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**DOMINICAN PENSION  
FUNDS: INVESTMENT  
REGULATORY REVIEW  
AND EFFICIENT  
PORTFOLIO FRONTIER  
DETERMINATION**

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This article reflects the particular considerations of the author. In no sense is it a document that identifies the policy guidelines carried out by the Ministry of Finance

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## PREAMBLE

The pension system reform in 2003 created new institutional investors. The pension fund administrators (AFP) have the objective of managing the savings accounts, for pension, of formal workers in the economy. So they must ensure two objectives. On the one hand, during the accumulation phase, carry out the optimal portfolio allocation (optimal asset allocation) that maximizes returns and minimizes risks. On the other hand, during the decumulation phase, create pension financial products that guarantee security and survival in old age. The challenge is not minor. To this end, the market, through regulatory entities, seeks to mitigate atypical behavior and ensure the achievement of pension objectives. In effect, it is regulated and supervised on three fronts: 1) industry structure, 2) fund performance, and 3) portfolio allocation. The three, in essence, are the financial pillars, on the supply side, of the pension market.

The literature on the fronts described above is extensive. However, this delivery is limited to portfolio allocation. The issue is the subject of constant debate due to its direct implications for the benefit of the pensioner. More specifically, the portfolio allocation is related to the financial performance of the individual capitalization accounts through the pension fund and, these in turn, to the future level of the replacement rate. Therefore, the diversification of fund investments is a sensitive part of the system and, moreover, subject to strict supervision. In fact, the Law regulates not only the type of investment instrument, but also the investment limits. Theoretically, the restrictions attempt against the maximization of profitability. However, there are mechanisms within the system

that look for desirable points of return given explicit restrictions. Investment limits are still the center of debate in individually funded pension systems.

Although the discussion is old, the arguments of both parties are still valid. On the one hand, Srinivas and Yermo (1999) suggest the elimination of investment limits in the long term, while Valdés-Prieto (1999) argues for their permanence. The former allude to inefficiency in portfolio allocation, while the latter indicates that these limits mitigate the risk due to the replacement rate and potential conflicts of interest. More recently, World Bank (2010) suggests that the level of rigidity or flexibility in investment regulation is related to the development of the internal capital market<sup>1</sup>. The truth is, according to the OECD (2014), that most countries have quantitative investment limits for pension funds<sup>2</sup>. These limits have a direct impact on portfolio allocation.

The Dominican Republic is no exception. From the beginning, it has had the Risk Classification Commission and Investment Limits (CCRLI), a unit in charge of determining the degree of risk, the diversification of investments and the maximum investment limit per instrument. This is integrated, in principle, by the superintendents of pensions, banks, insurance and securities plus the governor of the Central Bank and a representative of the affiliates. In operational terms, the commission is supported by three departments of the Superintendency of Pensions (SIPEN): 1) risk analysis, 2) investment diversification and 3) fixed income and separate equity<sup>3</sup>.

In the country, the issue of fund investments is cyclical in public opinion.

1 See about Evaluating the Financial Performance of Pension Funds (2010). World Bank, <http://www.apapr.ro/images/BIBLIOTECA/investitiirandamente/wb%202010%20evaluating%20financial%20performance.pdf>

2 See about Annual Survey of Investment Regulation of Pension Funds (2015). OECD, <http://www.oecd.org/daf/fin/private-pensions/2015-Survey-Investment-Regulation-Pension-Funds.pdf>.

3 Access this website: <http://www.sipen.gov.do/index.php/sobre-nosotros/organigrama>.

However, it focuses on the purpose of the investments and not on the instruments and limits of the same. That is why the debate points more to the impact of resources on economic growth than to the future wealth of pensioners. In this context, this installment escapes macroeconomic elements and focuses on the study of pension funds from the modern theory of finance. Therefore, the article is divided into five parts. The first introduces The second reviews investment regulation in the country. The third studies the performance of the funds managed by the local AFPs. The fourth presents the portfolio optimization model from which the efficient allocation arises. The fifth builds the efficient frontier and analyzes the portfolios of the Dominican AFPs. And the sixth concludes.

## **REGULATION OF PENSION FUND INVESTMENTS: DOMINICAN REPUBLIC<sup>4</sup>**

Portfolio allocation is one of the elements that guarantees the healthy performance of pension funds. That is why the CCRLI aims to establish investment instruments, degree of risk and portfolio diversification. From 2002 to 2015, the CCRLI issued 105 resolutions. Although the issues per year do not follow a pattern, it is noted that 2015 reached the maximum number of resolutions issued, 17. In general terms, four main issues are distinguished: 1) investment limits, 2) risk classification, 3) instruments financial public offering and 4) conditions and parameters of new instruments. Out of these, only those related to authorizations from risk rating agencies. The four relevant ones are analyzed below.

### **INVESTMENT LIMITS**

Limits will apply to the value of the funds.

They are built from the sum of resources placed both in financial instruments and in current accounts at a given time. The rule also establishes only two types of funds to be managed by the AFPs, Type 1 and 2. The first is constituted by accounts and investments with at least 70% in pesos. The second is made up of accounts and investments with at least 70% in dollars. The limits can be by type of instrument and by issuer. By type of instrument, they were initially concentrated in six: 1) time deposits, 2) mortgage bills, 3) company securities, 4) publicly offered shares, 5) BNV securities, and 6) funds for the housing sector. By issuer, and defined the instrument, investments may not exceed the amount that is less among three restrictions. These are: a) a proportion of the value of the fund adjusted for risk, b) equity of the issuer or c) proportion of the set of units of the same instrument.

The limits have a transitory nature since their origins in 2003. This is so as to guarantee a gradual process of adjustment and accumulation of funds. In the initial phase, a waiver was offered until specific thresholds were reached. One of these exemptions consisted of the investment of 100% of the resources in term deposits and titles of regulated banking institutions. It remained at that level from 2003 to 2007. Subsequently, it fell to 90% between 2007 and 2010. And since this last year it has remained at 75%.

The maximum investment limits have changed for some instruments during 2002 and 2015. First-generation instruments, specifically time deposits, mortgage notes and funds for the housing sector, present limit increases (Graph 1a). The first goes from 60% to 75% in 2010. The second reaches a level of 70%, increasing 40 percentage points in 2005. And the third reaches 20% in 2010. The remaining group of instruments, company

<sup>4</sup> Based on the resolutions of the CCRLI of 2002-2015.

titles, offer shares public and BNV securities<sup>5</sup>, keep their limits at 70%, 30% and 10% respectively.

In order to diversify the investments of the pension funds, the CCRLI continues to approve financial instruments. Therefore, from 2007 second generation instruments are included (Graph 1b). That same year, Central Bank securities were approved with a limit of 20%, reaching 50% in 2010. For their part, instruments from multilateral organizations and bonds guaranteed by the State were introduced in 2010. The former maintains an investment limit of 10%, while the second presents a rise from 15 to 30% between 2010 and 2015. Then infrastructure instruments are added from 2013 with a limit of 10%. To finally introduce the newest instruments of investment fund quotas, trust securities and securitized securities with a limit of 5% each.

#### **A) RISK CLASSIFICATION**

According to the CCRLI, debt financial instruments can be of two types. One for the medium and long term and the other for the short term. By definition, the former have a duration equal to or greater than one year. The seconds are less than a year. For classification purposes, a distinction is made by category and risk factors, as detailed in Graph 2. For medium- and long-term instruments, ratings between AAA and BBB have a risk factor greater than 0. While for short-term instruments, ratings between C-1 and C-3 have a risk factor greater than 0.

On the other hand, for term deposit instruments and financial certificates, the risk factor is 1 if the financial intermediary has a BBB or C-3 rating. The rest of the entities will have a factor of 0.8. In addition, entities interested in raising pension funds must comply with the minimum solvency ratio of the Monetary Board. In general terms,

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<sup>5</sup> In 2015 it became Export Bank (BANDEX)

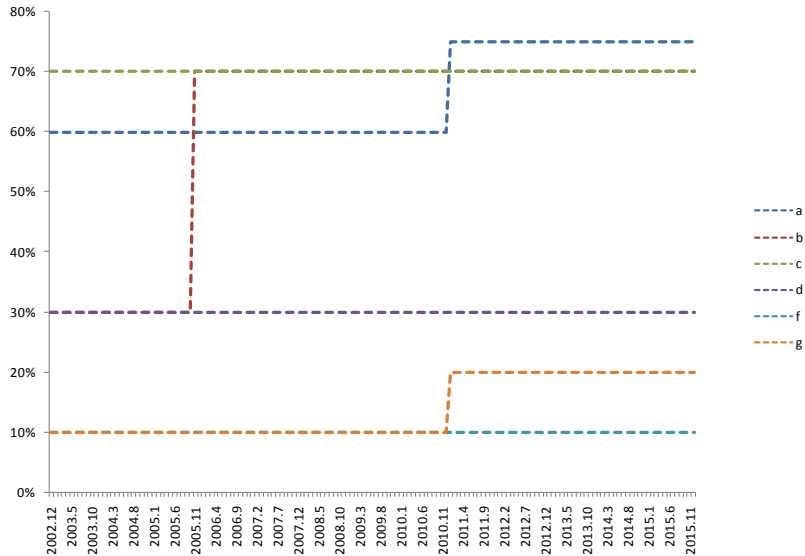
the evaluation by instrument qualifies the payment capacity and the effects of changes in the issuer's own industry or in the economy. These ratings are issued by rating agencies authorized by both the Superintendency of Securities (SIV) and the CCRLI.

Other relevant aspects of risk classification are linked to pre-approval elements. For example, as of 2006, debt issues greater than RD\$1,000,000,000 must have two ratings. Also, it is verified that active monitoring is maintained in the face of changes in the levels of risk experienced by the different financial intermediation entities. On the side of equity instruments, these must be submitted to the CCRLI after meeting the requirements of both the SIV and the Superintendency of Banks (SIB). The Commission will also require financial statements with favorable performance and indicators of market share, capital adequacy, structural gap and financial margin. However, the Commission itself reserves the right to a favorable case in the absence of requirements.

#### **PUBLIC OFFERING INSTRUMENTS**

The CCRLI approves investment alternatives after prospect analysis and approval by the SIV. In the study period, 2002-2015, 43 bond issues were approved, equivalent to RD\$80 billion. As evidenced in Graph 3, 56% of the issues correspond to financial intermediation institutions. The next 23% corresponds to emissions from the industrial sector, while the remaining 20% is distributed in the electricity sector (9%), brokerage firms (9%) and construction (2%).

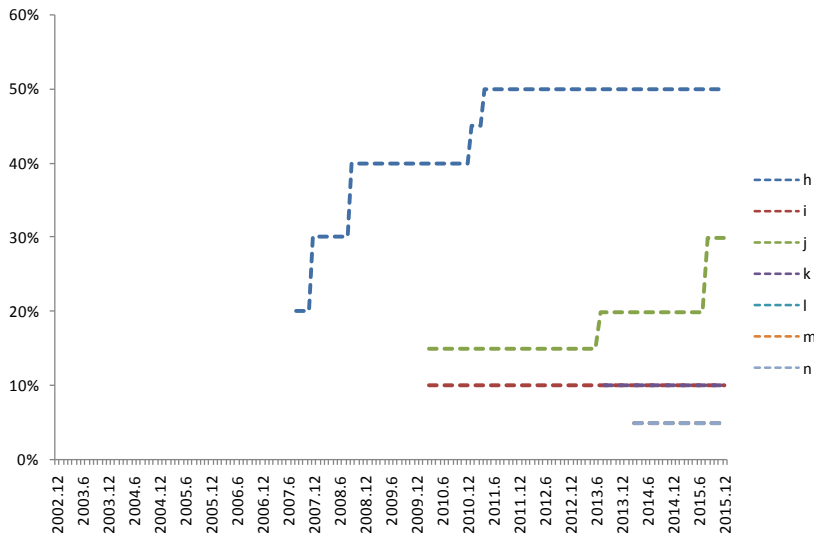
Within the intermediation sector, approvals were concentrated in multiple banks (53%), savings and loan associations (21%), housing and production banks (11%), multilateral organizations (10%) and savings



Graph 1a. Investment Limits per Instrument, 2002-2015

Source: Constructed by the author based on CCRLI resolutions.

Legend: a/ Term deposits, b/ Mortgage notes, c/ Company titles, d/ Public offering shares, f/ BNV titles, g) Housing sector funds



Graph 1b. Investment Limits per Instrument, 2002-2015

Source: Constructed by the author based on CCRLI resolutions.

Legend: h/ BCRD Bonds, i/ Multilateral Organization Bonds, j/ Bonds guaranteed by the State, k/ Infrastructure Instruments, l/ Closed and Open Fund Quotas, m/ Trust Securities and n) Securitized Securities

and loans banks. credit (5%). The first approvals are registered from brokerage and industry entities in 2005. Subsequently, the diversification of issuers has been gradual. In addition to industrialists and bankers, electric generators were introduced in 2010 and stock market stalls in 2014. Likewise, the approvals of issues in dollars since 2008 stand out.

On the instrument side, all are fixed income. With different terms and denominations according to the specific needs of the issuers. On the one hand, there are commercial papers (less than one year term) and debt securities (long term). On the other hand, ordinary and subordinated bonds with specific characteristics regarding payment of interest and liquidation order in bankruptcy. Issuance tranches range from 1 to 20 and risk categories range from BBB to AAA for virtually all instruments.

## **B) REGULATIONS FOR NEW INVESTMENT INSTRUMENTS**

In 2011, the CCRLI approved the minimum conditions for pension funds to be invested in new instruments. Four resolutions are identified related to: 1) quotas of closed investment funds and mutual or open funds, 2) securities issued by trusts, 3) mortgage letters and mortgage bonds and 4) securitized securities. For the first, closed and open funds are differentiated. The closed has a specific term of duration and the share or instrument grants rights over equity and is not redeemed in advance. The open has an indefinite duration, the quotas are redeemed at any time and the benefit is the increase experienced by the quota. Likewise, the investment of no less than 70% of its assets in instruments defined by the investment policy is established, as well as a maximum borrowing limit of up to 30% of equity (closed funds) and up to 10% (open funds). Otherwise, risk rating reports, additional factors and provisions to be met by

the fund are required.

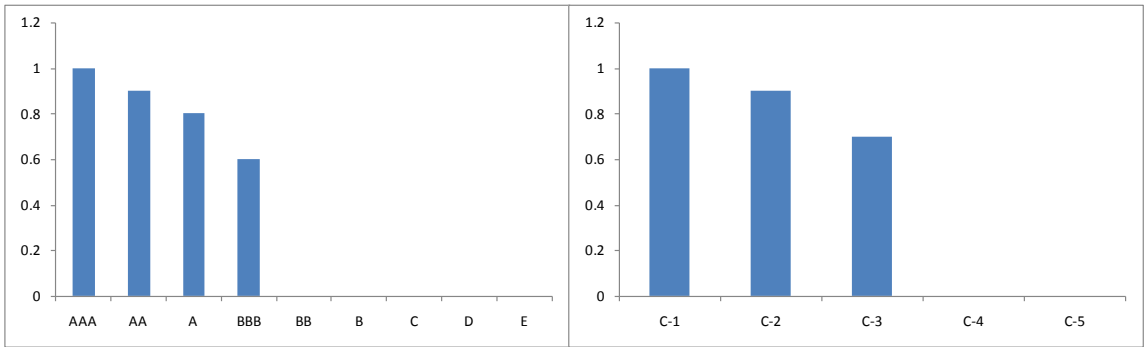
For securities issued by trusts, trust assets and trust securities are distinguished. The estate is of a separate and autonomous nature composed of property rights to manage as established by settlors. The securities, meanwhile, are public offering issued by an authorized company and backed by trusts. Before the CCRLI, the trustee must submit financial statements, adequate levels of solvency and liquidity, experienced trustee manager and feasibility studies and financing structure. On the other hand, letters and mortgage bonds can be considered as investment alternatives with a risk rating of BBB or higher with prior certification of the issuer obtained by the SIB. It is important to differentiate between bond and letter in this case. The bond is a public offering security issued with the guarantee of existing mortgage loans and registered in the assets of financial intermediation entities. The bills, meanwhile, are titles issued to finance new mortgage loans, which are constituted as a global guarantee of securities to be placed.

Finally, securitized securities originated from mortgage loans. These instruments will be issued through securitization companies with equity to support the payment of rights to holders of securities issued against equity. The minimum conditions are established for: 1) underlying mortgage loan portfolio, 2) securitization process, 3) management and ownership of the securitizer, and 4) securitized securities.

The portfolio must be diversified and not concentrated in more than 15% per housing complex or economic activity of the mortgage debtor. Loans may not exceed 80% of the lower value between the appraisal and the sale price. Nor may it exceed 30% of the borrower's income from the agreed installment. Likewise, the methodology for calculating the variable rate will be presented, if it is, and they must

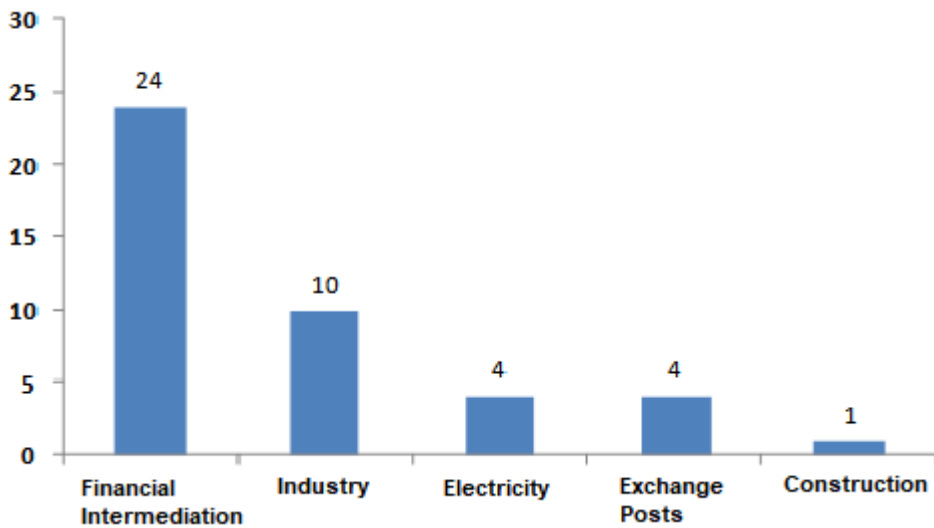
### Medium and long term

### Short term



Graph 2. Categories and Risk Factors

Source: Constructed by the author from resolutions of the CCRLI.



Graph 3. CCRLI-approved emissions by sector, 2002-2015\*.

Source: Constructed by the author based on CCRLI resolutions.

\*Separate brokerage positions from the financial intermediation block

be first-rate mortgages. Regarding the securitization process, collection conditions, cash flow and guarantees are established. For the administration of a securitization company, management and ownership requirements must be met, as well as specific procedures for conflicts of interest. Securitized securities must have a risk rating of BBB or higher and a value equal to 80% of the underlying loan portfolio.

## PERFORMANCE OF DOMINICAN PENSION FUNDS

Once the regulatory investment structure of pension funds has been reviewed, it is necessary to study their performance. The industry of pension fund administrators (AFP) began in July 2003 with 9 entities. At that time constituted by: 1) Camino, 2) Caribatico, 3) León, 4) Popular, 5) Porvenir, 6) Reservations, 7) Romana, 8) Scotia Crecer and 9) Siembra. However, industry consolidation starts fast. In less than 18 months, Camino and Porvenir are absorbed. Before the age of four, Caribatico and León are also absorbed. Three of the four mentioned were acquired by AFP Siembra. These mergers responded to expansion strategies and economies of scale within the industry. To all this, SIPEN authorized operations in 2015 to AFP Atlántico and AFP JMMB BDI<sup>6</sup>.

The average nominal return on investments reached 14.2% between 2003 and 2015<sup>7</sup>. However, the series presents several periods (Graph 4). Three are clearly distinguished. The first stage, from July 2003 to July 2007, begins in an adverse macroeconomic context due to the 2003-2004 banking crisis. The high nominal yields capture the strong uncertainty impact of financial assets at the time. Later, 2005, shows a sharp slowdown in performance as a result of corrective measures and confidence

of economic agents. The average return was 18.43% with a volatility of 5.44%. The second phase August 2007-July 2011, slowed the performance by 7.5 percentage points to 11.28% with moderate volatility of 2.24%. However, profitability reflects the measures taken by the monetary authorities before and after the international financial crisis. The last phase, August 2011-December 2015, observes average returns of 12.80% with a low volatility of 1.29%. This section shows a slowdown as a result of the general decline in price levels. The series shows a strong synchronization of returns between the AFPs during the 2007-2015 period.

The behavior of the series broken down into real return and inflation directly captures the effective profit of the funds (Graph 5). Therefore, in real terms, the funds achieved a return of 4.7% with a volatility of 9.2% for the same period<sup>8</sup>. The real result for the last 10 years is 6.6% with a volatility of 4.5%. While for the last two years, the average is 9.8% with a volatility of 1.5%. The effect of inflation on real profitability is quite marked. In 2004, for example, high inflation hurt the return on funds with a loss of up to 24.4% in real and year-on-year terms. Then, between 2005 and 2011, the contribution to nominal profitability is explained by effects on price levels in the economy. In moments of rising returns, inflation is above the real and there is evidence of an increase in rates that will counteract the evolution of the price level. However, real profitability has dominated between 2012 and 2015 due to the sustained decline in domestic and foreign price levels.

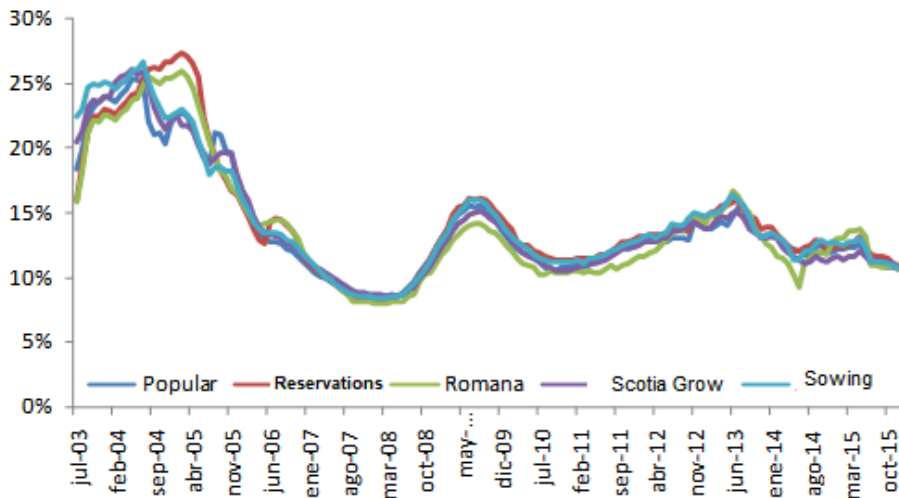
The correlation between returns of the funds managed by the Dominican AFPs follows the same pattern of Chilean and Peruvian AFPs outlined by Srinivas and Yermo (1999). Table 1 outlines the herd behavior of the monthly

<sup>6</sup> Access this website: <http://www.sipen.gov.do/index.php/resoluciones/resoluciones-de-la-sipen>

<sup>7</sup> Performance is evaluated based on the 5 AFPs that are currently operating.

<sup>8</sup> The actual return is calculated from  $r = \frac{1+g}{1+\pi} - 1$ , alternatively to the one established by the quota value rule.





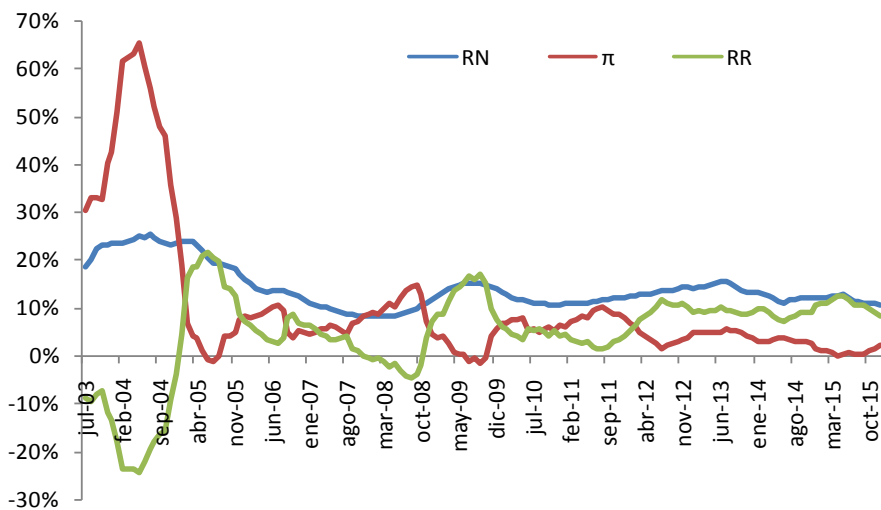
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ene-07-(Jan-07)

Ago-07- (Aug -07)

Graph 4. Nominal Return per AFP, 2003-2015

Source: Prepared by the author from SIPEN data



Graph 5. Rentabilidad descompuesta por AFP, 2003-2015\*

Source: Built by the author from statistical data from SIPEN

\*Legend: RN: Nominal Return,  $\pi$ : Inflation and RR: Real Return

	<i>Popular</i>	Reservations	Roman	Scotia Grow	Average
Popular					
Reservation	0.96				
Roman	0.95	0.99			
Scotia Grow	0.99	0.95	0.96		
Sowing	0.99	0.96	0.96	0.99	
Average	0.97	0.96	0.96	0.99	0.97

Table 1. Monthly Correlation of Pension Fund Returns

Source: Built by the author from statistical data from SIPEN

returns of the 5 AFPs. The correlation is very high between any two of the funds, reaching an average of 0.97 in nominal terms. The AFPs follow a marked collective behavior and it is a product of the regulation established by the CCRLI through limits and investment instruments. The design of the market conditions the investment policy to the AFP with the best performance and this could make the rivals approach the leader, this action is known as comparative regulation or Yardstick Competition<sup>9</sup>. Although the objective is to safeguard the resources of future pensioners, it is no less true that the current market does not have differentiated portfolios (multi-funds) that reflect the saver's behavior in the face of risk.

A look at pension fund investments by type of instrument reinforces the hypothesis of similarity in the behavior of the different AFPs. Graph 6 shows the percentage composition of the respective portfolios.

In accumulated terms, the CCI-Total Funds Graph (Graph 6) shows the concentration invested in Central Bank securities, notes and certificates, which reaches 48%. The second placement of relevance is located in central government bonds (22%), followed by term deposits and certificates in financial intermediation entities (20%). The remaining 10% is dispersed in bonds and bills from financial intermediation companies and corporate bonds and commercial paper, 7% and 3%, respectively. Two interesting patterns are noted: 1) AFP Siembra follows a balanced portfolio strategy and 2) AFP Romana concentrates 95% of its placements in BC securities, notes and certificates and deposits in financial intermediation entities.

## PORTFOLIO OPTIMIZATION MODEL

The objective of this section is to

9 See: A theory of yardstick competition (Shleifer, 1985). Recovered from: [http://scholar.harvard.edu/files/shleifer/files/theory\\_yardstick\\_comp.pdf](http://scholar.harvard.edu/files/shleifer/files/theory_yardstick_comp.pdf)

construct the efficient frontier of the AFPs through portfolio theory (Markowitz, 1952). Said frontier summarizes the portfolio opportunities available to the investor (AFP) based on the risk-return analysis. This is constructed through the minimum-variance frontier, where the expected return given the lowest possible variance is identified. The frontier takes the expected returns, variances, and covariances and is a theoretical reference for the direction of the portfolio. Indeed, the portfolios below this frontier are inefficient. Investments will always be diversified, aiming for a higher return given the lowest possible risk. Therefore, the portfolios above the minimum global variance and on the curve will be ideal for the optimal portfolio.

Given a set of assets, it is possible to build different portfolios from different proportions and dissimilar risk-return combinations. The return of a portfolio (p) is defined as:  $E(p) = W^t R$ , sum product of the weightings of each asset by its return. The risk, meanwhile, is specified as:  $\sigma_p^2 = W^t S W$  where  $W = (w_1, w_2, w_3, \dots, w_n)$  is the vector of weights and  $R = (r_1, r_2, r_3, \dots, r_n)$  is the vector of returns. The variance-covariance matrix is constructed:

$$S = \begin{bmatrix} \sigma_{r_1}^2 & Cov(r_1, r_2) & \dots & Cov(r_1, r_N) \\ Cov(r_1, r_2) & \sigma_{r_2}^2 & \dots & Cov(r_2, r_N) \\ \vdots & \vdots & \ddots & \vdots \\ Cov(r_1, r_N) & Cov(r_2, r_N) & \dots & \sigma_{r_N}^2 \end{bmatrix}$$

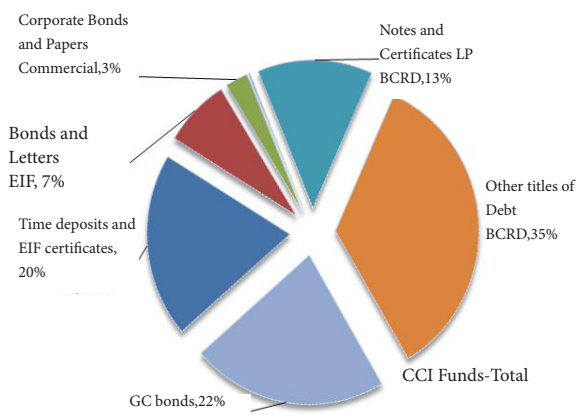
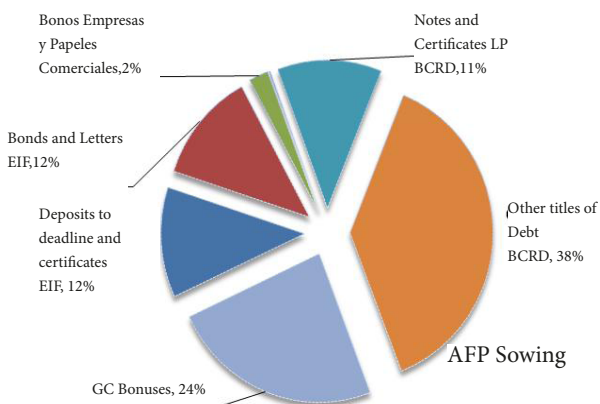
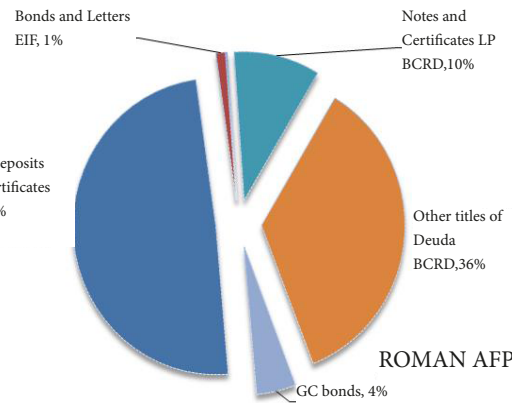
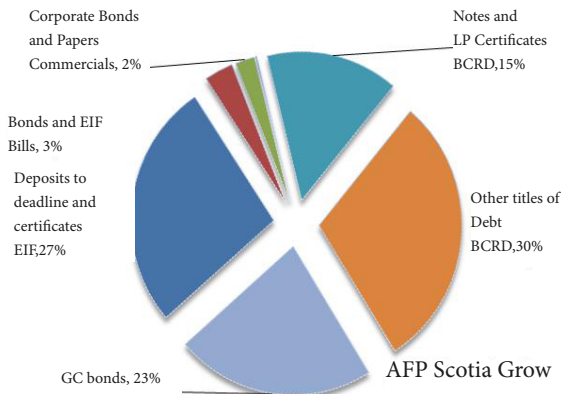
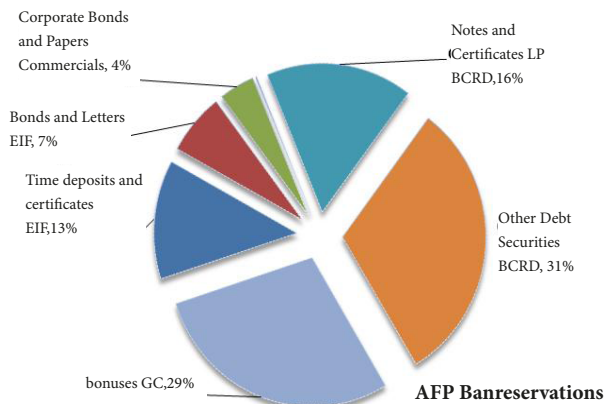
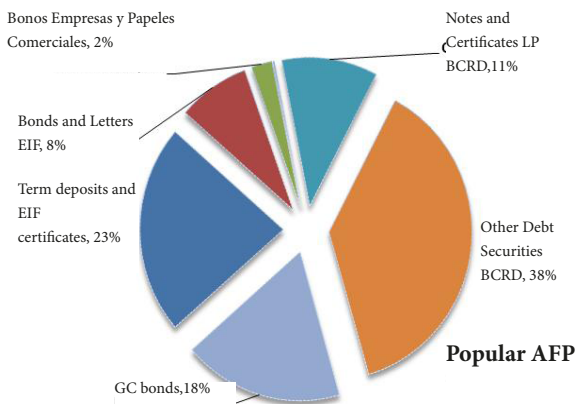
where  $Cov(r_1, r_2)$  is the covariance between any two assets y  $\sigma_{r_N}^2$  is the variance of a given asset. Therefore, the efficient frontier arises from the optimization process. Following Markowitz (1952), the portfolio selection problem is stated as:

$$\text{Min } \sigma_p^2 = W^t S W$$

$$\text{Subject to: } W^t R = \bar{r}$$

$$\sum W = 1$$

The second part of the process is related to



Graph 6. Composition of Pension Fund Portfolios, as of 12/31/2015, f: SIPEN

maximizing the return of the excess over the risk-free rate. ( $r_f$ ). So that:

$$Max w = \frac{R_p - r_f}{\sigma_p^2}$$

Subect to:  $\sum W=1$

The identification of the capital allocation line is built from the previous optimization process with which the optimal portfolio is obtained that is tangent to the efficient frontier. The article does not determine the utility function of the investor, leaving it for future research.

## PORTFOLIO CONSTRUCTION

For the Dominican case, the efficient frontier of the AFPs is built with a portfolio of 7 assets. Access to information is the main obstacle to the construction of the border. However, it is identified from the statistical bulletins of the SIPEN, the investments of the funds by instrument and weighted interest rate. The latter offers a first approximation to the current performance of the securities in the portfolio. This will be used as a proxy in the absence of price vectors for the instruments acquired by the pension funds. The weighted interest rate has been published since 2008, so the asset return series covers 8 years up to 2015 on a quarterly basis.

For calculation purposes, a characteristic portfolio is assumed that is built from the average aggregate yield of the AFPs in the sub-total of CCI funds. For each asset, as indicated above, the average interest rate is taken as its return. These rates solve two basic problems of the exercise: 1) the illiquidity of several of the instruments in the secondary market and 2) the aggregation of the different types of instruments (type of bond, term and risk).

In terms of correlation between assets, it is shown that the combination that generates benefits for diversification, at the first phase, are fixed-income investments and BCRD investment certificates with term deposits

and with bonds and mortgage letters by EIF (Table 3). On the contrary, the combinations of EIF mortgage bills with bonds issued by EIF and time deposits are not optimal due to their high correlation. In the middle, there are combinations of GC bonds with EIF bonds or time deposits with moderate positive correlations.

By identifying the returns of the 7 assets, the excess return (RE) matrix is constructed and then multiplied by the transpose to obtain the variance-covariance matrix S defined above. Matrixly:  $S=RE^t \times RE/T$ . Then the inverse of S is obtained and multiplied by the return spread and risk-free rate.

$$RE = \begin{bmatrix} r_{t,1} - \bar{r}_1 & r_{t,2} - \bar{r}_2 & \dots & r_{t,i} - \bar{r}_i \\ r_{t+1,1} - \bar{r}_1 & r_{t+1,2} - \bar{r}_2 & \dots & r_{t+1,i} - \bar{r}_i \\ \vdots & \vdots & \ddots & \vdots \\ r_{t+N,1} - \bar{r}_1 & r_{t+N} - \bar{r}_2 & \dots & r_{t+N,i} - \bar{r}_i \end{bmatrix}$$

The result gives rise to the column vector y which is used to determine the weights of the optimal portfolio:  $w_i^*$  as it is showed:  $y=S^{-1}[R-r_f]$   $y w_i^* = \frac{y_i}{\sum y}$ . When finding the optimal portfolio, the expected return is sought:  $E(p)=W^tR$  and the respective variance:  $\sigma_p^2 = W^tSW$ . The previous procedure is replicated to obtain a second optimal portfolio and thus build the efficient frontier from the linear combinations of both portfolios. where the return is  $E(r_{p^*}) = \alpha E(r_{p_1}) + (1-\alpha)E(r_{p_2})$  and the standard deviation is:

$$\sigma_{p^*} = \sqrt{\alpha^2 \sigma_{p_1}^2 + (1-\alpha)^2 \sigma_{p_2}^2 + 2\alpha(1-\alpha)Cov(P_1, P_2)}$$

## RESULTS

Once the model is outlined, portfolios are created with specific weights in order to compare different risk-return scenarios. One of these portfolios applies the investment limits approved by the CCRLI as of December 2015. The latter becomes a pioneering exercise for the Dominican case, since it is compared with the optimal portfolio without restrictions

1. Term deposits and financial certificates, issued by EIF\*
2. Bonds Issued by EIF\*
3. Mortgage Bills issued by EIF\*
4. Corporate Bonds
5. Fixed Income Notes and Long-Term Investment Certificates of the BCRD\*\*
6. Other Debt Securities Issued by the BCRD
7. GC Bonuses\*\*\*

Table 2. Characteristic Portfolio Assets

Source: SIPEN Quarterly Bulletins

Note: \* EIF-financial intermediation entities/\*\* BCRD-Central Bank of the Dominican Republic/\*\*GC-Central Government

Actives	1	2	3	4	5	6	7
1	1.00						
2	0.82	1.00					
3	0.90	0.95	1.00				
4	0.72	0.77	0.83	1.00			
5	-0.09	-0.11	-0.04	0.31	1.00		
6	0.30	0.30	0.39	0.78	0.74	1.00	
7	0.24	0.20	0.28	0.85	0.83	0.86	1.00

Table 3. Correlation between Assets of the Characteristic Portfolio

Source: Built by the author from statistical data from SIPEN

Legend: 1: Term deposits and financial certificates, EIF, 2: Bonds issued by EIF, 3: Mortgage Letters by EIF, 4: Corporate Bonds, 5: Fixed Income Notes and BCRD Investment Certificates, 6) Other Securities of BCRD debt, 7) GC bonds.

Briefcase	Composition	Instrument Weighting						
		time deposits	Bonds for EIF	Letters Mortgages by EIF	corporate bonds	Fixed Income Notes and Investment Certificates BCRD	Other titles of debt by BCRD	GC Bonds
A	50% Deposits -50% BCRD	50.0%	0.0	0.0%	0.0%	25.0%	25.0%	0.0%
B	1/7 proportional # assets	14.3%	14.3	14.3%	14.3%	14.3%	14.3%	14.3%
C	100% Deposits	100.0%	0.0	0.0%	0.0%	0.0%	0.0%	0.0%
D	100% BCRD	0.0%	0.0%	0.0%	0.0%	50.0%	50.0%	0.0%
E	adjustment by limits of Investment	3.3%	70%	0.0%	9.9%	16.8%	0.0%	0.0%

Table 4. Composition of portfolios based on instruments

Source: Author's elaboration

and, in addition, with portfolios created from the instruments that the AFPs can acquire. Table 4 presents the portfolios A, B, C, D and E taken into consideration. This seeks to study the dynamics within the efficient frontier and the capital allocation line. These portfolios show interesting risk-return ratios for the purposes of further studies.

The findings are interesting. Graph 7 presents the efficient frontier built from the portfolio optimization model (Markowitz, 1952). It is evident that the proposed scenarios turn out to be inefficient in terms of possible profit given a level of risk. Therefore, portfolio A (50% Deposit-50% BCRD) generates a return of 12.11% with a risk level of 9.55%. Portfolio B (proportional 1/7 # assets) has a return of 11.25% with a volatility of 8.59%. Portfolio C (100% Deposits), meanwhile, reaches the lowest return compared to the rest of 9.12% with a risk of 8.31%. On the other hand, portfolio D (100% BCRD) distributed equally between fixed income notes-investment certificates and debt securities has returns of 15.09% and risk of 17.38%. Finally, portfolio E (adjusted for investment limits). Of the 5 portfolios, it is the one that is closest to the efficient frontier.

Portfolio E presents a moderate return with respect to the evaluated portfolios; however, the lowest risk. Implicitly, the extreme caution of the CCRLI in fully complying with the Law is evident. To all this, the capital allocation line is added to determine the optimal portfolio defined as the tangent to the efficient frontier. With a return above 20% and a risk of less than 10%.

## CONCLUSION

The implications of this article transcend a simple reading. Although the CCRLI has acted in accordance with the Law, in protecting pension savings, it is necessary to speed up the process on several fronts. One, design and

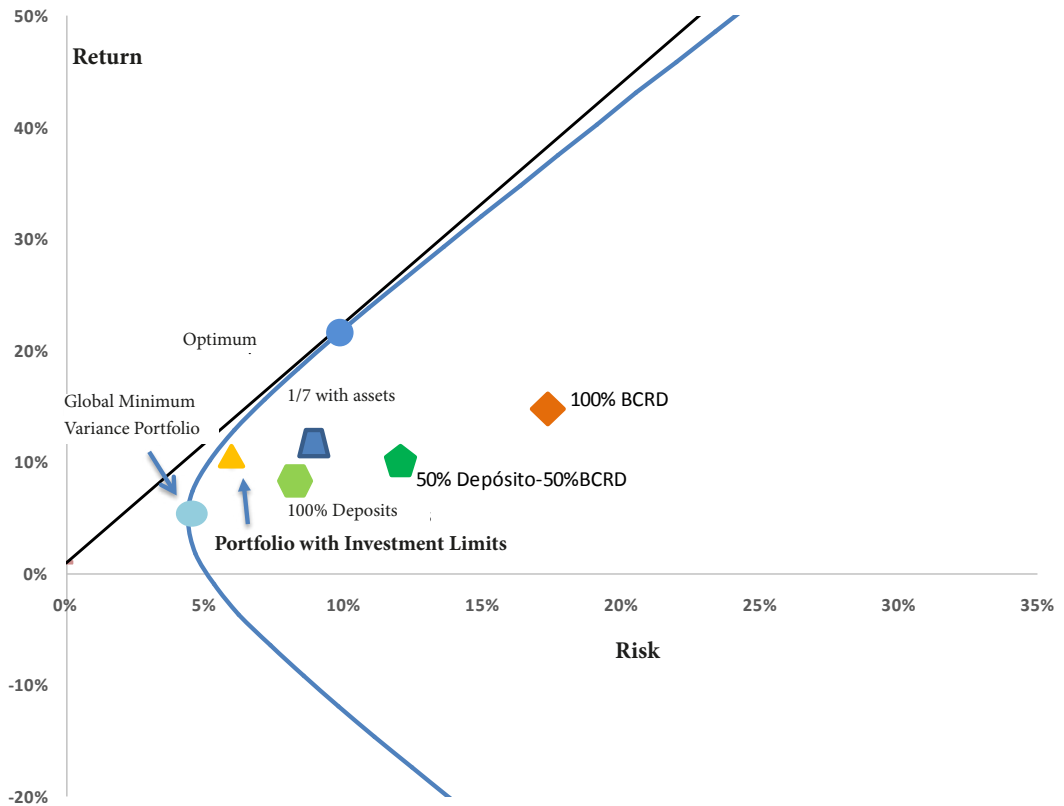
promotion of new types of funds that take into account the risk aversion of the saver. Two, gradual diversification into foreign fixed and variable income instruments through passive fund management (less expensive). Three, the stimulus of local equities through investment funds. Four, the exploration of investments in non-residential assets in strategic sectors. Fifth, including studying, under strong criteria, the direct endowment of loans to private physical or legal agents. The task is arduous but must be accelerated. The ultimate goal is to try to increase the average replacement rate of the pension funds by several percentage points.

This aggressive diversification must go hand in hand with increases in mandatory and voluntary contributions that guarantee a substantial increase in the flow of funds. In addition, macroeconomic, labor market-specific considerations such as wages and informality must also be addressed.<sup>10</sup>. Another underlying issue is understanding that the pensioner's goals are not national goals. This premise is reinforced to clarify that although it is true that significant savings have been generated in the economy, it is no less true that these resources are private. Therefore, if within the parameters and objectives established between workers, businessmen and the government, these resources are required for national projects, they must be clearly delimited for their successful execution and return.

Finally, the article presents a perspective not explored, at least publicly, of pension funds. The regulation of the funds is a key part of the individual capitalization systems. However, there are conflicting positions for and against regulation via investment limits. The fact that the restrictions reduce the returns of the portfolio in favor of the certainty of the savings is verified. Only time will judge the actions taken through the CCRLI for the sake of healthy diversification and a good return on the resources invested.

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<sup>10</sup> It will be covered in future posts.



Graph 7. Efficient Border  
 Source: Author's elaboration

## REFERENCES

Antolín, P., Blome, S., Karim, D., Payet, S., Scheuenstuhl, G., Yermo, J. (2009). Investment Regulations and Defined Contribution Pensions. OECD Working Papers on Insurance and Private Pensions, No. 37, OECD publishing. OECD. Recuperado de: <https://www.oecd.org/finance/private-pensions/43347646.pdf>

Annual Survey of Investment Regulation of Pension Funds (2015). OECD. Recuperado de: <http://www.oecd.org/daf/fin/private-pensions/2015-Survey-Investment-Regulation-Pension-Funds.pdf>

Arrau, P., Chumacero, R. (1998). Tamaño de los fondos de pensiones en Chile y su desempeño financiero. Cuadernos de Economía, 35 No. 105, pp-205-235. Recuperado de: [http://www.gerens.cl/gerens/publicaciones/colum\\_estudios/afps1.pdf](http://www.gerens.cl/gerens/publicaciones/colum_estudios/afps1.pdf)

Broadbent, J., Palumbo, M., Woodman, E. (2006). The Shift from Defined Benefit to Defined Contribution Pension Plans – Implications for Asset Allocation and Risk Management. Institutional Investors, Global Savings and Asset Allocation Working Group. Bank for International Settlements. Recuperado de: <https://www.bis.org/publ/wgpapers/cgfs27broadbent3.pdf>

Berstein, S. y Chumacero, R. (2003). Quantifying the Costs of Investment Limits for Chilean Pension Funds. Discussion Paper PI-0403. The Pensions Institute. Cass Business School. City University. Recuperado de: <http://pensions-institute.org/workingpapers/wp0403.pdf>

Campbell, J., Viceira, L. (2001). Strategic Asset Allocation: Portfolio Choice for Long-Term Investors. Oxford University Press. Recuperado de: [https://faculty.fuqua.duke.edu/~charvey/Teaching/BA453\\_2006/Campbell\\_Viceira.pdf](https://faculty.fuqua.duke.edu/~charvey/Teaching/BA453_2006/Campbell_Viceira.pdf)

Hinz, R., Rudolph, H., Antolín, Yermo, J. (2010). Evaluating the Financial Performance of Pension Funds. The World Bank. Recuperado de: <http://www.apapr.ro/images/BIBLIOTECA/investitiirandamente/wb%202010%20evaluating%20financial%20performance.pdf>

Ley No. 87-01 que crea el Sistema Dominicano de Seguridad Social”. Promulgada el día 9 de mayo de 2001.

Pereda, J. (2007). Estimación de la Frontera Eficiente para las AFP en el Perú y el Impacto de los Límites de Inversión: 1995-2004. Serie de Documentos de Trabajo. DT. No. 2007-009. Banco Central de Reserva del Perú. Recuperado de: <http://www.bcrp.gob.pe/docs/Publicaciones/Documentos-de-Trabajo/2007/Documento-Trabajo-09-2007.pdf>

Resolución No. 1 sobre Límites de Inversión de los fondos de pensiones. Comisión Clasificadora de Riesgos y Límites de inversión. Superintendencia de Pensiones. Dado en Santo Domingo el 16 de diciembre de 2002.

Resolución No. 2 sobre Clasificación de Riesgos de Instrumentos de Deuda y Aprobación de Acciones. Comisión Clasificadora de Riesgos y Límites de inversión. Superintendencia de Pensiones. Dado en Santo Domingo el 6 de junio de 2003.

Resolución No. 3 sobre Régimen Transitorio de los Límites de Inversión de los Fondos de Pensiones. Comisión Clasificadora de Riesgos y Límites de inversión. Superintendencia de Pensiones. Dado en Santo Domingo el 1 de julio de 2003.

Resolución No. 63 sobre las Condiciones y Parámetros Mínimos a que están sujetas las inversiones de los fondos de pensiones en Letras Hipotecarias y Bonos Hipotecarios. Comisión Clasificadora de Riesgos y Límites de inversión. Superintendencia de Pensiones. Dado en Santo Domingo el 9 de septiembre de 2011.

Resolución No. 64 sobre las Condiciones y Parámetros Mínimos a que están sujetas las inversiones de los fondos de pensiones en Valores Títularizados. Comisión Clasificadora de Riesgos y Límites de inversión. Superintendencia de Pensiones. Dado en Santo Domingo el 9 de septiembre de 2011.

Resolución No. 109 sobre las Condiciones y Parámetros Mínimos a que están sujetas las inversiones de los fondos de pensiones en Valores emitidos por Fideicomisos de Oferta Pública. Sustituye la Resolución No. 62. Comisión Clasificadora de Riesgos y Límites de inversión. Superintendencia de Pensiones. Dado en Santo Domingo el 5 de abril de 2016.

Resolución No. 104 sobre las Condiciones y Parámetros Mínimos a que están sujetas las inversiones de los fondos de pensiones en Cuotas de Fondos Cerrados de Inversión y Fondos Mutuos o Abiertos. Sustituye la Resolución No. 61. Comisión Clasificadora de Riesgos y Límites de inversión. Superintendencia de Pensiones. Dado en Santo Domingo el 5 de abril de 2016.

Resolución No. 17-02 sobre Control de las Inversiones Locales de los Fondos de Pensiones. Superintendencia de Pensiones. Dado en Santo Domingo el 9 de diciembre de 2002.



Resolución No. 71-03 sobre Rentabilidad de la Cuota, Rentabilidad Mínima y Garantía de Rentabilidad Mínima. Superintendencia de Pensiones. Dado en Santo Domingo el 25 de abril de 2003.

Roldos, J. (2004). Pension Reform, Investment Restrictions, and Capital Markets. IMF Policy Discussion Paper, PDP/04/4. International Capital Markets Department. International Monetary Fund. Recuperado de: <https://www.imf.org/external/pubs/ft/pdp/2004/pdp04.pdf>

Shleifer, A. (1985). A theory of yardstick competition. *Rand Journal of Economics*, Vol. 16, No.3. Recuperado de: [http://scholar.harvard.edu/files/shleifer/files/theory\\_yardstick\\_comp.pdf](http://scholar.harvard.edu/files/shleifer/files/theory_yardstick_comp.pdf)

Srinivas, P.S., Yermo, J. (1999). Do Investment Regulations Compromise Pension Fund Performance? Evidence from Latin America. *Revista de Análisis Económico*, Vol.14, No. 1, pp. 67-120. Recuperado de: <http://www.rae-ear.org/index.php/rae/article/view/110/212>

Superintendencia de Pensiones (2015). Valor y Rentabilidad de los Fondos de Pensiones. Chile. Recuperado de: [http://www.safp.cl/portal/informes/581/articles-10880\\_recurso\\_1.pdf](http://www.safp.cl/portal/informes/581/articles-10880_recurso_1.pdf)

Superintendencia de Pensiones (2015). Boletín Trimestral No.50. República Dominicana. Recuperado de: [http://www.sipen.gov.do/images/docs/boletin\\_trimestral/Boletin50\\_Sipen.pdf](http://www.sipen.gov.do/images/docs/boletin_trimestral/Boletin50_Sipen.pdf)

Valdés-Prieto, S. (1999). Reply to the article "Do Investment Regulations compromise pension fund performance? Evidence from Latin America", by P.S. Srinivas and Juan Yermo. Instituto de Economía UC. University of Chile, Santiago. Recuperado de: <http://www.pension.kiev.ua/files/valdes.pdf>

Zvi, B., Kane, A., Marcus, A. (2014). *Investments*, 10<sup>th</sup> Edition. McGraw-Hill Education.