would increase by 5-6%. Even

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<sup>6</sup> We use the term “cost elasticity” because “price” is ambiguous in this context. We might think of “price” as the total premium paid for the policy or, alternatively, as the difference between the premium paid and the present value of the benefit stream received, i.e. as 1-MWR. A 1% change in premium, or cost, would

with an elasticity of 2, quantity demanded would go up only 10-12%. Most people would still stay out of the market.

These numbers suggest that most people who would be forced into a mandatory annuity market would prefer not to buy at an actuarially fair price. Forcing them to buy (beyond the modest amount dictated by myopia and moral hazard) in order to obtain an actuarially fair price for those who want to buy is not only inefficient, it is “unfair” in terms of equity. The main beneficiaries would be wealthy people who would have bought anyway, while the main losers are poor people who have a high opportunity cost. (The impact of differential mortality on redistribution under mandatory annuitization is discussed in Brown 1999).

### **The challenge for the future**

Nevertheless, as multi-pillar systems grow, the pay-out phase will have to be constrained to make sure that people do not run out of money before they die, and annuities are bound to be an important option within that constrained system. The challenge for countries that have already reformed their accumulation phase will be to design a decumulation phase that is cost-effective and consistent with peoples’ preferences. This means that sufficient product variety should be permitted to satisfy diverse tastes and any restrictions should be thought through carefully. Chile requires all annuitants to purchase a joint annuity (to provide survivors insurance), does not permit profit-sharing annuities and gives workers considerable flexibility concerning when pay-outs begin. Singapore encourages single annuities, permits participating annuities and requires that pay-outs should begin exactly at age 62. One desirable restriction may be to standardize product descriptions to facilitate price competition and informed choice.

The numbers we have presented suggest that annuity companies are capable of functioning effectively, even in countries that do not have well developed financial markets. Consumers do indeed get their money’s worth, seemingly more so than in other countries than in the US or UK, providing nominal annuities are desired and risk-free discount rates are appropriate. Part of the challenge for governments is to ensure that the

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imply a small proportionate change in the price under the first definition but a much larger proportionate change in price under the second definition.



risk free rate is appropriate by tight regulations regarding funding and disclosure requirements, and to encourage institutional arrangements that enable consumers with higher risk preferences to bear some investment risk while still retaining longevity insurance.

The biggest weakness of the annuity market seems to be its inability to deal with inflation protection in a low-cost way. Contrary to previous belief, private insurance companies can and do provide indexed annuities in several countries. However, consumers pay 10-12 cents on the dollar for this protection, while nominal annuities cost practically nothing. Of course, inflation insurance is never low cost, whether provided through the market or the public sector. Governments can facilitate low cost indexed annuities by issuing long term indexed bonds and by keeping inflation under control. Annuity companies can facilitate them by providing partial inflation insurance. Until these policies are in place, indexed annuities are unlikely to develop.

**TABLE 1**  
**Term Structure of Government Rates**

<b>Year</b>	<b>Australia</b>	<b>Canada</b>	<b>Switzerland</b>	<b>UK</b>	<b>Singapore</b>	<b>Chile</b>	<b>Israel</b>
1	4.67	5.43	2.08	4.94	2.38	8.14	4.3
2	4.69	5.35	2.08	4.94	2.38	8.14	4.1
3	4.70	5.53	2.08	4.89	2.88	7.22	4.0
4	4.74	5.55	2.13	4.85	3.39	7.22	3.8
5	4.80	5.58	2.53	4.81	3.89	6.73	3.7
6	4.89	5.64	2.53	4.77	4.15	6.73	3.6
7	4.99	5.71	2.53	4.74	4.41	6.73	3.3
8	5.00	5.69	2.53	4.71	4.53	6.66	3.4
9	5.04	5.68	2.53	4.68	4.65	6.66	3.4
10	5.07	5.67	2.71	4.66	4.76	6.67	3.4
11	5.09	5.69	2.71	4.63	4.76	6.67	3.4
12	5.13	5.71	2.71	4.61	4.76	6.65	3.4
13	5.13	5.72	2.71	4.59	4.76	6.65	3.4
14	5.13	5.75	2.71	4.57	4.76	6.67	3.4
15	5.13	5.77	2.71	4.56	4.76	6.67	3.4
16	5.13	5.79	2.71	4.54	4.76	6.67	3.4
17	5.13	5.81	4.05	4.53	4.76	6.67	3.4
18	5.13	5.84	4.05	4.52	4.76	6.67	3.4
19	5.13	5.86	4.05	4.51	4.76	6.67	3.4
20	5.13	5.88	4.05	4.50	4.76	6.45	3.4
21	5.13	5.87	4.05	4.50	4.76	6.45	3.4
22	5.13	5.86	4.05	4.49	4.76	6.45	3.4
23	5.13	5.85	4.12	4.49	4.76	6.45	3.4
24	5.13	5.84	4.12	4.49	4.76	6.45	3.4
25	5.13	5.83	4.12	4.49	4.76	6.45	3.4
26	5.13	5.83	4.12	4.49	4.76	6.45	3.4
27	5.13	5.82	4.12	4.49	4.76	6.45	3.4
28	5.13	5.81	4.23	4.49	4.76	6.45	3.4
29	5.13	5.80	4.23	4.49	4.76	6.45	3.4
30	5.13	5.79	4.23	4.49	4.76	6.45	3.4

**Term Structure of Corporate Rates**

<b>Australia</b>	<b>Canada</b>	<b>Switzerland</b>	<b>UK</b>	<b>Singapore</b>	<b>Chile</b>	<b>Israel</b>
Gvt + 1	Gvt + 0.8	Gvt + 0.9 After 10 years	Gvt + 0.69 After 10 years	Gvt + 1	Gvt + 1.09 After 15 years	Gvt + 1

**TABLE 2****Monthly Pay-Outs per Immediate Annuities at Age 65  
(\$100,000 premium)\*****A. Male - Nominal**

	<b>Australia</b>	<b>Canada</b>	<b>UK</b>	<b>Switzerland</b>	<b>Singapore<sup>e</sup></b>
Level SPIA <sup>a</sup>	700	738	709	590	
Level SPIA + 10YG <sup>b</sup>	658	706	674	571	635
Escalating SPIA <sup>c</sup>	431		550		
Joint SPIA <sup>d</sup>	543	664	626	501	

**B. Male - Real**

	<b>Australia</b>	<b>UK</b>	<b>Chile</b>	<b>Israel</b>
Level SPIA <sup>a</sup>	563	509	820	625
Level SPIA + 10YG <sup>b</sup>	531		761	584
Joint SPIA <sup>d</sup>		427	731	

**C. Female - Nominal**

	<b>Australia</b>	<b>Canada</b>	<b>UK</b>	<b>Switzerland</b>	<b>Singapore<sup>e</sup></b>
Level SPIA <sup>a</sup>	621	662	624	526	
Level SPIA + 10YG <sup>b</sup>	599	648	611	519	600
Escalating SPIA <sup>c</sup>	356		463		

**D. Female - Real**

	<b>Australia</b>	<b>UK</b>	<b>Chile</b>	<b>Israel</b>
Level SPIA <sup>a</sup>	484	425	723	552
Level SPIA + 10YG <sup>b</sup>	469		695	530

See Appendix for ages 55 and 65

a SPIA = single premium immediate annuity

b 10YG means payment continues for at least 10 years even if individual dies; beneficiary is named

c Escalating annuity means that payment increases at fixed rate per year—5% for Australia, 3% UK

Payout given is for initial year; in later years payout will be higher

d Joint annuity is based on assumption that both spouses are same age and survivor gets 50% of initial payout. In Chile survivor gets 60%. For Australia husband is assumed to be 65, wife is 60 and survivor gets 85% of initial payout.

e For Singapore annuity begins at age 62 (a requirement of the Minimum Sum Scheme of the CPF) and carries 15 years of guaranteed benefits.

**TABLE 3**

**Price Dispersion in The Annuity Market**

**Monthly Pay-Outs, Male Age 65 (SPIA)**

	<b>UK</b>	<b>Australia</b>	<b>Canada</b>
Top 1	772	764	754
5 <sup>th</sup> Best	723	720*	748
Average	708	700	738 (Median)
Worst		626	723

\* This is AMP price, not 5<sup>th</sup> best

**TABLE 4****Money's Worth Ratio (MWR) with Risk-Free Interest Rate – Age 65 (as %)****A. Male - Nominal**

	Australia		Canada		UK		Switzerland		Singapore
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Ann. P.
Level SPIA	91.4	98.6	92.5	101.4	89.7	96.6	96.5	116.9	125.6
Level SPIA + 10YG	91.9	97.5	93.9	100.6	92.7	97.5	99.6	116.5	
Escalating SPIA	89.3	101.6			88.6	97.1			
Joint SPIA	95.9	100.1			91.7	97.1	87.7	105.3	

**B. Male - Real**

	Australia		UK		Chile		Israel		
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Mandat.
Level SPIA			80.1	87.8	86.8	93.9	79.9	92.1	116.0
Level SPIA + 10YG					88.9	93.3	82.6	91.4	
Joint SPIA			80.3	86.3	88.4	92.7			

**C. Female - Nominal**

	Australia		Canada		UK		Switzerland		Singapore	
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann.P.
Level SPIA	91.4	97.0	93.7	101.5	91.0	95.7	102.9	115.2		
Level SPIA + 10YG	91.3	96.0	94.8	101.3	93.3	96.8	104.4	115.2	124.5	
Escalating SPIA	88.0	97.9			89.4	95.4				

**D. Female - Real**

	Australia		UK		Chile		Israel		
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Mandat.
Level SPIA			79.8	85.0	86.6	94.7	76.0	91.1	124
Level SPIA + 10YG					87.8	94.0	78.4	90.6	

See Appendix for ages 55 and 75

Gen. P. = general population

Ann. P. = annuitant population

For Israel, mandatory pension is a mandatory contribution for covered group. It yields a deferred pension that must be purchased annually with payout beginning at age 65. MWR is shown for purchase at age 55 with payout beginning at age 65.

For other definitions and notes see table 2.

**TABLE 5****Money's Worth Ratio (MWR) with Corporate Rate – Age 65 (as %)****A. Male - Nominal**

	Australia		Canada		UK		Switzerland		Singapore
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Ann. P.
Level SPIA	84.6	90.6	86.9	94.7	85.4	91.6	92.2	110.4	107.3
Level SPIA + 10YG	85.2	89.8	88.3	94.0	88.3	92.5	95.3	110.1	
Escalating SPIA	80.9	90.8			81.1	88.4			
Joint SPIA					86.7	91.5			

**B. Male - Real**

	Australia		UK		Chile		Israel		
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Mandat.
Level SPIA			75.6	82.3	80.2	86.3	74.2	84.7	99.0
Level SPIA + 10YG					82.2	85.8	76.7	84.0	
Joint SPIA			75.0	80.3	80.9	84.5			

**C. Female - Nominal**

	Australia		Canada		UK		Switzerland		Singapore
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Ann. P.
Level SPIA	83.9	88.5	87.4	94.1	86.0	90.1	97.4	108.3	105.8
Level SPIA + 10YG	83.9	87.7	88.4	93.9	88.1	91.3	98.9	108.3	
Escalating SPIA	78.6	86.5			81.0	86.0			

**D. Female - Real**

	Australia		UK		Chile		Israel		
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Mandat.
Level SPIA			74.5	79.1	78.8	85.9	70.3	83.0	104.2
Level SPIA + 10YG					80.4	85.4	72.5	82.5	

\* See Tables 2 and 4 for notes and definitions

## **APPENDIX 1**

### **Annuity Pay-Outs per Immediate Annuities at Age 55 (\$100,000 premium)\***

#### **A. Male - Nominal**

	<b>Canada</b>	<b>UK</b>	<b>Switzerland</b>
Level SPIA	605		474
Level SPIA + 10YG	597		469
Escalating SPIA			
Joint SPIA	561		421

#### **B. Male - Real**

	<b>UK</b>	<b>Chile</b>	<b>Israel</b>
Level SPIA		650	460
Level SPIA + 10YG		632	451
Joint SPIA		597	

#### **C. Female - Nominal**

	<b>Canada</b>	<b>UK</b>	<b>Switzerland</b>
Level SPIA	562		435
Level SPIA + 10YG	559		433
Escalating SPIA			

#### **D. Female - Real**

	<b>UK</b>	<b>Chile</b>	<b>Israel</b>
Level SPIA		591	420
Level SPIA + 10YG		583	415

\* See Table 2 for notes and definitions

## APPENDIX 2

### **Annuity Pay-Outs per Immediate Annuities at Age 75 (\$100,000 premium)\***

#### **A. Male - Nominal**

	<b>Canada</b>	<b>UK</b>	<b>Switzerland</b>
Level SPIA	1016	1030	821
Level SPIA + 10YG	862	842	725
Escalating SPIA		851	
Joint SPIA	869	859	

#### **B. Male - Real**

	<b>UK</b>	<b>Chile</b>	<b>Israel</b>
Level SPIA	799	1130	953
Level SPIA + 10YG		918	760
Joint SPIA		971	

#### **C. Female - Nominal**

	<b>Canada</b>	<b>UK</b>	<b>Switzerland</b>
Level SPIA	876	871	720
Level SPIA + 10YG	797	776	675
Escalating SPIA		706	

#### **D. Female - Real**

	<b>UK</b>	<b>Chile</b>	<b>Israel</b>
Level SPIA	669	965	814
Level SPIA + 10YG		852	701

\* See Table 2 for notes and definitions



### APPENDIX 3

#### Money's Worth Ratio (MWR) with Risk-Free Interest Rate – Age 55 (as %)\*

##### **A. Male - Nominal**

	Canada		UK		Switzerland		Singapore
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Ann. P.
Level SPIA	94.9	100.0		98.5	104.3	119.5	99.0
Level SPIA + 10YG	95.5	100.2			105.2	119.3	
Escalating SPIA							
Joint SPIA							

##### **B. Male - Real**

	UK		Chile		Israel	
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.
Level SPIA			86.0	90.9	80.3	88.9
Level SPIA + 10YG			86.6	90.5	81.0	88.6
Joint SPIA			86.5	89.4		

##### **C. Female - Nominal**

	Canada		UK		Switzerland		Singapore
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Ann. P.
Level SPIA	95.0	99.9			108.4	116.9	98.5
Level SPIA + 10YG	95.6	100.0			108.7	117.0	
Escalating SPIA							

##### **D. Female - Real**

	UK		Chile		Israel	
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.
Level SPIA			84.8	90.5	78.3	88.1
Level SPIA + 10YG			85.3	90.2	78.7	87.8

\* See Tables 2 and 4 for notes and definitions

## APPENDIX 4

### Money's Worth Ratio (MWR) with Risk-Free Interest Rate – Age 75 (as %)\*

#### A. Male - Nominal

	Canada		UK		Switzerland	
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.
Level SPIA	88.9	103.6	85.0	94.0	85.4	111.1
Level SPIA + 10YG	92.4	100.1	92.0	95.8	94.7	110.0
Escalating SPIA			82.0	92.2		
Joint SPIA			86.8	94.7	76.8	99.5

#### B. Male - Real

	UK		Chile		Israel	
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.
Level SPIA	77.6	87.1	86.5	94.7	79.7	95.6
Level SPIA + 10YG			91.3	94.5	86.9	93.2
Joint SPIA	79.1	87.6	89.0	94.1		

#### C. Female - Nominal

	Canada		UK		Switzerland	
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.
Level SPIA	93.3	103.5	87.1	94.2	94.7	109.5
Level SPIA + 10YG	95.2	101.9	91.7	96.1	99.5	109.2
Escalating SPIA			84.9	93.4		

#### D. Female - Real

	UK		Chile		Israel	
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.
Level SPIA	79.1	87.1	86.5	97.7	72.5	94.8
Level SPIA + 10YG			90.4	96.0	81.5	93.1

\* See Tables 2 and 4 for notes and definitions

## APPENDIX 5

### Money's Worth Ratio (MWR) with Corporate Rate – Age 55 (%)

#### A. Male - Nominal

	Canada		UK		Switzerland	
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.
Level SPIA	87.7	91.9			97.6	110.3
Level SPIA + 10YG	88.3	92.1			98.5	110.1
Escalating SPIA						
Joint SPIA						

#### B. Male - Real

	UK		Chile		Israel		
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Mandat.
Level SPIA			77.9	81.8	72.7	79.7	
Level SPIA + 10YG			78.4	81.5	73.4	79.4	
Joint SPIA			77.6	79.9			

#### C. Female - Nominal

	Canada		UK		Switzerland	
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.
Level SPIA	87.2	91.1			100.0	107.4
Level SPIA + 10YG	87.7	91.3			100.7	107.5
Escalating SPIA						

#### D. Female - Real

	UK		Chile		Israel		
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Mandat.
Level SPIA			76.0	80.5	70.6	78.3	
Level SPIA + 10YG			76.6	80.3	70.9	77.9	

\* See Tables 2 and 4 for notes and definitions

## APPENDIX 6

### Money's Worth Ratio (MWR) with Corporate Rate – Age 75 (%)

#### A. Male - Nominal

	Canada		UK		Switzerland	
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.
Level SPIA	85.1	98.4	82.3	90.7	83.3	107.2
Level SPIA + 10YG	88.3	95.1	89	92.5	92.4	106.3
Escalating SPIA			76.8	86.1		
Joint SPIA			83.6	90.8	74.7	95.6

#### B. Male - Real

	UK		Chile		Israel		
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P	Mandat.
Level SPIA	73.1	81.8	81.6	89.0	75.7	90.1	
Level SPIA + 10YG			85.9	88.6	82.1	87.6	
Joint SPIA	75.7	83.5	83.3	87.8			

#### C. Female - Nominal

	Canada		UK		Switzerland	
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P.
Level SPIA	88.5	97.7	83.8	90.3	91.7	105.4
Level SPIA + 10YG	90.4	96.2	88.3	92.2	96.4	105.2
Escalating SPIA			78.9	86.5		

#### D. Female - Real

	UK		Chile		Israel		
	Gen. P.	Ann. P.	Gen. P.	Ann. P.	Gen. P.	Ann. P	Mandat.
Level SPIA	75.7	82.8	80.9	90.7	68.7	88.6	
Level SPIA + 10YG			84.4	89.2	76.9	86.9	

\* See Tables 2 and 4 for notes and definitions

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