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Is Efficiency the Equivalent to a High Rate of Return for Private Pension Funds? Evidence from Latin American Countries

by

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Abstract

During the last few years, there has been a large increase in the rate of return for most Latin American private pension fund institutions (AFPs). This favorable performance of funds comes with an economic boom in the region. However, efficiency, which is the equivalent of good management, does not go along with this successful performance of AFPs. We measure efficiency with the Data Envelopment Analysis technique, and we test for a sample of 9 countries in Latin America to determine if there is any link between efficiency of AFPs and their rate of return. The results suggest that local market power is not necessarily sufficient for certain large AFPs.

Keywords: Relative efficiency, Private pension funds, Fund Regulation.

Introduction

Latin America is performing much better than at any time since the 1960s. Economic growth has averaged over 5 percent a year since 2004 (International Monetary Fund (IMF), 2008). Despite the high price of gas, corn, and soy, inflation has been generally low, direct investment is hitting two-digit growth, and the region's current account and fiscal accounts are both in surplus (See IMF, 2008).

Latin America's economies are expected to grow on average by 4.6 percent during 2008, according to the latest forecast from Latintrade (2008). That compares well to the high level of growth of 5.4 percent for 2007. Latin America will therefore see higher economic growth than the United States and the European Union, but lower than Africa, Asia, and the Middle East.

The successful performance of the Latin American economies can largely be attributed to favorable external shocks. The boom in China's economy caused an increased demand for some commodities, leading to an increase in the price of Latin American exports (Deutsche Bank, 2006; Waggoner, 2006).

Despite the slowdown in some developing economies, growth in Latin America has not faltered. The credit crunch has so far had little discernible effect. As long as international prices of commodities continue to increase, the pace of growth for Latin American countries seems to be assured (The credit crunch, 2008).

The recent interest-rate cuts in the United States have prompted a number of investors to shift their portfolios towards higher yielding Latin American shares and bonds. Most Latin American stock markets have been holding up

relatively well. The good macroeconomic performance has led Fitch, a credit-rating agency, to grant Peru's sovereign bonds to investment grade. The upgrades recognize the strong improvement in Peru's fiscal and external solvency ratios, which now demonstrate a sufficient counterbalance to the country's key credit weaknesses, including a concentrated export base as well as political and social risks. It is likely that if the positive economic condition for Latin America continues, more Latin countries will follow this favorable trend and more investment will flow toward the region (A coming test of virtue, 2008; Mishkin, 2007).

This positive macroeconomic environment in the Latin American region has permitted a good performance in the portfolio rate of return of private pension funds (AFPs), averaging 7.88 percent, 9.91 percent, and 3.09 percent in 2005, 2006, and 2007 respectively. Some countries achieved in 2007, rates of return in their AFPs´ portfolios of 37.99 percent. Despite the credit crunch problems associated with the subprime mortgage,[1] Latin America seems to be decoupling from the United States and Europe (Citibank, 2007). However, our concern goes beyond the scope of just looking at AFPs' portfolio rate of return.

The purpose of this paper is to verify whether the boom in the AFPs' performance is consistent with the good management of these institutions. The assessment of management quality introduces some difficulties into the analysis. The most important problem is measuring management quality. The assessment of overall management quality requires judgment of the AFPs' compliance with policies and procedures, risk taking, strategic plans, and decisions.

In this paper, we measure management quality with Data Envelopment Analysis (DEA). DEA is able to rank AFPs within a country or in the whole region. DEA is a particular frontier analysis technique which measures the efficiency of a decision-making unit (DMU). The DMU, in this case, is AFPs.[2] This technique permits one to obtain scores of managerial efficiency for each AFP. There is agreement in the literature that efficiency scores should be able to identify whether the AFP is processing multiple input-outputs in an efficient manner (Hansweck, 1977; Martin, 1977; Pantalone & Platt, 1987).

The hypothesis within this paper is that management of AFPs does not go along with rate of return in their portfolio. External positive environment helps the portfolio of AFPs to keep a positive trend. Therefore any relative market power of an AFP within a country is not sufficient to demonstrate efficient management of funds.

The rest of the paper is organized as follows: Section 2 describes the situation of AFPs. Section 3 describes the Data Envelopment Analysis methodology, and section 4 presents the regression analysis results. Finally, the last section concludes the paper.

Situation of Private Pension Funds (AFPs) in Latin America

The reform of pension funds in Latin America has resulted in the creation of private pension funds. This has had an important effect of these economies (Barrientos, 2001). Pension funds have many functions. They are able to collect workers' contributions before retirement into a large fund. The fund is supposed to manage workers' funds efficiently in order to guarantee a decent retirement for them according to their effort in giving money to the fund. For the purpose of providing the best retirement to their affiliates, the AFPs invest the fund in a wide array of financial assets (risky or risk free). In addition, the AFPs arrange disability and survivor insurance for active contributors and some support services. The success or failure of the pension funds depends on management as well as external positive environment.

The reformers of pensions in Latin America claimed that the pensions needed to be set up in a competitive framework (Barrientos, 2001). However, according to Stiglitz and Orszag (1999), there is a myth about how a competitive framework leads to low administrative costs in a decentralized pension fund.[3] The administrative costs of these funds are relatively high because of advertising expenses, loss of economies of scale, and various other costs.

In a perfect competitive framework, competition gives incentives for self-improvement. Competitive firms lower their prices and improve their products to increase their sales. According to Barrientos (2001), competition among AFPs is constrained to commission fees, services, and rate of return. However, in our study, the latter framework does not fit with AFPs.

AFPs, like banks, are grouped within the financial system and consequently can be regulated by government. Regulation has to be intense and covers product, commission, investment portfolios, rates of return, and probity.

The history of Latin American AFPs can be traced back to 1981 with the pension reform in Chile. Then came reforms in Peru (1993), Colombia (1993), Argentina (1994), Uruguay (1996), Bolivia and Mexico (1997), El Salvador (1998), and Costa Rica (2001). In this new framework of pension funds, the possibility of contributing a fraction of a salary was allowed. Independent workers were permitted to contribute as well. The AFPs supply individual retirement accounts, and they are still regulated by Superintendencia de Administradoras de Pensiones (SAFP).[4]

According to the Asociación Internacional de Organismos de Supervisión de Fondos de Pensiones (AIOS), the new system may coexist with the old one which is the case in Chile, Peru, Colombia, Costa Rica, El Salvador, and Uruguay.[5] However in Bolivia and Argentina, the new system completely replaced the old. In the first group of countries, the transfer of funds from the old to the new system is optional, but it is mandatory for the second group of countries.

The pension system can have public and private administrators, but in most of the countries, the AFPs belong to private owners. The regulation of AFPs is not the same for each country. One of the main issues concerning regulation is the possibility of investment abroad which is allowed[6] for all the countries except El Salvador. The constrained possibility of investing outside may reduce efficiency in the management of pension funds.[7] However, if AFPs withdraw all the local funds for investment options abroad, the local government may exert pressure on the economy. The latter is a latent risk for open small economies like those of Latin American countries (Rajan & Parulkar, 2008).

Investment limits have been the subject of interest in other regions like OECD countries and Japan.[8] Even in developed countries, there are restrictions on limits for investments abroad because AFPs' funds can be used for financing government budgets or social investments, such as low-cost housing and low-interest mortgages.

countries. Our hypothesis that management of AFPs does not affect the rate of return in their portfolio may partly explain the differences. The differences in the outcome shown below would be explained by heterogeneity in the management of private funds.

By taking a look at the indicators of AFPs for the region, we can see that the number of these institutions varies from country to country. There might be some barriers to entry or regulation that impede the free entry and exit from the industry. The different countries have different requirements, and some of them may stipulate minimum capital. In some countries, the number of AFPs is very low (below five) which may suggest some market concentration and difficulties for new entrants to the market.

The number of contributors and affiliates varies in the region according to the size of the country. We can see that Mexico has the highest number of contributors and affiliates (14.2 and 37.5 million people). Uruguay has the

Table 1
Key indicators of AFPs[27]

Country/ Variable	Number of AFPs	Market Share of the Largest AFP (% Contributor)	Number of Transfers/ Affiliates[ab]	Affiliates (Millions)[ac]	Contributors (Millions)[ad]	Total Expenses/ Contributors	Annual Real Rate of Return
Argentina	12	0.18	2.21	11.70	4.67	62.53	8.28
Bolivia	2	n.d	0.03	1.03	0.00	n.d	2.97
Chile	6	0.19	0.71	7.85	3.61	90.29	11.17
Colombia	6	0.33	n.d	7.41	3.21	208.85	8.91
Costa Rica	8	n.d	13.97	1.59	0.70	93.35	6.25
Salvador	2	0.51	1.33	1.50	0.55	51.6	1.72
Mexico	21	0.17	13.29	37.50	14.20	87.73	6.34
Peru	5	0.30	8.03	3.99	1.61	84.54	21.17
Dom. Republic	7	0.33	0.23	1.53	0.78	11.73	8.60
Uruguay	4	0.45	0.14	0.75	0.47	35.47	2.29

Source: AIOS

Another regulation issue in AFPs is the minimum profitability which ensures that people have a reliable, fair, and simple system. Minimum profitability helps to protect investors in the less deep emerging financial market that characterizes the Latin American region. This minimum requirement of profitability may change from country to country. Some countries do not have rules for minimum profitability. Minimum profitability does not give much flexibility to the investor in a pension fund, but avoids an AFP incurring excessive risk taking and allows it to keep equity reserves in case it needs to support its operations.

Table 1 summarizes some statistics regarding AFPs. It shows an average of the variables for each country for the period 2005-2007. We can see some differences between

lowest number of contributors and affiliates. The number of affiliates is always bigger than contributors because the first implies a registration in the system but not necessarily a contribution out of the payroll. The people who pay a percentage of their salary to an AFP are classified as contributors and are affiliates at the same time. Being an affiliate does not imply one is a contributor, although the reverse situation may exist.

The transfer of funds[9] as a ratio of affiliates is very high in Mexico (13.29) and Costa Rica (13.97), which may indicate a healthy competition within those countries. Abuhadba (1994) studied the determinants of transfers in Chile for the period 1992-1993. He regressed transfers on a set of variables conformed by rates of return, sales, and commis-

sion variables. He found that rates of return and commission have a small impact on transfer behavior, but the sales personnel are very important in the transfer option.

Another interesting result in the data is the market share variable which is measured as the percentage of contributors attained by the largest AFP within a country. This number is low in Chile (0.19) and Argentina (0.19) but very high El Salvador (0.51) and Uruguay (0.45). This suggests higher competition for the first two countries, and some degree of economies of scale in the management of funds for the other two countries with a high rate of concentration. Stiglitz and Orszag (1999) claimed that economies of scale work under a centralized system of pensions (as would be the case for Uruguay).[10]

The annual rate of return varies from 21.17 for Peru to 2.97 for Bolivia. These results are supported by the evolution in the stock market for each country. The good macroeconomic performance and stability may account for the differences for the countries in the region.[11] Authors like Li and Hu (1998) explain the link between macroeconomic environment and the stock market in the United States. Even though the Latin-American region has outstanding macroeconomic performance, some countries have a better impact on their local stock market. This local stock market is the main investment source of any particular domestic AFP.

Finally, the variable expenses as percentage of contributors may be a proxy for efficiency. This is very high in Colombia (208.85) and Chile (90.29) but low in Dominican Republic (11.73) and Uruguay (35.47). In the next section, we will explain how we can measure the efficiency of AFPs in the management of private funds. The methodology is standard in the literature of financial institutions in many countries.

Estimation of Efficiency

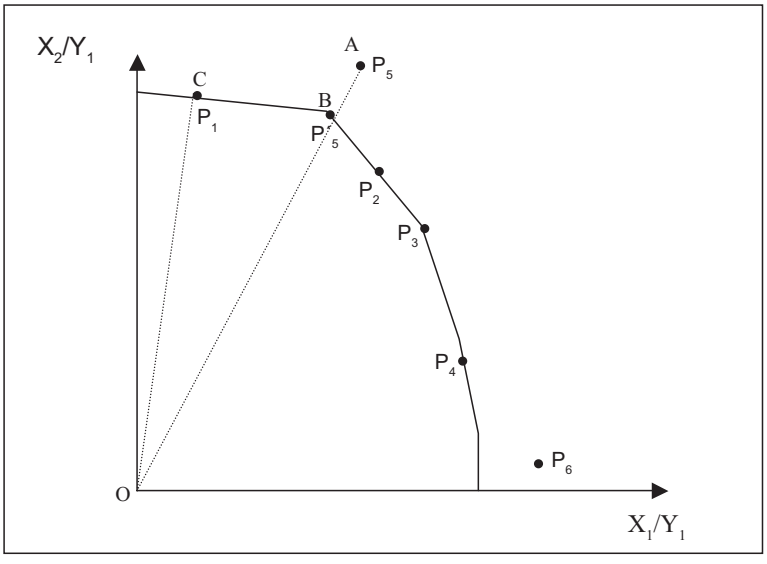
In this section, we will explain how efficiency scores are constructed. In addition, we describe the data sources and justify the use of certain variables to elaborate the efficiency scores.

The efficiency indicator has been calculated using the Data Envelopment Analysis (DEA) technique. In the past, average productivity of labor was used to measure efficiency, but this indicator failed to use all the information of inputs and outputs available (Farell, 1957). Cooper et al. (2004) provided the following definition of "relative efficiency" that solves the problem of the efficiency indicator used in the past:

> A DMU is to be rated fully efficient on the basis of available evidence if and only if the performances of other DMUs do not show that some of its inputs or outputs can be improved without worsening some of its other inputs or outputs.

Farrel (1957) introduced the basic idea of measuring relative efficiency using Euclidean distances from a given observation to an optimal "relative frontier". The word "relative" is used because it is constructed based on sample information. An AFP allocated on the frontier receives a score of one while AFPs allocated above the frontier receive scores lower than one. The idea can be visualized by looking at Figure 1.

Figure 1. A graphical explanation of the DEA



Note: The axes measure the ratio input *i* divided by output *j.* The units P1, P2, P3 and P4 are efficient while, P5 and P6 are inefficient.

The figure represents the case of two inputs as a ratio of one output and six decision-making units (DMUs): P1, P2, P3, P4, P5, P6.[12] DMU P1 is efficient, and, according to Farrel's (1957) distance method, it receives a score of one. This score is calculated by dividing two rays: the Euclidean distance from the origin to the optimal frontier (OC) divided by the Euclidean distance of the DMU P1 to the origin (OC). DMU P5 obtains an efficiency score lower than one because the Euclidean distance from the origin to the frontier is lower than the Euclidean distance of DMU P5 to the origin (i.e., OB/OA<1).

In the case of multiple inputs, outputs, and DMUs, efficiency scores are calculated using linear programming techniques. This methodology receives the name of DEA. Charnes et al. (1978) set up this linear programming that was not completely solved in the paper of Farrel (1957).

The linear program employed by Charnes et al. (1978) calculates the efficiency scores given by

$$\begin{aligned} &\text{Min } \varphi \\ &\sum \lambda_j x_{ij} + S^+{}_i = \varphi x_{ij_0} \\ &\sum \lambda_j y_{rj} - S^-{}_r = y_{rj} \\ &S^+{}_i, S^-{}_i \geq 0 \\ &\lambda_j \geq 0 \\ &\forall i, j, r \end{aligned} \qquad (1)$$

Where x_{ij} is the amount of ith input at DMU j, y_{rj} stands for the amount of rth output from DMU j, and finally j_o is the DMU to assess. $S^+{}_i$, $S^-{}_r$ are the slack variables.[13]

The linear program is called the input-oriented model[14] with variable returns to scale (VRS).[15] The first restriction says that a DMU $j0$ cannot use more resources than any other DMU or a linear combination of DMUs. The second restriction means that no other DMU or combination of DMUs has at least the same amount of output as DMU $j0$. At the minimum $\varphi = 1$ and $S^+{}_i = S^-{}_r = 0$ for all i and r. If, at the minimum, the slack variables are non zero, the solution is weakly efficient. Our estimation resulted in fully efficient,[16] which means that the slack variables ($S^+{}_i$, $S^-{}_r$) are zero at the minimum.

We use as AFP outputs, total revenue and number of contributors and as AFP inputs, administrative cost and sale cost. This input/output selection has been used previously in empirical analysis by Barrientos (2001) and Pestana et al. (2008). The availability of data for all the AFPs in the region permits us to discriminate inputs and outputs in this way. It makes sense to say that according to the selection of these multiple inputs and outputs, the AFP will have a management decision to incorporate the necessary input allocation and product mix decisions needed to attract contributors and make favorable investments.

There are other ways of calculating measures of efficiency. Berger and De Young (1997) and Cheng et al. (2001) calculated the efficiency of banks in the U.S. system by introducing stochastic elements (cost efficiency analysis). Authors like Berger and Mester (1999) used profit efficiency instead of cost efficiency because mergers of U.S. banks and technological changes negatively affected the results. We show later how our DEA scores are reliable and consistent, which guarantees they are suitable in the study.

Data Description

We use the Asociación Internacional de Organismos de Supervisión de Fondos de Pensiones (AIOS) as a source of quarterly data from March 2005 to December 2007. It includes nine countries in the sample: Argentina, Bolivia, Chile, Colombia, Costa Rica, El Salvador, Mexico, Peru, Dominican Republic, and Uruguay. In the end, we did not calculate scores of efficiency for Bolivia and El Salvador because of lack of information for these countries.

The most common applications of DEA have been done for banks (see, for example, Barr et al., *1999;* Berger and DeYoung, 1997; Berger & Mester, 2003). Some papers in the literature apply these DEA indicators of efficiency to analyze the links between efficiency and nonperforming loans (Berger & De Young, 1997). DEA is also very popular for CAMEL[17] models and therefore for predicting the failure of a bank (Hansweck, 1977).

Efficiency Estimation Results

Table 2
Summary of Results for Efficiency during the Period 2005-2007

Country	Absolute Efficiency	Relative Efficiency
Argentina	0.49	0.72
Bolivia	Nd	Nd
Chile	0.50	0.85
Colombia	0.42	0.94
Costa Rica	0.31	0.68
El Salvador	Nd	Nd
Mexico	0.66	0.68
Peru	0.43	0.90
Dominican Republic	0.65	0.86
Uruguay	0.36	0.97

The results give a wide variety of DEA scores for each AFP in a particular country. The variability in the scores for some AFPs can be attributed to outliers, but we have confidence in our indicators because we have run a test of difference in quartiles, and we verify that there is a sig-

nificant difference between the extreme quartiles.[18] In addition, we have run a Bootstrap[19] for the first 100 AFPs,[20] and the ranking of the estimated scores does not differ from the simulated DEAs. Therefore, our efficient indicators can respond to sampling variations of the estimated frontier.

Absolute Efficiency versus Relative Efficiency

In Figure 2, we can see two types of efficiency: absolute and relative. The former is a measurement of efficiency that comes by comparing all the AFPs in the region, and the latter estimates AFPs´ efficiency within a country. In terms of the methodology described in section 3, the frontier for absolute efficiency will consider the total 876 AFPs in the sample. In the relative efficiency estimation, the frontier will be bounded to each country's AFPs. Therefore, we will have eight frontiers, one for each of the eight countries. In this case, the ranking of efficiency will be relative to the local market.[21]

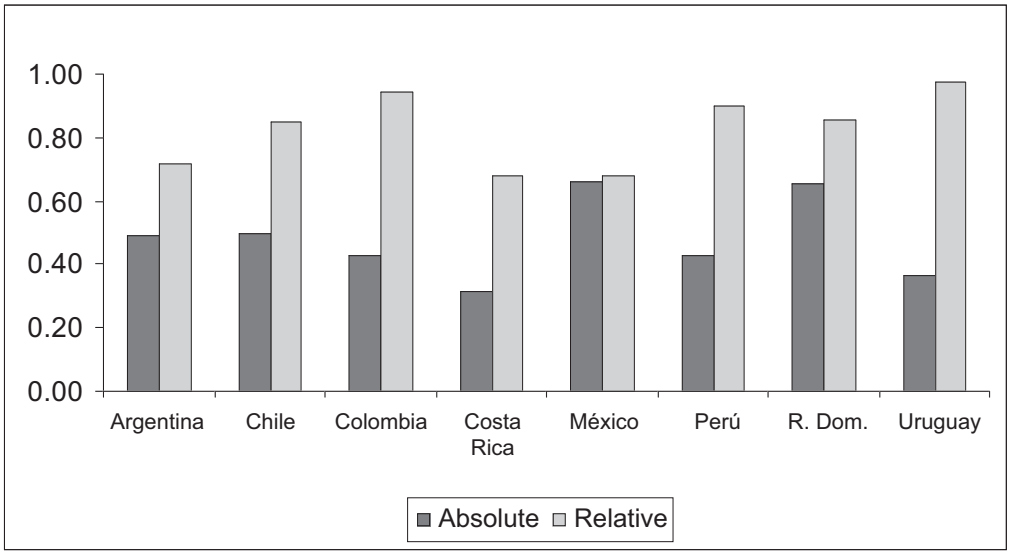
By looking again at Figure 2, we note an interesting result because the relative and absolute efficiency differs for each country. This will mean that relative efficiency (being good in a country) does not necessarily lead to absolute efficiency (being good in the region). This figure may also imply that local market power is not important for efficiency.

The purpose of our paper is to verify if the rate return of an AFP´s portfolio is the result of good management.

Table 3 shows the result of the regression with the endogenous variable: annual real rate of return for a portfolio of a particular AFP. We had controlled for fixed effects, time, and country. Column four shows the model for fixed effects, and columns one to three control for year effects. In this case, we implemented dummies for each year in the sample. The control variable for countries is represented with another set of dummies for each of the 10 countries in the sample. We worked with 10 countries over 12 periods of time. Some countries have up to 21 AFPs. Therefore, the sample can be up to 730 observations, but because of some lack of information, we ended up with 592 observations in the sample.

For the first three models, the estimation has been made with OLS but controlling for some variables, while for the last one, the technique was fixed effects. The signs of the coefficient for all the given specifications are consistent with the economic intuition. In the case of the ratio of affiliates/contributors, we may expect a negative sign because as long as contributors increase, the return should increase as a result of more availability of funds. This variable is also a good proxy for informality because if affiliates increase more than contributors, it can represent some workers who cannot contribute to AFPs because of unemployment. In developing countries, the latter situation induces one to look for alternative ways to support a family, for example, underground economies.[22]

Figure 2. Absolute and Relative Efficiency for the Latin American Region (average for 2005-2007).[ae]



Source: FIAP

Note: Absolute efficiency is estimated for the whole set of AFPs in the region while relative efficiency is the estimation within a country.

Table 3
Determinants of AFPs' portfolio rate of return

	Dependent Variable : Real Rate of Return							
Variables	Model 1		Model 2		Model 3		Model 4	
Affiliates/Contributors	0.465		-0.036		0.299		0.858	
Transfers/Funds	0.002		-0.003		0.001		-0.005	*
Regulation	-0.940		-8.686	*	-2.065			
Relative Efficiency	-4.188	***	0.259		-2.065	***	1.219	
Absolute Efficiency	2.814	***	-0.592		2.150	**	0.675	
Variation of Exchange Rate	-0.219	***					-0.341	
Growth of GDP	0.267	***					0.220	***
Fixed Effects	No		No		No		Yes	
Control for Years	Yes		No		Yes		No	
Control for Countries	Yes		Yes		Yes		No	
Observations	592		592		592		592	
Adjusted R2	0.6590		0.5323		0.6364		0.4220	

* Significant at 10%

** Significant at 5%

*** Significant at 1%

For the ratio transfers/funds, the expected sign must be negative because an increase in this ratio will reduce the liquidity of funds for the AFP. Another variable, the regulation, considers the case where outside investment is forbidden but the possibility exists to certain degree. We may expect the sign of regulation to be negative because the prohibition against investing abroad blocks the diversification of the portfolio.

The case of relative and absolute efficiency is very important and crucial to our analysis. According to our hypothesis, management of an AFP does not correspond to the real rate of return of an AFP´s portfolio. Therefore absolute efficiency, which measures local management, should have a significant positive sign. We may expect different results for the variable relative efficiency.

Finally, we have used external variables. They are basically macroeconomic variables that we may expect to be positive for growth of GDP and negative for the variations of exchange rate. In the first case, the GDP is a good sign of positive expectations about a country's economy and this should increase the rate of return. However, if the dollar is expected to devalue, it may represent negative expectations[23] about the economy, and in a developing region, it can cause inflation which is bad for the real rate of return of an AFP.[24]

Table 3 shows the result for each formulation described above. The ratio affiliates/contributors is not significant, but the transfer/funds ratio gave the correct and expected sign in fourth model. Also, the regulation variables gave the negative and expected sign in the third formulation. For all the models, the sign of the coefficient for the variation of the exchange rate and growth of GDP resulted negative and positive in all the models.

The variables that concern our study gave the expected sign which may verify our hypothesis in the paper. The sign of the coefficient for the relative efficiency is negative, while the coefficient of absolute efficiency is positive. The significant negative sign for relative efficiency may tell us that the local management does not affect real rate of return. However, absolute efficiency may increase real rate of return. The latter variable measures management of an AFP within the whole set of private pension institutions in the region.[25]

The latter result is relevant for the policy maker because local market power does not guarantee a good performance in the portfolio of AFPs. The boom in Latin American economies (A coming test of virtue, 2008) may permit a local stock market to be outperformed, but local management of private funds does not influence the portfolio of AFPs. The performance of an AFP´s portfolio is linked to external macroeconomic shock but not to good internal management. However, the latter result differs if an AFP has an outstanding absolute efficiency which means that it has good management in comparison to all its partners in the region. An AFP may be the best in its country, but this is not necessarily to the result of its management's efficiency.[26]

Conclusions

This study shed light on the role of market power in the private pension funds in Latin America. Our results support the view that local economic benefits may have induced excellent performances in the stock market and, consequently, increased the real rate of return of AFPs.

In our sample, local management of AFPs does not explain good performance in the portfolios of these private pension funds. This suggests that local market power is not enough to create a good portfolio for AFPs. In contrast, absolute power in the market is important and significant in the portfolio of private pension funds which means that large AFPs operating on a significant scale are able to diversify better.

The recent international crisis or other external and negative shocks would reduce the good performance of the stock market in the region, and hence, policymakers in the region should monitor the necessity for good management of the funds.

Future research may extend this analysis by exploring in more detail the implicit mechanisms between relative and absolute efficiency with real rate of return.

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Footnotes

1. Crisis manifested itself by liquidity issues mostly in developed countries like the United States and Western Europe. It permitted banks to foreclosure and triggered developed countries to slowdown. For further information regarding this issue, see Kiff and Mills (2007).
2. The DEA methodology was formally introduced in a seminal paper by Farrel (1957) and later estimated by Charnes et al. (1978).
3. In Latin America, a centralized pension fund may work when the government manages the funds with the private sector.
4. Most countries regulate their AFPs by a "Superintendencia," but in Uruguay, the Central Bank assumes the role.
5. We do not have information for Dominican Republic even though it has seven AFPs: BBVA Crecer, Caribalico, León, Popular, Reservas, Romana, and Siembra.
6. The percentage of investment abroad may vary for each country.
7. It basically reduces the diversification of portfolio.
8. For more about retail, see Vittas (1998).
9. We mean by transfer of funds, the right of a contributor to switch between AFPs within a country. There may be some limitations that vary by country.
10. This is not the case for El Salvador because there are just two AFPs there. They each have half of the contributors in this country.
11. Bravo (1996) explained the evolution of the rate of return in a different way.
12. In our case, the DMUs are AFPs, but there are several studies that use DEA for banks, hospitals, colleges, departments, etc.
13. See Charnes et al. (1978) for a more complete explanation of this problem.
14. There is another approach besides the input-oriented model which is called the output-oriented model. The maximization of outputs is the dual of the linear program introduced by Charnes et al. (1978).
15. There are models that include constant returns to scale (CRS) instead of VRS. VRS signifies that in a production process, the operations will follow increasing or decreasing returns to scale. Note also that some firms that have not been efficient in the models so far may become efficient if we allow a variable returns to scale assumption (relaxing the CRS assumption).
16. See these definitions in Cooper et al. (2004).
17. CAMEL stands for Capital, Asset Adequacy, Management, Earning, and Liquidity. DEA is the proxy for management assessment.
18. This guarantees reliability of our DEA scores because the efficiency scores show a consistent measure over the time.
19. Bootstrapping is based on the idea of repeatedly simulating the data generating process (DGP) by re-sampling and plugging the original estimator to each simulated sample so that the resulting estimates mimic the sampling distribution of the original estimator. We follow the Bootstrap commands posted by Wilson (2007).
20. We have in total 876 AFPs for the whole region.
21. We had to withdraw Bolivia and El Salvador because of lack of information.
22. However, Barrientos (2001) considered the inverse of this variable as a proxy of regulation. We are more specific when approximating for regulation.
23. Along these lines, Aggarwal et al. (1999) identified high volatility of stock markets during the Mexican peso crisis as well as during high periods of hyperinflation. In addition, Poterba and Summers (1984) showed that shows in the stock market do not persist. Our sample is short in the period of time analyzed.
24. Hamilton and Lin (1998) found that economic recessions are the primary factor that drives fluctuations in the volatility of stock returns.
25. Barrientos (2001) concluded the same for Chile but did not make a measurement of efficiency in absolute or relative terms.
26. Forster and Shaffer (2005) concluded something similar for the banks in Latin America.
27. Consider the average of each country for the period 2005-2007.
28. It has been multiplied by 100 for scaling issues.
29. As of January 2007.
30. As of January 2007.
31. We have taken an average of AFP efficiency in each country too.

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