

Payout Phase for Fully-Funded Pension Schemes: An Alternative Approach to Risk Distribution

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The payout phase of fully-funded pension schemes relies on the existence of annuity market and an insurance that can support it. This is not the case when these schemes result from pension reforms in less developed countries. In these situations, in general, the annuity market is going to develop from the pension reform itself. Therefore, the industry has to deal with three delicate issues: first, the low initial base that is the starting point; second, lack of reliable mortality data; and third, underdeveloped capital markets. If these issues are not clearly understood and factored into the methodologies for determining reserves and capital requirements, it is very possible that in the long run the insurance industry will not be able to respond to the expectations. This would be a major drawback, with difficult to measure costs.

This work proposes an alternative scheme of risk distribution. The idea is to keep the insurance industry's exposure to risk in line with their current Capital Requirements. The excess risk is shifted to the annuitants, under a methodology in which they are rewarded consistently with the risk they bear.

Summary

Although many socioeconomic aspects should be considered to evaluate a Private Pension Fund scheme, for a particular individual, the efficiency of the scheme can be visualized as the relationship between the amounts saved during his working lifetime and the monthly payments received during his retirement. This relationship is highly dependant on the investment return during both phases (savings and retirement). Higher investment return produces a lower (and more desirable) relationship.

The private pension funds have a minimum return requirement (see below) based on the average return of all the funds and the theoretical return of a synthetic portfolio "managed" by the Superintendency of Banking. This requirement, in essence, only protects the individual from the deviations in the return of his particular pension fund with the return of the system as a whole. Therefore,

during the savings phase, the individual bears the investment risk based on the performance of the whole system.

A life annuity, issued by an insurance company, provides the monthly payments during retirement. The single premium available to purchase this annuity is the accumulated value of the savings in the private pension fund. A key ingredient in the calculation of the annuity based in the available premium is the technical interest rate, which can be seen as the rate that the insurer guarantees to the annuitant.

It seems that the investment risk during retirement is bore by the insurance company. Obviously this is true when viewed only from the perspective that the insurance guarantees the technical interest rate. However, there are other aspects that should be considered to determine who bears the investment risk.

In first place, it is clear that the annuitant is protected against the downside risk. However, it is not clear that, even though the life annuity acquired for retirement contains a profit sharing scheme, the annuitant is benefited from high returns. Part of the problem here is that if extra investment yield is returned to the annuitant via higher annuity payments, the company would loose protection against higher longevity.

In second place, the technical interest rate, which is the guaranteed rate equivalent to the rate used to calculate the premium, is set by the regulators; currently it is 4% real (see below). The insurers are continuously struggling to get the regulators to decrease that rate for obvious reasons. However, a decrease in the rate shifts negatively the relationship between the amounts saved during the working lifetime and the monthly payments received during retirement. In this sense, even though it is clear that an interest rate is going to be guaranteed during retirement, there is no guarantee as to what interest rate will be guaranteed at that point.

In third place, the technical interest for an individual is the one prevailing at the retirement date. Most likely insurance companies will try to build an investment portfolio that matches the cash flows as much as possible (see below). Therefore, the outcome for an individual partially depends on the interest rates prevailing at the date of his retirement. This could create some undesirable effects between retirees' cohorts.

In fourth place, as mentioned above, the insurers guarantee the technical interest rate. If the prevailing rates when an annuity is issued are too close to the guaranteed rate, and the term structure of the available investments does not allow cash flow matching for an important number of years, the capital requirements for the insurers could increase dramatically.

The study of the above problems is of crucial importance. It is necessary to understand who is bearing the risks, and specially to make sure that they the capacity to bear them. For example, currently the insurance companies are concerned with their capacity and risks involved in guaranteeing a 4% interest rate (see below). It is possible that based on their concerns, the regulators might consider lowering the required technical rate. This type of solution reduces the concerns of the insurers, maybe temporarily, but will not solve other aspects of the problematic, such as the mortality risks.

It is mandatory to understand the capacity of the insurance sector, in the short and in the long run, so that a reasonable scheme can be adopted. In January the World Bank published a paper titled “Developing the Market for Retirement Products: The Case of Chile” (2). In numeral 3 of the Executive Summary it states: “One of the central questions faced by policy-makers in these countries is whether it is possible to develop an efficient market for retirement products from a low initial base. A more specific and critical question is whether the insurance sector can effectively deliver relatively complex products such as annuities, and honor contracts that may span for a period of 40 years or longer. This is not a trivial question given the lack of reliable mortality data in many emerging countries, their less developed institutional and regulatory frameworks, and their less developed capital markets”.

This paper analyses these problems and presents a methodology to keep a balance between the interests of the scheme participants and the insurers. Particular emphasis will be made to maintain the balance between the benefits to different retiree’s cohorts, and assuring an appropriate risk-adjusted return for insurance, as well as retirees. The basic idea is to consider alternative mechanisms to:

- establish the interest rate guarantees (not necessarily based on a technical interest rate defined at issue),
- determine profits, profits release, and profits sharing,
- estimate capital requirements taking into consideration shifts in risk profile due to profit sharing mechanisms.

The paper initially presents some background to the problem, explains the Colombian private pension scheme, and summarizes the results of a study conducted by FINAC, a Colombian Actuarial Consulting firm member of Milliman Global, in 2004 to determine sufficiency of premiums and capital for retirement annuities (1).

Then there are three sections: Investment Portfolio, Investment Risk Profile and Profit Sharing, that lay the principles on which the recommendation scheme is based.

The final five sections: Considerations for a Solution, Current Approaches, Proposed Scheme, Comparison of New Scheme and Current Scheme, and Final Comments, present the proposed scheme, and analyze its advantages, disadvantages, and efficiency.

The work developed here is based in the Colombian case. However, the same situation is present in many countries that have implemented Private Pension Funds. In general, inflation has decreased as well as interest rates. Multilateral institutions, such as the World Bank, have expressed concern about the viability of this scheme. Therefore, the ideas presented here are widely applicable and, hopefully, they will help in the process of finding an ultimate solution to a very delicate problem.

This work has not been discussed with Colombian authorities. Therefore, certain new roles that official institutions would play in the proposed scheme are based on common sense only, and should be considered as a recommendation.

Background

The Private Pension Fund scheme, existent in Colombia since 1990 (see below), is a two phase system. The initial phase is the savings period during the working lifetime of the individual. Each participant has an individual savings account in a Pension Fund. The second phase is the retirement period. In general, in this last phase the income is provided by an immediate life annuity purchased with the accumulated value of the savings at the moment of retirement.

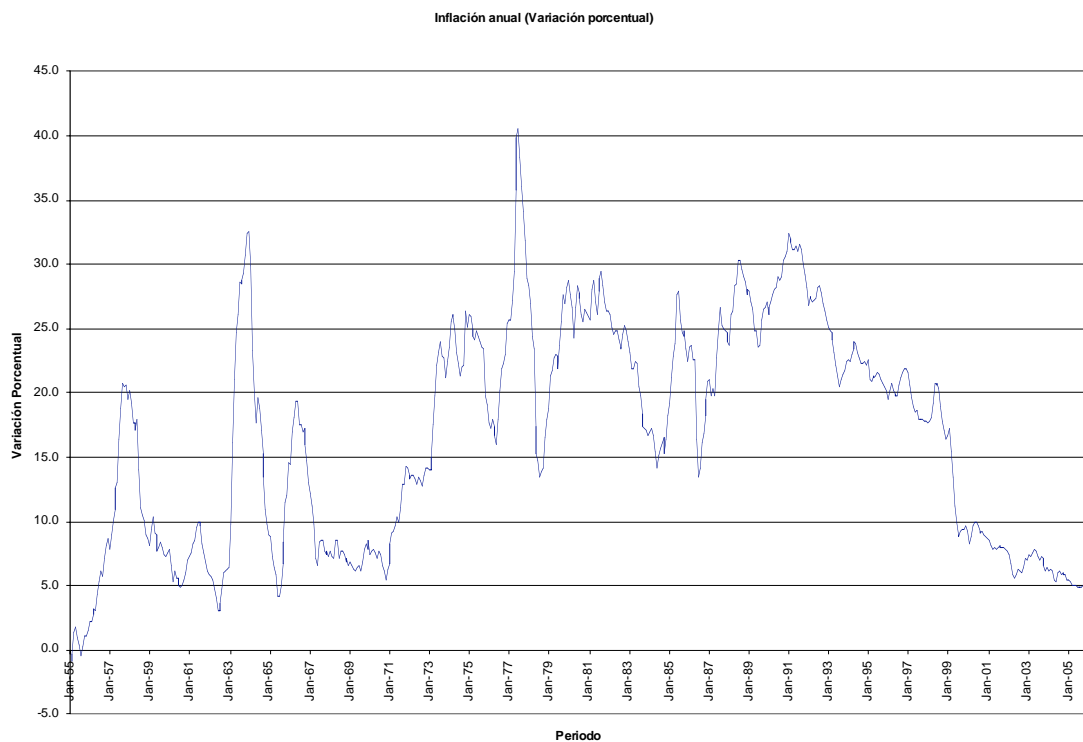
Evidently the efficiency of the system is highly dependant on the investment return during the savings phase, and the premium for a given level of annuity. During the savings phase there is a regulatory minimum investment yield requirement that is based on the yield of all the Pension Funds, and the theoretical yield of a synthetic portfolio designed by the Superintendency of Banking. Very rarely has any fund been short of the required return. The average annual real rate in the history of the funds has been 11.42%¹.

The situation is different in the retirement period. The retired purchases a life annuity sold by an insurance company. The calculation of the premium involves an interest rate, which currently is 4% real. This 4% was the rate that was used in the analyses performed during the design of the Pension Funds scheme. At that time the inflation rate was 22.6%, and 4% seemed like a conservative reasonable rate. (see graph below) A proof of that has been the pension fund's historical investment yield mentioned above.

¹ From June 1995 to December 2004

This might have been a misconception. The real interest rate, in theory, is more related to the Capital Stock than to the inflation. In consequence it is not true that that is some proportion between the inflation rate and the real rate. Many argue that at a current inflation rate of 5%, it is very difficult to yield 4% real. It is true that currently it is very difficult to yield real 4% because the market rates are lower than that, not because the inflation is 5%. That is to say that the current problem might still be present in high inflation scenarios.

The reality is that insurance companies are very concerned with the investment risk assumed with this product. A study was performed in 2004 (see below) to assess the sufficiency of premiums. It indicated that annuities could be issued with a 4% rate. The rates at the time the study was performed were above 6% real for 10-year Treasury. The study also showed that the situation could be very different if the rates went down.



Private Pension Fund Scheme

The Law 100 of 1993 established in Colombia a Private Pension Fund scheme as an alternative to the pay-as-you-go system that exists since 1960 and is administered by the Social Insurance Institute (ISS). Both schemes coexist and compete with each other. People can select between private pension funds and ISS. When the private funds appeared, people had the choice to move from the

ISS to a fund. In those cases, the ISS issued a Pension Bond that was deposited in the individual's account in the pension fund, to recognize prior contributions.

Most of the older workers stayed in the ISS. The majority of the younger workers moved to private pension funds. New workers, in general, join private pension funds.

Colombia's current population is 39 million people. In 1990, 7 million workers were affiliated to the ISS and .5 million received pension benefits. Currently the ISS has 5.6 million affiliated workers and 1 million receive pension benefits. On the other hand, there are six pension funds (AFPs), with a 5.7 million affiliated workers and an accumulated value of US\$14.3 billion.

Under the Private Pension scheme an individual saves in an individual account during his working lifetime. A monthly contribution of 15% of his monthly salary is made (of this contribution 25% is deducted from the employees salary and 75% is paid by the company). This contribution is divided as follows: 10% goes to his individual savings account, 1% goes to a Solidary Minimum Pension Guarantee Fund (the purpose of this fund is to provide a minimum pension benefit, equivalent to 110% of the official minimum wage), and the remaining 4% is split among AFP's expenses and profit, premium for Group Death and Disability coverage, and Deposit Insurance premium.

Under this scheme the retirement age is not absolutely predefined. When an individual has enough savings to acquire a Minimum Pension, which consists of payments equivalent to the 110% of the Minimum Wage, he or she can retire. Some people retire prematurely acquiring a minimum pension to increase their monthly net income because, once they do this, they do not have to contribute to a pension fund. The official retirement ages are 65 for men and 60 for women; at this point a Minimum Pension is guaranteed by the Solidary Minimum Pension Guarantee Fund.

At retirement, the individual has the option of purchasing a life annuity or choosing a programmed retirement. In this last mode, the money stays in the AFP. The retired gradually makes withdrawals. No more withdrawals are accepted when the funds are only enough to purchase a minimum pension annuity. When that point is reached an annuity is purchased. This option is preferred by people with higher incomes, because if they die prematurely the funds go to their heirs.

The funds must provide a minimum yield for a 3 year period based on a synthetic portfolio "managed" by the government, and the average yield of all the AFPs. The compliance with this minimum yield requirement is verified quarterly.

1994 Study Results

A study was performed in 1994 to determine the sufficiency of premiums for the required annuities. These annuities provide a monthly income that is adjusted for inflation every year.

A simulation model was used to perform the analysis. The model simulated the behavior of the mortality in a block of annuities, as well as the interest rate. Each iteration mixed a mortality scenario with an interest rate scenario, generating an outcome that was either, that the premium was enough to cover the payments until the insured population died, or that it was not enough. It was considered that a premium is enough when at least 50% of the iterations covered all the payments.

The capital requirement was calculated as the excess premium needed to be sufficient in 95% of the iterations.

Obviously the level of interest rates and the capacity to match the cash flows impact the results. In Colombia the longest term available instruments are the Public Debt Bonds, with a maximum maturity that rarely is more than 10 years.

The rates at the time the study was performed were above 6% real for 10-year Treasury Bonds (the longest term available). The following cases were considered in the study:

Case 1: The interest rates started at 4% and no immunization was considered.

Case 2: The interest rates started at 4.8% and immunized for the first ten years, then it started again at 4%.

Case 3: The interest rates started at 6% and the cash-flows were matched for the first 10 years.

The following results were obtained:

	Percentage of Iterations in which the premium was enough	Required Capital Percentage of Premium to increase the probability of sufficiency to 95%
Case 1	42.66%	15%
Case 2	97.33%	5%
Case 3	99.9%	--

The mortality table used for the study was the ISS Experience Table 1980-1989, adjusted by the mortality experienced by the Group Death coverage provided to

the pension fund affiliates. This experience was combined with the mortality rates of the table for ages 25 to 55. The resulting rates were extrapolated to age 110, which is the maximum age in the Table. The differential between the combined table and the original table was gradually decreased until it reached zero at age 110. It was recognized that this is not the most technical methodology, but there is no information available to construct a mortality table for retirees. The adjusted table produced a life expectancy from age 60 approximately .5 years greater than the original table.

The study did not consider administration expenses or any profit release. It was assumed that the premiums were loaded for expenses and profit. Considering profit releases would have result in lower sufficiency probabilities and greater capital requirements.

For Minimum Pension annuities the risk derived from the possible difference between the inflation adjustments in the annuity payments and the inflation component of the investment yield, was not considered. The way it works is that the annuity payments are adjusted with the level of the minimum wage, which is adjusted at the beginning of each year based on the expected inflation for the year that is starting. The inflation component of the investments yield is based on current inflation. This differential is a source of risk; however, in the long run very likely they will net out. For other annuities the annuity payments are adjusted with inflation, regardless of the behavior of the minimum wage.

Investment Portfolio

It is clear that to reduce interest rate risk in long term products, such as annuities, cash flow matching techniques are the most widely accepted. Assuming that the required investment instruments are available in the market, a consequence of cash flow matching is that the investment income will always be consistent with the interest rate required for the product.

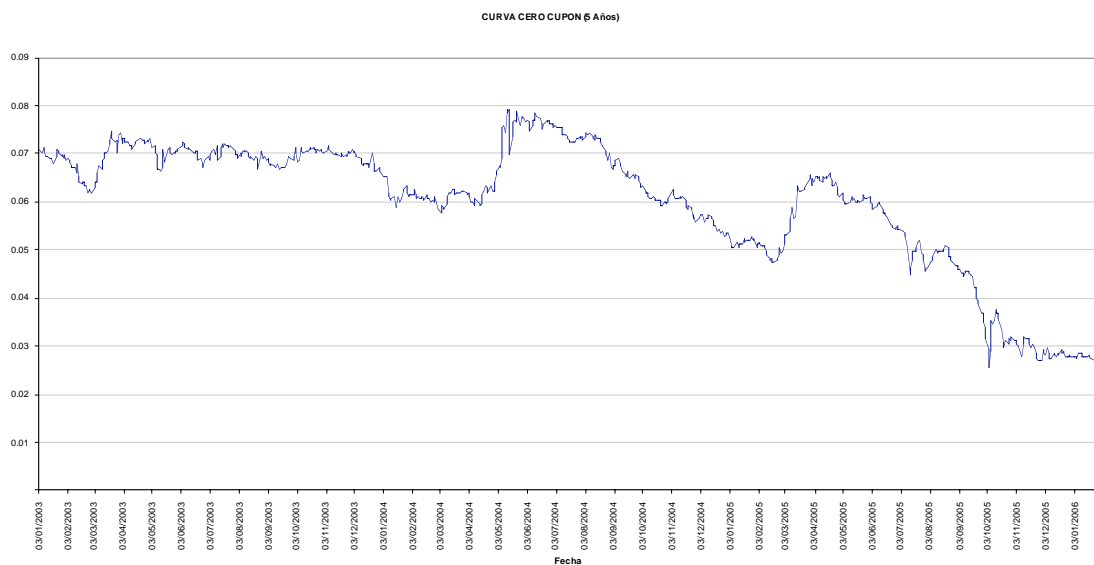
As mentioned before, for annuities the required interest rate is the technical rate. Therefore, the ideal situation would be to invest the single premium in a portfolio that matches the expected cash flows of the annuity and has a yield rate at least equal to the technical rate.

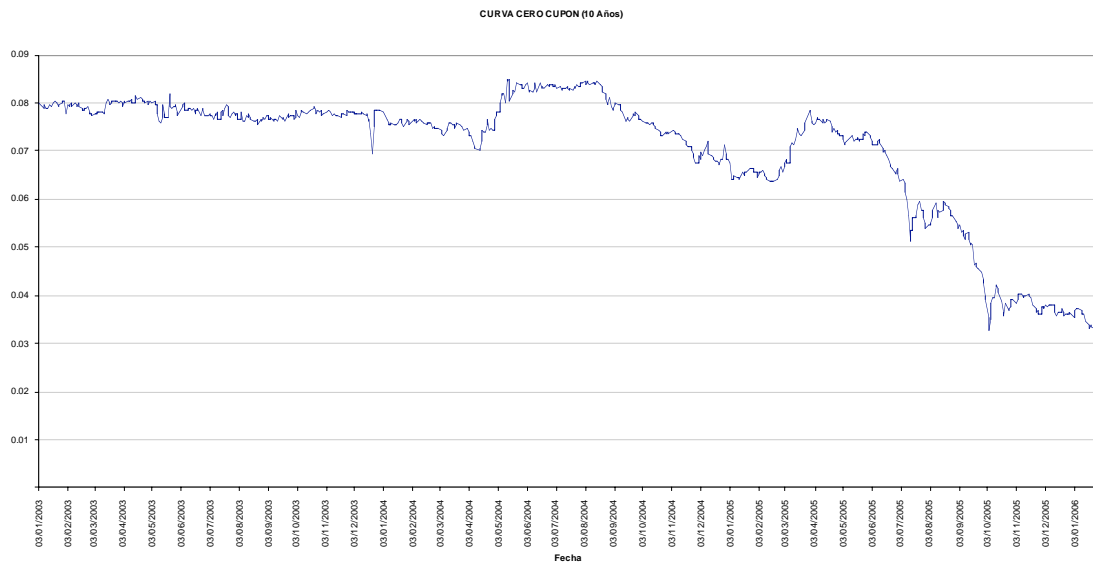
This approach is attractive for annuity products in markets in which the population has a choice. In that situation people can analyze the guaranteed interest rate, compare it with other investment choices for retirement purposes, and select what is more convenient for them.

In contrast, when the annuities are part of a mandatory retirement scheme, people cannot select other alternatives. In this case the value of the annuity is mostly determined by the interest rates available at retirement. This is very risky for the retiree. It is nice if rates are high. But if they are not high the annuity can be much lower than the annuities of other that saved all their lives in the same fashion. The situation is even worst because once the investments are made, if the rates go up, it is very difficult to rollover the portfolio because of the immediate losses that would be incurred.

When the system was designed this type of problem was not considered. It was always assumed that 4% real was a rate that was always going to be available for investment. Under that scenario interest rate risk was not even an important item. If rates were always above 4% real and that was the guaranteed rate, there was no need for immunization of any source. In reality perfect immunization was not, and still is not, possible because the longest available term in the market for fixed income securities is around 10 to 12 years.

The two graphics below show the evolution of the real rate for 5-Year and 10-Year Public Bonds respectively.





Investment Risk Profile

It is important to understand the investment risk profile of the investment portfolios to avoid ideas that would conduct to recommendations that would imply increasing investment returns via assuming irrational higher risks. Pension Funds investment portfolios must comply with an investment regime that is basically the same as the investment regime of the insurance companies for annuity products. Due to their size there is more information about the Pension Funds investment portfolios.

Regulation establishes that the investment portfolios for Pension Funds and Annuities must comply with the following limits:

- i. Domestic Internal Public Debt Securities – 60% maximum
- ii. Corporate Bonds – 60% maximum
- iii. Savings Accounts and very short term instruments– 2% maximum
- iv. Trust Funds – 5% maximum
- v. Domestic Stocks – 30% maximum
- vi. Colombian External Public Debt Instruments – 50% maximum
- vii. Foreign Internal Public Debt Securities with rating above BBB- - 20% maximum
- viii. Foreign External Public Debt Instruments with rating above BBB- 20% maximum
- ix. Foreign Corporate Bonds with rating above BBB- - 20% maximum
- x. Foreign Stock represented by indexes – 20% maximum
- xi. Forwards \$COL / US\$

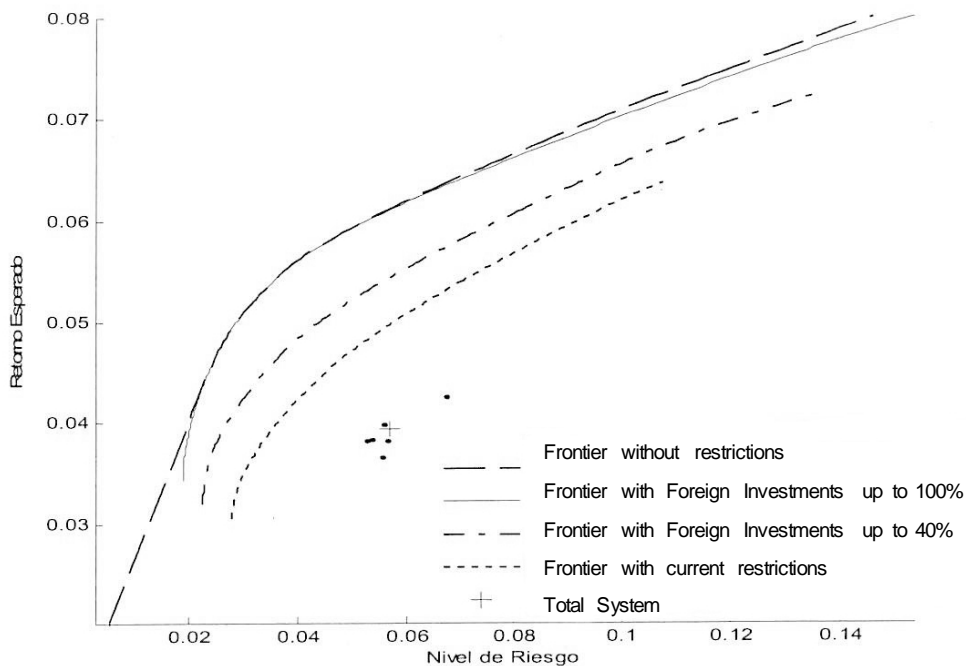
Also there are the following combined limits:

- i + vi cannot represent more than 60% of the portfolio
- vii + viii + ix + x cannot represent more than 20% of the portfolio.

Last year the Banco de la República (Central Bank) conducted an analysis of the efficiency of the Pension Fund portfolios. For that purpose an efficient frontier was constructed selecting different combinations of assets complying with the regulatory allocation restrictions. The efficiency of the Pension Fund portfolios was established based on their nearness to the efficient frontier. Also the sensitivity of the efficient frontier to changes in the asset allocation restrictions was determined.

The main results of the study were the following: first, the Pension Fund portfolios stand below the efficient frontier; second, all the efficient portfolios have an exposure of 20% to foreign investment instruments; third, the only restriction that undermines the portfolio efficiency considerably is the 20% of maximum exposure to foreign investment instruments.

Other aspects of the analysis are interesting. All Pension Fund portfolios have very similar risk level and expected yield (see graph below). The latter is very close to 4%; very close to the current technical rate of the annuities. For this level of risk, the efficient frontier is close to 1% higher.



Also the study shows the expected return with similar risk levels loosening the restriction of participation of foreign investment instruments in the portfolio. In this case, increasing the maximum percentage participation of foreign debt instruments in the portfolio to 40% adds almost .5% to the expected yield. Eliminating all the restrictions or just eliminating the maximum percentage participation of foreign debt instruments produce almost the same result, which an expected yield of 1% higher than the efficient frontier yield. This is almost 2% higher than the current expected yield for the same level of risk.

Profit Sharing

Colombia's law establishes that insurance products associated with Social Security must contain a profit sharing clause. From a political perspective this requirement is understandable. However, the law does not specify how the profit scheme should be implemented.

For long term products, such as annuities, it is very difficult to establish when profits emerge. Based on accounting rules, determining the profits for an annuity on a particular period is a straight forward exercise. Basically, the profit is the difference between your investment income and the sum of annuity payments, expenses, and reserve increase (which normally is negative) during the period. The reserves for annuity payments and expenses are calculated using the technical rate. Therefore, if your real expenses stay in line with the expenses embedded in the premium calculation, and the mortality table reflects the mortality that will be experienced by the block of policies, any investment return in excess of the technical rate constitutes the profit.

Under this approach, the common practice, that consists in the insurance companies sharing with the annuitants the investment return in excess of the technical rate (4%), sounds very reasonable. However, from an economical perspective the situation can be quite different. To understand the problem it is useful to break an annuity into its three components: expenses, investment return, and mortality. Profits increase when real expenses are lower than expense premium loads, when the real investment return is greater than the technical rate, or when the real mortality is higher than the mortality reflected by the mortality table used.

The risk of the product is the volatility of the profits. This volatility comes from the combination of the differences between the real expenses and the expense premium loads, the real investment return and the technical rate, and the real mortality and the mortality reflected by the mortality table used.

In other words, each of the annuity components is a risk factor. However, these risk factors are completely uncorrelated. As such, the volatility of the profits is less than the sum of the volatilities of the risk factors. This means that the coexistence of the three factors reduces the overall risk.

The problem comes when the profit sharing mechanism is based in only one factor. In this case, what happens is that the profit sharing mechanism eliminates the risk diversifying contribution of one of the components of the product.

Based on this narrow perspective it would seem that Profit Sharing is a problem. However, the problem is not Profit Sharing per se, the problem is how it is implemented. Profit sharing is meant to share profits and risks with the insured. For example, if there are two standard whole life policies, one with a participation clause and the other without participation, the premium for the policy with participation would be higher. The insured would be interested in paying a higher premium because with the profit sharing mechanism he would have a potential derived from the benefit of the participation scheme (automatic purchase of additional coverage, cash dividends, or others). In other words, the insured bears more risk, but has a higher utility expectation.

The same principle should be applied to annuities. A well thought Profit Sharing mechanism should reduce the risks of the insurance companies to an acceptable level. That is to say that the risks bore by the insurance companies must be consistent with their capital requirements and their profit expectation.

At the same time, the Profit Sharing mechanism must benefit the retirees. In this case, the additional risk they assume must translate in higher annuity payments.

Considerations for a Solution

In the prior sections, several aspects of the annuity product, in the context of the Private Pension Funds scheme were discussed. This section summarizes the aspects that should be considered for a possible solution.

First, it was previously discussed that annuities priced in the traditional way, which basically consists of calculating the single premium based on the prevailing rates at the date of issue, can create a discriminating effect on the population. This is because, although people make the same savings effort during their working life, the people that retire during higher interest rate periods will benefit much more than the others. Therefore, it is necessary to expand the span of time, to several years, during which the market affect the performance of the annuity of an individual. Obviously there will be some discrimination, as

explained in this context, but it will be much less than if everything is based in the rates at retirement point.

Second, for insurance companies the ideal world would be to receive the single premium and invest it in a portfolio that yields at least the technical rate, and that matches the annuities' cash flows. In many markets this is not possible because there are no instruments with the required term. It was shown that the capital requirements for this case could oscillate between 5% and 15%, depending on the difference between the technical rate and the prevailing interest rate at issue, and the longest available term for investments. Therefore, maintaining a technical interest rate very close to the available market rates can have the undesired effect of creating a need for additional capital that the companies cannot support because it would be inconsistent with their profit expectations. If the additional capital is ignored eventually there could be a situation that will break the system entirely.

Third, even though the Pension Fund portfolios' efficiency is lower than the efficient frontier, it is not possible to affirm that there is irrationality or lack of good investment management. Other objectives might have more priority to the investment managers. There is no reason to expect that investment managers for insurance companies would perform better than Pension Fund managers. As a matter of fact, having more certainty about the cash flows, insurance investment managers would probably tend to build portfolios with lower risk level and, in consequence, with lower expected yield. For the purpose of this work it would be assumed that the annuity investment portfolios will perform about the same as the Pension Fund portfolios.

Fourth, loosening the maximum percentage level that can be invested in foreign instruments would increase the expected yield rate. However, this could have undesirable macroeconomic consequences. It is also true that, even though the yield could be increased by almost 1% assuming that the efficient frontier is not the sole objective of the investment managers, under certain interest rate environments the main problem would persist. For example, currently the 10 year real rate is under 3%; by adding 1% still the technical rate (4%) is not reached. Some experts argue that this is the way to go. Others consider that the savings in these products are very important as a source of investment in the country.

Fifth, insurance companies, understandably, are always in a position to lobby for a reduction of the technical rate. Since the Private Fund Scheme started there has been no reduction. However, currently the market rates are below the technical rate and that, of course, builds pressure to the regulators. Any reduction in the technical rate will result in a less efficient system, as explained above. It could be argued that a good scheme should contain a very well defined system of adjusting the technical rate based on a series of economic and market indicators. However, this would have the discriminating effect mentioned before.

Sixth, as explained above, the system must guarantee a Minimum Pension. This guarantee is for people that contribute a minimum number of months to a Pension Fund and do not accumulate enough to purchase a Minimum Pension. As explained, the minimum pension is guaranteed by the Solidary Minimum Pension Guarantee Fund. If the technical rate is reduced, the cost of the minimum pension guarantee will increase. This is because the annuity single premium calculated at a lower interest rate will be higher. The proposed scheme must address this problem.

Current Approaches

Currently the focus is on the Annuities Market. There is concern with the interest rates and the mortality. Obviously the problem is different depending on the development of the market itself. Some markets have better mortality data, as well as a more efficient capital market. Another aspect is that new markets have to deal with the growth of the portfolios, which imposes additional risks.

In the more developed markets, three issues are being discussed: reinsurers participation, longer term for government debt, and longevity bonds. In the less developed markets, the discussion is centered on longer term for government debt and minimum pension guarantee funds.

Reinsurers Participation

A paper (4) published by the Association of British Insurers states that reinsurers could play an active role in the annuity market “by

- creating a more transparent and more efficient market in the longevity risk
- smoothing out volatility experience particularly in smaller annuity portfolios
- facilitating research and knowledge transmission for example around the impact of medical developments
- sharing the burden of capital requirements
- bringing down barriers to entry.”

However, the same paper states that “There is a substantial diversity of views among reinsurers as to the nature and extent of exposure to longevity risk that is acceptable.....For some reinsurers supply is dependent on the pricing of risk; for others, the nature of the risk appears to provide a qualitative barrier that would not be easily overcome through pricing changes.”

Longer Term for Government Debt

The idea behind this is to have longer term instruments available. Of course this sounds nice from the perspective of the insurers. However, it would mean reversing again to pensions provided by the government, in a similar fashion as the phased out pay-as-you-go systems.

There are two reasons for this: first, in the long run the government would be making the pension payments because most of the investments would be in public debt instruments. Second, the government would be guaranteeing a yield rate for the annuities very possibly different from the market rates.

Longer term debt would be very interesting if it could be issued by the private sector.

Longevity Bonds

These bonds provide lower yield at the beginning in exchange for additional coupons if mortality exceeds some index. In theory they are attractive. However, unless an unlikely liquid market develops for this type of bonds, in which the private sector can take positions similar to other type of derivative instruments, really what happens is that the cost of extra mortality is shifted to future generations.

Minimum Pension Guarantee

This element is not related with the annuity market. It is more related with the pension scheme as a whole. It is a contribution made by the government so that, subject to minimum requirements, all affiliates of the system can receive a pension at least equivalent to the minimum wage (in Colombia it is 110% of the minimum wage). The contribution of the government is the premium in excess of the final amount of the savings in the Pension Fund by the annuitant.

The cost of this guarantee is uncertain. A study performed by FEDESARROLLO (5) in 2001 indicates that the present value of this guarantee can oscillate between 10% and 20% of the National Gross Product (in that study the 2001 NGP was taken as a reference). For both scenarios 6% was the real yield rate and retirement ages were 62 for men and 57 for women. In the first scenario 5% was taken as the real discount rate, and in the second scenario 4% was taken as the real discount rate.

Other scenarios were analyzed, showing that the results were very sensible to the interest rates, to the real increase in the minimum wage, and to the retirement ages. Also, it must be noted that the rates used in the study seemed reasonable in 2001, but would not seem reasonable now.

Proposed Scheme

Of the elements mentioned in the prior section, only the Minimum Pension Guarantee is considered here. The reason for not considering the longevity bonds or the reinsurers participation is that those elements seem to be far away from being available in underdeveloped markets.

The reason for not considering Longer Term Government Debt is that it seems that the problem of the insurers would be only partially solved, but at the same time a larger problem could be created in the long run. The longevity risk would still be there.

The proposed scheme relies heavily in the Minimum Pension Guarantee. It is true that its cost is uncertain but, as a whole, the proposed scheme will guarantee a minimum pension, and at the same time eliminates the cost associated with the uncertainty about the capability of the insurance sector to bear with the risks currently present.

The proposed scheme is as follows:

- A mechanism must be designed to continuously establish the rate at which the annuities would be priced. The design of this mechanism is not within the scope of this work. However, the obtained rate should be lower than the available real interest rate by 30-100 bp. The purpose of the rate being lower than the available rates is to release some of the risk born by the insurance companies. This would generate a lower annuity at the beginning, but will gradually increase based on the minimum yield requirement and the profit sharing scheme proposed below. On the current rate scenario a recommended rate could be 2.5%. The World Bank's paper (2) also addresses this issue and recommends that "The technical rate should be forward looking, and possibly consist of the yield of fixed income instruments....". For the rest of this paper we assume that the recommended rate is 2.5%.
- Each individual annuity would be priced with a technical rate of 2.5%. The price of an annuity based on a 2.5% interest rate is around 17% higher than the price of an annuity priced at 4%.
- The reserves have a minimum yield requirement, similar to the requirement of the Pension Funds (explained earlier).
- Each quarter the yield of the portfolio is determined.

- If the yield is under the minimum yield requirement, the insurance company must provide the difference from its own resources.
- If the yield is still under 2.5% the insurance company must provide the difference from its own resources. This case would only happen if the required yield is below 2.5%.
- If the yield is greater than 2.5%, the minimum between 10% of the yield and the difference between the yield and 2.5% is profit for the insurance company. There is no other source of profit to the insurance companies. It is assumed that the premiums have the appropriate load factors for administration expenses.
- The remaining yield, after insurance company's profit, is distributed among the policy holders in proportion to their reserves.
- Any reserve release, due to death of the annuitant or any other reason, is distributed among the policy holders in proportion to their reserves.
- With the new value of the reserve, and always using 2.5% as the technical rate, a new value for the annuity payment is calculated.

Mortality Assumption

As mentioned before, the annuities are calculated using the ISS Experience Table 1980-1989. There are serious doubts as to the validity of this table, but there is no other table available at the moment. This, of course, poses a serious risk to the insurance companies.

However, with the scheme proposed above, the risk is shifted away from the insurance companies. The first layer of risk will be absorbed by the covered population. If the population has greater life expectancy than what the table reflects, gradually the annuity payments will start decreasing. The decrease in the annuity payments will offset the extra payments.

The second layer of risk is absorbed by the Solidary Minimum Pension Guarantee Fund. If in the process the annuity payment decreases where it reaches the Minimum Pension, the annuity is classified as a Minimum Pension Case. For these cases the Solidary Minimum Pension Guarantee Fund provides the amount in which the reserve is deficient. Notice that the Solidary Minimum Pension Guarantee Fund only needs to provide resources when there is enough extra longevity to absorb the increases in annuity payments derived from investment yield above 2.5%.

An important aspect is that being the Solidary Minimum Pension Guarantee Fund the ultimate insurer, there will be interest from the regulators to update the

Mortality Table. This is very important because currently the only institution that has information for constructing an Annuity Mortality Table is the ISS, the insurance companies do not have enough volume yet to produce a table.

Minimum Pension Cases

The Minimum Pension Cases have two possible origins: first, Minimum Pension annuities purchased with subsidy from the Solidary Minimum Pension Guarantee Fund; second, annuities whose payment decreased due to longer longevity than the reflected by the mortality table to the point where they reached the Minimum Pension.

What differentiates the Minimum Pension Cases from the other cases is that the Profit Sharing does not go to the annuitant, it is returned to the Solidary Minimum Pension Guarantee.

The Minimum Pension Cases have the following special procedure:

- The yield is the same yield of the overall portfolio.
- The Profit is distributed to these annuities in the same way as it is distributed to all the annuities.
- The annuity is recalculated based on the current minimum wage. Notice that this almost eliminates from the insurances the risk of mismatch between the yield of instruments tied to inflation and the pattern of the minimum wage. As long as there is extra yield, it will offset adverse conditions.
- The exceeding reserve is returned to the Solidary Minimum Pension Guarantee Fund.

The Minimum Pension Guarantee should not be available for retirees that chose a programmed retirement and later purchased an annuity. The reason for this is that it doesn't make sense that a retiree spends his savings in the early retirement years and then purchases a very low level annuity, usually forced to do so, and then the nation guarantees that this pension will always be at least equal to some percentage of the minimum wage. If the retiree is so concerned of future payment guarantees he should not spend most of his money in the early years of his retirement.

Capital Requirement

The proposed scheme has three main characteristics:

- i. The technical rate (2.5%) is consistent with current rates. This does not mean that there could be phases in which market real rates will be below that level. FASECOLDA (the association of insurance companies in Colombia) contracted a study of the expected future behavior of the real interest rates with the Universidad de los Andes. No results have been published yet.
- ii. The mortality risk is shifted away from the insurance companies.
- iii. The Minimum Yield is based on the same scheme of the Pension Funds, in which, as mentioned earlier, 50% of the weight is the average of industry. The remaining weight is a synthetic portfolio that has the same restrictions and operates in the same market.

Based on this, and on the results obtained by FINAC's study, presented above, it is very unlikely that insurance companies will need additional capital (currently 7%).

Comparison of New Scheme and Current Scheme

The following three elements must be considered to compare the schemes:

- i. Financial Dynamics of the Insurance Companies. The insurance companies must have an adequate return for their invested capital. This return should be around 15-20%.
- ii. Annuity payment dynamics. There is a basic reality that must always be considered: the private insurance industry cannot provide annuities with a technical rate superior than the rates available in the market. Based on that, the dynamics of the current annuity payments is compared with the dynamics of the annuity under the new scheme. It will be determined if the decrease in payments justifies the sustainability of the system.
- iii. Financial Dynamics of the Solidary Minimum Pension Guarantee Fund. Under the new scheme this fund plays new roles. Not only it provides resources, but is benefited from the Profit Sharing scheme. The analysis of the cost of this fund is beyond the scope of this work.

Financial Dynamics of the Insurance Companies

The chart below shows the Return on Capital for an insurance company under a scenario attainable on current conditions:

Inflation:	5.00%
Required Capital:	7.00%
Real Yield Rate:	3.50%
Profit Share:	90.00%
Yield Rate:	8.67%
Annuity Reserve:	\$ 100.00
Capital:	\$ 7.00
Yield:	\$ 8.67
Profit:	\$ 0.87
ROE:	12.39%

The following chart shows the Return on Capital under a scenario in which the Real Yield Rate is to close to the Guaranteed Rate. It can be seen that still under this scenario there is a reasonable return.

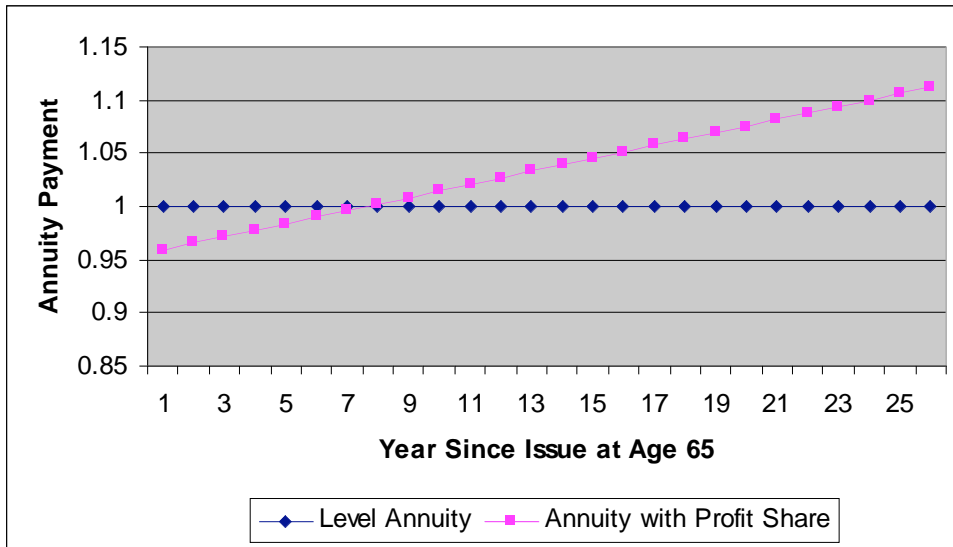
Inflation:	5.00%
Required Capital:	7.00%
Real Yield Rate:	3.00%
Profit Share:	90.00%
Yield Rate:	8.15%
Hurdle Yield:	7.62%
Annuity Reserve:	\$ 100.00
Capital:	\$ 7.00
Yield:	\$ 8.15
Profit:	\$ 0.53
ROE:	7.50%

Annuity Payment Dynamics

To illustrate the payment dynamics two annuities were compared. First, an annuity priced at a technical rate of 3%, which no Profit Share. Second, an annuity priced at a technical rate of 2.5% under the proposed scheme. For this annuity it is assumed that the real yield rate of the reserves is 3.5%.

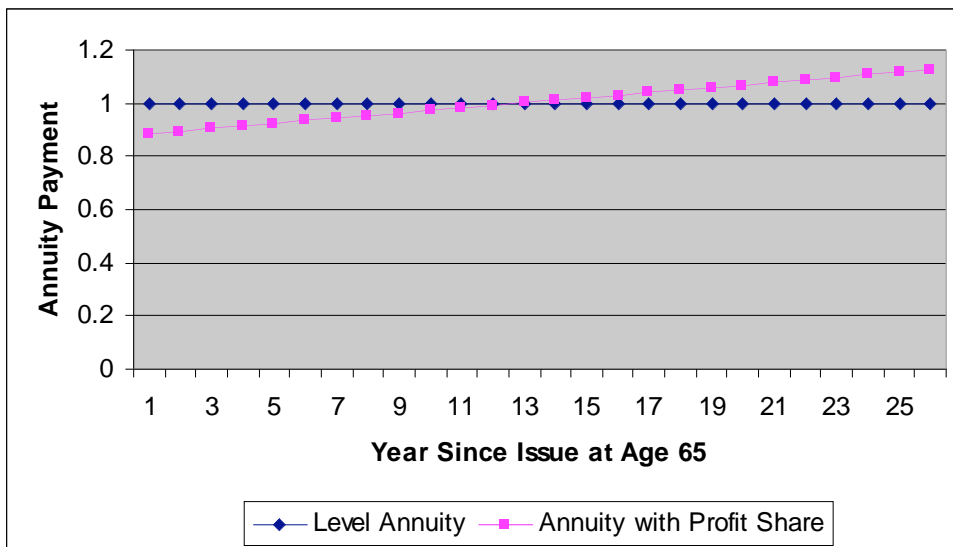
The single premium is the premium for the annuity calculated at 3%. For that premium, pricing at 2.5% provides an annuity payment of .96. This .96 grows because there is profit sharing. In year 8 the second annuity provides a greater annuity payment than the first annuity.

The following graphic illustrates the dynamics of the payments.



Final Comments

The scheme proposed here obviously has some drawbacks. The main one is that the early payments for an annuitant are lower. In the graph below two annuities are compared. The level annuity assumes a technical interest rate of 4%. The annuity with profit share is priced at 2.5%, but it is assumed that the yield rate is 4%. It can be seen that after 10 years the annuity with profit share payments surpass the level annuity payments. However, the initial payment is 89% of the level annuity initial payment.



In present value, the expected annuity payments for the annuity with profit share are lower. Intuitively this is because the higher payments are going to happen

when less people are alive. In reality what happens is that under the profit share scheme the insurance company retains 10% of the yield.

A solution for this could be a mixture of an annuity and a programmed retirement. In this case the retiree can leave some money in the Pension Fund to be used under a programmed retirement to complement the lower initial payments received by the annuity. The price is a lower annuity in later years and no access to the Minimum Pension Guarantee.

An interest aspect of the proposed scheme is the effect that it might have in the cost of the Minimum Pension Guarantee. On one side, the cost is going to increase because the amount saved needs to be higher to purchase a minimum annuity. This means that there will be more workers that will need to use the guarantee and, for each one, more additional capital will be required. Also because it will be guaranteeing pensions that reach the minimum level due to extra longevity, which is not a case currently considered. On the other side, the cost might be reduced because of the profit sharing scheme proposed for the minimum pensions.

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