The Efficiency of Defined Contribution Pension Plans in the Americas

Denise Gómez-Hernández
Autonomous University of Querétaro

Alberto M. Ramírez de Jurado Frías
Conference of Consulting Actuaries,

SOCIAL SECURITY
AND
PENSION REFORM
International Perspectives

ben·e·fit
advantages or imp
program that has h
have the b
cl

Marek Szczepański
and John A. Turner, Editors

Social Security and Pension Reform

International Perspectives

Marek Szczepański
John A. Turner
Editors

2014

W.E. Upjohn Institute for Employment Research
Kalamazoo, Michigan

The facts presented in this study and the observations and viewpoints expressed are the sole responsibility of the authors. They do not necessarily represent positions of the W.E. Upjohn Institute for Employment Research.

12

The Efficiency of Defined Contribution Pension Plans in the Americas

Denise Gómez-Hernández
Autonomous University of Querétaro

Alberto M. Ramírez de Jurado Frías
Conference of Consulting Actuaries, American Academy of Actuaries, and Colegio Actuarial Mexicano

Defined contribution pension plans are widespread among the Americas. Pension actuaries use the pension replacement rate as a benchmark to measure how much a worker's preretirement income is replaced by its pension. Although this measure is intended to make the system efficient, the postretirement challenge for workers is to be able to purchase at least the basic market basket. Income projections used in pension replacement benchmark rates do not capture this because workers' incomes are not efficiently linked to macroeconomic variables in Latin America. This chapter proposes the use of macroeconomic variables such as the Consumer Price Index and the basic market basket to develop a benchmark indicator of basic income replacement as an alternative to the replacement rate. This indicator is calculated along with the replacement rate by country and compared to illustrate the efficiency level of their current defined contribution plans.

REPLACEMENT RATES

A pension is intended to replace a worker's income after his working lifetime. Because of this replacement objective, the pension serves the

same purpose as the worker's preretirement salary, that is, to purchase goods like the basic market basket, health care, housing, entertainment, and other needs or goods. Upon retirement, the pension amount is often the only source of income for retirees; this is the main reason why the pension amount is compared with the salary, defined as the Traditional Replacement Rate (TRR), which is the ratio of the pension amount and salary upon retirement

$$TRR_t = \frac{f_t}{\ddot{a}_y^{(12)} S_t} \ ,$$

where f_t is the amount in the fund at the end of the accumulation period, (t) is the worker's individual account under the defined contribution plan, $\ddot{a}$ is the annuity factor used to convert a lump sum to an annuity, and S_t is the projected salary for the accumulation period (t). The traditional replacement rate is affected by the contribution rate to the pension plan, the fees charged, the rate of return received, and the starting salary.

In the Americas—North, Central, and South—the race between inflation and salary is often lost by the salary, that is, salaries are often adjusted by employers at a rate below the inflation increase. Therefore, the salary is not an item that is necessarily linked to macroeconomic variables. For this reason, the authors believe the current replacement rate approach underestimates the future effectiveness of pension income due to price increases in the set of goods.

Three aspects are affected when salary and macroeconomic variables are unlinked:

1) country-wise comparison between different geographies, economies, and currencies,

2) determination of money purchase levels for goods upon in and out of work lifetime periods, and

3) notion of pension plan efficiency and retiree satisfaction levels.

The authors identified the basic market basket variable as a candidate to benchmark a defined contribution plan, particularly because this is a standard measurement performed by most if not all of the central banks in the Americas. The minimum satisfaction level or replacement

rate under this measure is when the pension amount is sufficient to purchase the basic market basket.

LITERATURE REVIEW

Since the implementation and growth of defined contribution plans, many authors have tried to model and project the final amount in the individual accounts at retirement. Vigna and Haberman (2001) analyze the financial risk in defined contribution plans using dynamic programming through a model that incorporates a regime of fixed and variable income. The main conclusion of this research is the sensitivity of the projected amounts in the fund to the returns during the accumulation period.

Gómez-Hernández, Vidal, and Enrique (2009) compare the competitiveness of the defined contribution plans in Mexico, Chile, and Argentina. They conclude that in Argentina and Chile, the pension obtained is greater than in Mexico mainly because of high commissions in Mexico. Ramírez de Jurado Frías (2010) proposed a revised model for Vigna and Haberman (2001) and implemented it to analyze the Mexican regulatory framework, showing various curves for projected accumulated amounts of the individual accounts at retirement.

In the latest G20 report for pensions (OECD 2011), the OECD uses two benchmarks to measure pension entitlements: the replacement rate and pension wealth. It also provides comparisons of replacement rates between various OECD members and G20 countries.

METHODOLOGY

We calculated the working life contributions and investment returns until age 65 for a worker with $0 initial account balance and entry age of 25. The accumulative model uses the current regulatory framework in various countries of the Americas with defined contribution plans.

We selected a group of nine countries with defined contribution pension plans in the Americas. The selected countries may provide a fair representation of the current situation from the perspective of the benchmark indicator of basic income replacement. The nine countries are Canada, the United States, Mexico, Costa Rica, El Salvador, Colombia, Brazil, and Chile; thus, North, Central, and South America are each represented by three countries. For details about the selected countries—population size, mortality, and annuity factors—refer to Appendix 12A.

The basic market baskets were then projected to retirement age (65) by country using the consumer price index. The projected income or final projected salary at age 65 is compared to the projected basic market basket at age 65 for an arbitrary and fixed annual salary increase assumption of 2 percent real per annum. The Basic Satisfaction Level (BASAL) is then calculated as the ratio of the accumulated fund at retirement, converted into an annual benefit by the annuity factor and divided by the basic market basket at age of retirement. (In medicine, *basal* commonly refers to the minimal level that is necessary for health or life.) These BASAL values are then used to compare by country the efficiency of the defined contribution systems.

MODEL

The BASAL postretirement is defined as the ratio

$$BASAL_t = \frac{f_t}{\ddot{a}_y^{(12)} P_t} ,$$

where f_t is the accumulated fund for accumulation period (t) of the worker's individual account under the defined contribution plan and P_t is the projected basic market basket for the accumulation period (t). The accumulation period t is the difference between the entry age (x) and retirement age (y).

The accumulated fund at retirement age (t) of the worker f_t is also defined as

$$f_{i+1} = f_i \left[(1 - y_i) e^{\mu i} + y_i e^{\lambda i} \right] e^{-\delta i} + S_i (c - \beta)(1 + s) \left[(1 - y_i) e^{\frac{\mu i}{2}} + y_i e^{\frac{\lambda i}{2}} \right] e^{\frac{-\delta i}{2}},$$

where f_i is the accumulated fund value under the defined contribution plan during year i or period $[i, i + 1]$, the factor c is the contribution percentage over the pre-retirement salary S_i at year i, β is the commission charged on the value of the contributions (known also as commission on entry fee and death and disability insurance fee), the factor s is the real salary increase, y_i is the percentage allocated to fix return instruments during the period $[i, i + 1]$ and $(1 - y_i)$ the percentage allocated to variable return instruments during the same period $[i, i + 1]$, μ_i is the force of interest for fix return instruments and λ_i the force of interest for variable return instruments and δ_i are the commissions on rates of return (or assets under management) charged.

The projected basic market basket cost at retirement age (t) of the worker PB_t is given by

$$PB_{i+1} = B_i(1 + j)^{y - x},$$

where PB_i is the projected basic market basket value during year i or period $[i, i + 1]$, B_i is the annualized basic market basket value at the year i, and is an average of the rates at which the historical values of B_i increased (or decreased).

DATA DESCRIPTION

Information was collected from original and secondary sources. Below is a brief description of the data. In order to model the accumulation of contributions and returns, the authors relied on data from the International Association of Supervisors of Pension Funds (AIOS). Data were collected on rates of return, contributions, commissions, investment portfolios, and salaries. Other data for countries not included in the AIOS report was collected from the original country source. The mortality factors used to calculate the annuities came from the documentation issued by the regulators or the country legislation relative to their pension plans. Basic market basket or basket of goods costs came from the central banks or minister of statistics from the respective countries. Other inputs, parameters, or assumptions used in this chapter have been set by the authors and are documented in Appendix 12B.

RESULTS

Figure 12.1 shows the benchmark comparison for BASAL and TRR rates. These are compared side by side to illustrate their differences, although these values are not entirely comparable as they use a different basis in their calculations; that is, BASAL uses the basic market basket and TRR uses projected salaries. The x-axis shows the country names segmented by regions in the Americas, whereas the y-axis shows the ratio between the final accumulated fund amount value converted into an annualized pension and the basis or item (basic market basket or salary).

Figure 12.1 Benchmark Comparison for BASAL and Replacement Rate
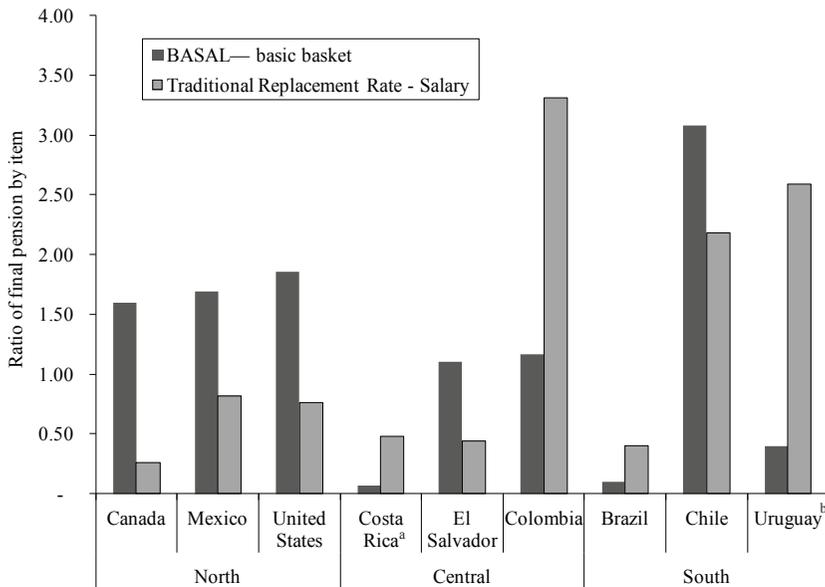
[a] The Costa Rica pension system relies on pension fund managers added to a public system. In this chapter only the pension fund manager system was taken into account to obtain the results.

[b] The Uruguay pension system relies on a private system administrated by the Uruguay Central Bank plus a public pension system. In this article only the UCB fund was taken into account to obtain the results.

SOURCE: Authors' calculations.

ANALYSIS

Comparing the BASAL levels in Figure 12.1, we conclude that Costa Rica holds the lowest BASAL from all the countries with 0.07, followed by Brazil with 0.10 and Uruguay with 0.40. The low BASAL in Costa Rica and Brazil indicates that workers in these countries will not have enough resources at retirement to buy 1.0 basic market basket if they rely solely on the basic pension system. In other words, an average worker in Costa Rica and Brazil can expect to buy 0.07 and 0.10 basic market baskets, respectively, at retirement with his or her pension. The reason for this is because Costa Rica charges two kinds of fees: an entry fee and a high percentage of charge on returns. This reduces considerably the amount accumulated at retirement by the worker. Another key factor is that in Costa Rica only 3.85 percent of salary is contributed to the pension fund. Additionally, the high 10-year average basic market basket inflation for Costa Rica and Brazil (11.8 and 17.1, respectively) reduces the purchasing power over the accumulation period; salary growth is assumed to be 2.00 percent real annually.

On the other side we have Chile, which holds the highest BASAL followed by United States. The reason for this high level of BASAL is because Chile only charges one kind of fee (an entry fee with no charge on returns), reducing considerably the total amount charged at the end of the cumulative period. Another difference with respect to Costa Rica (the lowest BASAL) is that the contribution percentage of the salary is higher in Chile: 10.0 percent.

In North America there are small differences in the values obtained for the BASAL: Mexico, 1.69; United States, 1.86; and Canada, 1.60. This suggests that upon retirement age the workers from this region will be able to buy more than 1.50 basic market baskets with their monthly pensions. The annual salary increase rates in these countries are similar to the increase rates seen in the 10-year average basic market basket inflation, so these results were expected.

The results are consistent with Gómez-Hernández and Stewart (2008), who find that El Salvador has the lowest 40-year weighted charge (fee) ratio of the 21 countries analyzed, and Costa Rica one of the highest. The results for the TRR benchmark suggest Colombia has the highest TRR at 3.31 and Canada the lowest with 0.26. This low

value of TRR would appear to be a problem for the Canadian workers. However, the Canada Pension Plan is designed to provide a 0.25 TRR upon workers retirement, and Canadian workers rely on other complementary pensions to increase their retirement incomes, as well as receiving benefits from the old-age security program, which is a social security benefits program that is financed out of general revenues. For Colombians, the 3.31 TRR value, which is the result of a relatively high contribution rate and the highest rates of return of any country considered, seems appealing, but this value cannot tell Colombian workers how much purchasing power they will have with a monthly pension 3.31 higher than their latest preretirement salary. In fact, Canada has higher purchasing power with a BASAL of 1.60 versus 1.17 for Colombia (Table 12.1).

Comparing the results between BASAL and the TRR benchmarks, the difference in values is evident. Colombia has the highest value of TRR 3.31 but a BASAL of 1.17. Chile has the highest value of BASAL 3.08 and TRR of 2.18. In Colombia, the TRR value is misleading, as it would suggest that retirees have done a good job saving for retirement; they are receiving 3.31 times their salary when converting their individual retirement savings into a monthly pension, while in reality Colombian workers would be able to buy only 1.17 basic market baskets. For Chile, the BASAL and TRR do not appear to be critically different, still TRR cannot reflect the final salary purchasing power at retirement.

CONCLUSION

For future research, it would be relevant to consider the use of a benchmark like BASAL to tie the future workers' incomes upon retirement with macroeconomic variables. A standardized methodology tied to the macroeconomic environment would help the contributory systems to benchmark, identify, quantify, and address potential issues concerning purchasing power at retirement age.

Appendix 12A

The Americas are composed of 35 sovereign states. We make an arbitrary region segmentation into North, Central, and South America and select an arbitrary assortment of nine countries that provide defined benefit contribution pension schemes to the working class.

With the selected countries, we intend to show, compare, and determine the defined contribution systems efficiency when it comes to replacing income upon workers retirement. Although arbitrary, the selected countries provide a reasonable representation of the benchmark indicator of basic income replacement.

Table 12A.1 Summary of Population Size, Mortality Tables, and Annuity Factors

Region/country	Total population in millions	Percent of people aged 65 and older	Mortality table name	Annuity factor
North				
Canada	33	14.80	ICA2020	14.11
Mexico	110	6.20	EMSS 97	11.87
United States	312	13.30	2008 PY IRC 430 Static	13.70
Central				
Costa Rica	3	5.60	SP-2005	13.08
El Salvador	7	5.20	SP-2005	13.08
Colombia	47	6.70	Ren ISS 80-89	11.87
South				
Brazil	190	6.50	AT 83	13.92
Chile	17	9.40	MI-2006	11.95
Uruguay	3	13.50	MI-2006	11.95

SOURCE: Prepared by the authors from data collected from various sources.

Appendix 12B

Table 12B.1 Historical Annual Basic Market Basket Prices ($, U.S.)

	North			Central			South		
Year	Canada	Mexico	United States	Costa Rica	El Salvador	Colombia	Brazil	Chile	Uruguay
2001	4,418	1,183	6,612	n/a	881	1,759	n/a	3,321	3,025
2002	4,517	1,244	6,716	n/a	866	1,867	n/a	3,403	3,159
2003	4,644	1,291	6,870	n/a	866	1,965	n/a	3,499	4,008
2004	4,730	1,362	7,052	411	877	2,055	1,232	3,536	4,441
2005	4,834	1,415	7,291	474	912	2,137	687	3,644	4,683
2006	4,929	1,465	7,527	545	936	2,220	1,259	3,768	4,969
2007	5,037	1,510	7,741	608	996	2,329	1,582	3,934	5,324
2008	5,154	1,555	8,038	740	1,085	2,482	1,004	4,276	5,726
2009	5,168	1,602	8,010	909	1,195	2,653	1,578	4,340	6,276
2010	5,263	1,645	8,141	894	1,103	2,845	2,512	4,406	6,725
2011	5,416	1,727	8,398	967	1,227	3,062	4,048	4,476	7,213
2012	5,580	1,752	8,544	985	1,214	3,308	6,609	4,550	7,881

SOURCE: Prepared by the authors from data collected from various sources. The authors collected historical Consumer Price Index (CPI) data and determined the average increase rate over a 10-year period. Additionally collected average basic market basket household costs per country and applied CPI to roll back/forward the basic market basket. Certain underlying assumptions were made to have data consistency, for example Chilean ministry of social development only provides basic market basket per individual, so original cost was multiplied by five to reflect the household annual basket.

Table 12B.2 Average Monthly Salary ($, U.S.)

Region/country	Year							
	2003	2004	2005	2006	2007	2008	2009	2010
North								
Canada	2,560	2,633	2,745	2,822	2,940	3,031	3,110	3,215
United States	2,299	2,295	2,330	2,375	2,349	2,275	2,247	2,207
Mexico	451	483	545	543	578	492	548	607
Central								
Costa Rica	438	448	459	479	556	567	441	461
El Salvador	313	298	452	459	474	518	522	560
Colombia	245	300	334	364	458	480	486	538
South								
Brazil	665	656	666	693	715	739	762	791
Chile	539	614	681	685	794	685	877	1,012
Uruguay	348	379	471	511	634	632	912	987

SOURCE: 2010 AIOS Bulletin. Data for Mexico, Canada, Brazil, and the United States come from various sources.

Table 12B.3 Pension Funds Composition, December 2010 (%)

Region/country	Fix rate	Variable rate
North		
Canada	33.2	66.8
United States	38.0	62.0
Mexico	58.9	41.1
Central		
Costa Rica	62.4	37.6
El Salvador	84.7	15.3
Colombia	39.9	60.1
South		
Brazil	49.0	51.0
Chile	11.7	88.3
Uruguay	83.9	16.1

SOURCE: 2010 AIOS Bulletin. Data for Mexico, Canada, Brazil, and the United States come from various sources.

Table 12B.4 Pension Fund Annual Returns (%)

Region/country	Average annual return
North	
Canada	6.2
United States	8.0
Mexico	10.2
Central	
Costa Rica	15.1
El Salvador	4.0
Colombia	12.6
South	
Brazil	6.0
Chile	9.2
Uruguay	9.2

SOURCE: 2010 AIOS Bulletin. Data for Mexico, Colombia, Chile, Canada, Brazil, and the United States come from various sources. Percentages shown for Colombia, Mexico, and Chile are the weighted average of the target or risk portfolio returns for each of those countries.

Table 12B.5 Fees and Contributions, December 2009

| Region/country | Fees | | | Contributions | | |
	Salary percent (1)	Death and disability insurances (2)	Net fees (3) = (1) − (2)	Contribution (4)	Fee over contributions (5) = [3(4) + (3)]	Total (6) = (1)/(4) + (1)
North						
Canada	—	—	1.32	4.95	—	—
United States	—	—	0.78	8.20	—	—
Mexico	—	—	1.81	8.50	—	—
Central						
Costa Rica[a]	—	—	0.40	3.85	0.09	—
El Salvador	2.70	1.20	1.50	10.30	0.13	0.21
Colombia[b]	3.00	1.41	1.59	11.50	0.12	0.21
South						
Brazil	—	—	2.00	8.00	—	—
Chile	3.37	1.87	1.50	10.00	0.13	0.25
Uruguay[c]	2.62	1.01	1.62	14.94	0.11	0.16

NOTE: — = not applicable or not necessary input for purpose of BASAL or traditional replacement rate calculation.

[a] Fee per transaction. Death and disability coverage is provided by public plan but its cost is included in the aging contribution period.

[b] Additional fees apply for rollover and voluntary contributions.

[c] Additionally, a custodial fee applied to balance. The average rate as of December 2007 was 0.0002%.

SOURCE: 2010 AIOS Bulletin with original footnotes translated into English. Data for Mexico, Colombia, Chile, Canada, Brazil, and the United States come from different sources.

References

Gómez-Hernández, Denise, and Fiona Stewart. 2008. "Comparison of Costs and Fees in Countries with Private Defined Contribution Pension Systems." Working Paper No. 6. Paris: International Organisation of Pension Supervisors.

Gómez-Hernández, Denise, Kato Vidal, and Leonardo Enrique. 2009. *Competitividad del Sistema de Pensiones Mexicano. Mercados y Negocios* (8): 25–37. Jalisco, Mexico: Universidad de Guadalajara, Centro Universitario de Ciencius Economico Administrativas.

Organisation for Economic Co-operation and Development (OECD). 2011. *Pensions at a Glance 2011: Retirement-income Systems in OECD and G20 Countries*. Paris: OECD. http://dx.doi.org/10.1787/pension_glance-2011-en (accessed July 12, 2012).

Ramírez de Jurado Frías, Alberto M. 2010. "Metodología para la Proyección del Monto Constitutivo de la Cuenta Individual dentro del Sistema de Ahorro para el Retiro en México." *Revista Actuari@* online magazine. http://revista-actuario.com/weff/ (accessed May 21, 2013).

Vigna, E., and S. Haberman. 2001. "Optimal Investment Strategy for Defined Contribution Pension Schemes." *Insurance: Mathematics and Economics* (28)2: 233–262.