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Article

Determining equivalent charges on flow and balance in individual account pension systems

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A B S T R A C T

In this article, we determine a charge on balance that is equivalent to a certain fixed charge on flow for a particular utility–maximizer affiliate participating in a defined-contribution pension fund under the system of individual accounts. We also prove, under market completeness, that the equivalent charge on balance depends only on the current level of the charge on flow, the length of the accumulation period and the risk free rate of return.

Determinación de exacciones de efecto equivalente en el flujo y el balance de los sistemas de pensiones de cuentas individuales

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R E S U M E N

En este artículo se determina una exacción en el balance, que es equivalente a cierta tasa fija en el flujo de una empresa asociada particular maximizadora, que participa en un fondo de pensiones de aportación definida en el sistema de cuentas individuales. También se prueba, en la integridad del mercado, que la exacción de tipo equivalente en el balance depende solo del nivel actual de la tasa en el flujo, la duración del período de acumulación y un tipo de rentabilidad sin riesgo.

1. Introduction

Two important characteristics of a defined–contribution (DC) pension fund are that affiliates borne the risk derived from fluctuations in the value of assets and that imposed administrative charges have a direct and significant impact on the terminal wealth of the corresponding individual account (IA). For example, Murthi, Orszag, and Orszag (2001) estimate that in the U.K. over 40% of the IA's value is dissipated through fees and charges while Whitehouse (2001) determines that a levy of one per cent of assets adds up to nearly 20% of the final pension value. Administrative charges have also received a great deal of attention from the pension supervisory agencies, policy-makers and researchers, especially in countries that have partially or totally transformed their public defined-benefit pension systems into individual capitalization ones. The most familiar and documented example is Chile and the reader can find main aspects of such reform in Arrau, Valdés-Prieto, and Schmidt-Hebbel (1993), Diamond and Valdes-Prieto (1994), Edwards (1998), Arenas de Mesa and Mesa-Lago (2006). Also, Queisser (1998), Sinha (2000), Kay and Kritzer (2001), Mesa-Lago

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(2006), Kritzer, Kay, and Sinha (2011) and Marthans, J. and Stok, J. (2013) provide good references for the reform, situation and perspective of pension systems in Latin America.

As mentioned by Mitchell et al. (1998), James, Smalhout, and Vittas (2001) and Whitehouse (2001) the high charges of IA systems is one of their main criticisms since they discourage participation (as people consider contributions as taxes instead of savings), damage the reputation of the system, reduce future pensions, and increase future costs for the government whether there is guaranteed minimum pension. Devesa-Carpio, Rodríguez-Barrera, and Vidal-Meliá (2003) consider that the charge scheme adopted by the IA system is very important since fund accumulation process is exponential and targeted for long horizons. Following Kritzer et al. (2011), the most common administrative charges in IA pension systems are proportional on flow (or a percentage of the affiliate's salary), fixed on flow, proportional on assets (balance) and proportional over excess returns. Analysis and comparison of administrative charges across different countries can be found in James et al. (2001), Whitehouse (2001), Devesa-Carpio et al. (2003), Corvera, Lartigue, and Madero (2006), Gómez-Hernandez and Stewart (2008), Tapia and Yermo (2008). Moreover, Sinha (2001), Masias and Sánchez (2007) and Martínez and Murcia (2008) analyze in detail the administrative charges in Mexico, Peru and Colombia, respectively.

However, this article will focus only on charges that are proportional on balance and flow since they are by far the most popular and important in Latin America[1]. Queisser (1998) considers that the charge on flow is more advantageous for the Pension Fund Administrator (PFA) in the initial stages of the system, and although the charge on balance aligns the PFA's objectives in terms of increasing the fund's profitability, it tends to be more expensive in the long-run as personal accounts grow in size. On the other hand, Shah (1997) mentions that the charge on flow generates distortions and undesirable tendencies like promoting high start-up costs for the PFAs, discouraging competition in the system and generating losses for older affiliates.

Asset allocation, performance and risk of a DC pension plan during its accumulation and decumulation phases have received a considerable attention in the literature. Blake, Cairns, and Dowd (2001) using different models for asset returns and portfolio strategies estimate the value-at-risk of the pension ratio. Poterba, Rauh, and Venti (2005) calculate the expected utility of retirement wealth for different investment strategies and assumptions. Devolder, Bosch Princep, and Domínguez Fabián (2003) derive several optimal portfolio strategies for different types of utility functions assuming the risky asset follows a geometric Brownian motion (GBM). Gao (2009) provides a similar analysis but under a constant elasticity variance (CEV) process for the risky assets. The efficiency of the mean-variance portfolio selection in a DC pension plan is studied in Vigna (2014) when the risky asset follows a GBM. Haberman and Vigna (2001) consider downside risk of an optimal asset allocation strategy derived from a discrete-time dynamic programming approach. Salary risk and inflation risk were incorporated in Battocchio and Menoncin (2004) and Han and Hung (2012) while maximizing the expected utility of terminal wealth. Battocchio, Menoncin, and Scaillet (2004) and Yang and Huang (2009) incorporate longevity risk in the optimal asset allocation of a DC plan; the former using as objective expected utility, and the latter deviation of terminal wealth with respect to a predetermined target. Stochastic lifestyling under terminal utility with habit formation is found and compared with other strategies in Cairns, Blake, and Dowd (2006). Finally, the reader interested in the analysis and optimal allocation during the decumulation phase can be referred, among others, to Blake et al. (2001), Gerrard, Haberman, and Vigna (2004), Horneff, Maurer, Mitchell, and Dus (2006) and Gerrard, Haberman, and Vigna (2006).

Nonetheless, methodologies to compare administrative charges in DC pension fund with IA during its accumulation period have not received that level of attention in the literature, especially in a continuous-time stochastic setting. Therefore, we fill such gap by developing a methodology, in the aforementioned environment, to determine equivalent charges on flow and balance. We consider a risk-averse affiliate who maximizes her expected utility of terminal wealth in a complete Black-Scholes market model[2]. Then, we determine the equivalent charges by equating the maximum terminal certainty equivalent that can be achieved under both kinds of charges. Moreover, under certain assumptions, we prove that the equivalent charges on balance and flow depend only on the length of the accumulation period and the risk-free rate of return; and, to the best of our knowledge this relationship between charges is new in the literature. This result is independent on the risky asset's growth rate and volatility, as well as, the affiliate's risk-aversion since the comparison of administrative charges can be performed by simple terminal wealth expectations under a risk-neutral probability measure.

The rest of the article proceeds as follows: Section 2 introduces a methodology to mathematically represent and compare charges on balance and flow. Section 3 discusses an application of the methodology to the Peruvian Private Pension System. Finally, Section 4 draws conclusions.

2. Methodology

Throughout this paper $(\Omega, F, \mathbb{P}, \{F_t\}_{t\geq 0})$ represents a filtered and complete probability space on which a standard $\{F_t\}_{t\geq 0}$ –adapted one-dimensional Brownian motion $B(t)$ is defined. We denote by $L^2_F(0, T, \mathbb{R})$ the set of all $\mathbb{R}$ -valued, measurable stochastic processes $g(t)$ adapted to $\{F_t\}_{t\geq 0}$, such that $E[\int_0^T |g(t)|^2 dt] < \infty$.

For any $t \in [0, T]$, we assume that the PFA can invest the affiliate's contributions in only two assets which satisfy:

$$dP_0(t) = rP_0(t)dt, \quad P_0(0) = P_0 > 0, \tag{1}$$

$$dP_1(t) = \mu P_1(t)dt + \sigma P_1(t)dB(t), \quad P_1(0) = P_1 > 0. \tag{2}$$

It is clear that r is the risk-free rate of return, μ and σ are the risky asset's growth rate and volatility, respectively. The stochastic differential equation (SDE) in (2) generates a geometric Brownian motion (GBM) which is a common specification to model asset values and it is heavily utilized in stochastic control of DC pension funds as mentioned in the introduction. But most important, assets (1) and (2) generate a complete financial market and therefore it guarantees the existence of a risk-neutral probability measure. This property will be extremely useful to verify our theoretical results of Section 2.4.

2.1. The affiliate's problem

Consider a particular PFA's affiliate who has $T > 0$ months before retirement, i.e., T represents the length of her accumulation phase. She already has $W_0 > 0$ ready to be invested in her individual

[1] On the one hand, Bolivia, Colombia, Chile, El Salvador, Peru, and Uruguay have charges on flow. On the other hand, Mexico, Bolivia, Costa Rica, and Uruguay have charges on assets. Notice that in Bolivia and Peru both type of charges coexist.

[2] This market consists on a risky asset following a geometric Brownian motion and a risk-free asset. Both assets can be traded continuously and frictionless.