A Study on Financial Risk Analysis in Pension Funds Investment: an Implication of Exchange Rate Exposure

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Abstract: This paper tried to unveil the multifarious risks that were contained in pension fund investment. Apart from analyzing the exchange rate risk that affects the optimal value of pension funds firms，the content of the paper revealed two major risks: financial market related risks and non-financial market risks. Even though risk cannot be eliminated totally but with effective portfolio management of securities asset, risk can be diversified. It is recommended that pension funds companies should establish an ERM unit to be headed by an expert in both risk and investment analysis to enable them mitigate risks efficiently and effectively.
Key words: Define Benefit (DB); Define- contribution (DC); Enterprise risk Management (ERM); Exchange rate exposure

1 Introduction

Over the past two decades, pension industry witness incessant reforms globally, with many countries shifting from government managed pension system to privately managed pension system. Considerable size of literature explains different reforms that had taken place in many countries such as Korea (Jung and Walker, 2009) Latin American countries (Muller, 2000) Russia (Millar and Devonish, 2009) Nigeria (Casey, 2009) Portugal (Garcia 2010) and so on.

A pension is a representative of a long standing obligation to retirees to support sustainability of their consumption in retirement (Millar and Devonish, 2009). Predominantly in the past, pay-as –you-go (PAYG) system was the prevailing modality of pension management, but due to its inherent inconsistencies coupled with changing life expectancy rate, income level and demand for macro – economic adjustment, pension liabilities have been considered as one of the crucial financial expenditure that affects economic instability of many nations. Accumulated pension liabilities accrued over trillions of dollars. This serves as a motivating factor why many countries particularly the advanced nations implement pension reforms in order to secure optimal solution to pension problems.

According to the World Bank report (2006), pension systems have become a source of macroeconomics instability, a constraint to economic growth and an ineffective and or multiple provider of retirement income. In the 1990s, the World Bank took a leading role in pension reform. The bank strategy for pension reform is formalize in social protection sector strategy; from Safety Net to Springboard (World Bank, 2001) which sets forth a multi-pillar framework consisting of (1) a publicly managed tax- finance pension system (2) a privately managed funded schemes and (3) voluntary retirement savings.

The fundamental objective of the reform in the pension industry is to ensure safe income for the retirees and at the same time boost economic activities of a given countries through investment of the pension funds. Chile is one of the countries that reaped the fruits of the reforms implemented in 1981 that led to achieving high economic growth more than projected. Today, Chilean pension reform has become a conspicuous model copied by many countries including US and Nigeria.

Understanding the concept of risk is very vital for the pension funds survival and success. Bernstein (1996) asserts 'the revolutionary idea that defines the boundary between modern times and the past is the mastery of risk', the implication is that for institution to be modern they must have mastered risk. By this standard, most pension funds are not yet modern institutions, for they are still struggling with both the concept of risk, and the practicalities of managing and measuring it in useful ways.

Managing risk is a fundamental concern in today's dynamic global environment. In recent years, however, a paradigm shift has occurred regarding the way to view risk management. Instead of looking at risk management from a silo-based perspective, the trend is to take a holistic view of risk management. This holistic approach toward managing an organization's risk is commonly referred to as enterprise risk management (ERM). A general argument gaining momentum in the literature is that the implementation of an ERM system will improve firm performance (e.g., see Lom, 2003; Hoyt and Liebenberg, 2009). However, according to Casuality Actuarial Society Committee on Enterprise Risk

Management (2008), ERM is define as the discipline by which an organization in an industry assesses, controls, exploits, finances, and monitors risks from all sources for the purpose of increasing the organization's short and long term value to its stakeholders.

The objective of this paper is to identify and evaluate the risks associated with pension funds investment. The analysis of risk is strictly base on privately managed funds scheme, which is more commonly found in many countries. The remaining part of the paper is structured as follows: Section 2 presents perspectives of pension funds management that entails Defined Benefit (DB) and Defined-Contribution (DC). Section 3 analyses risks factors associated with pension funds investment. Section 4 explains measure of pension fund risk, while section 5 describes risk mitigation and the last section concludes.

2 Perspectives of Managing Pension Fund

In a general perspective, there are two extremely different ways to manage a pension fund. First, the pension fund can be managed through Defined-Benefit Plans (DB), where benefits are fixed in advance by the sponsor and contributions are initially set and subsequently adjusted in order to maintain the fund in balance. In other words, DB provides a guarantee by the pension agency or government that a pension will be paid based on a prescribed formula in which contribution may not be tied actually to benefits. Secondly, pension fund can be managed through Defined- Contribution Plans (DC), where contributions are fixed and benefits depend on the returns on fund portfolio. In other words, DC provides a pension plan in which a periodic contribution is prescribed and the benefit depends on the contribution plus the investment return. In particular, DC plans allow contributors to know at each time the value of their retirement account.

Historically, fund managers have mainly proposed DB plans, which are definitely preferred by workers. In fact, in the case of DB plans, the associated financial risks are supported by the plan sponsor rather than by the individual member of the plan. Nowadays, most of the proposed pension plans are based on DC schemes involving a considerable transfer of risks to workers. Miller and Devonish (2009) assert that there has been significant shift from DB pensions to DC pensions. It is common knowledge that this shift from DB to DC has placed greater responsibility on the pension holders (in term of the capital and asset allocation surrounding their contributions), and this may result in inadequate or sub-optimal investment decisions.

One factor that affects investment is lack of finance knowledge. For example, what is riskier between money market securities and government bond? to many investment analysts or those marginally knowledgeable about investment, this is definitely an elementary question. However, researchers found that many individuals Lack general knowledge surrounding finance and investment, thereby prone to make wrong investment decisions pertaining to their pension assets portfolio.

3 Risk Assessment in pension funds investment

Risk and return are the major determinants of any financial decisions in business organization (Kurfi, 2003). Risk therefore provides a basis upon which an investor considers in selecting investment on security before investing his money. There is no doubt that every investment is associated with risk hence these risks need to be analyzed to make profitable investment.

Generally, the risk of any given security can be divided into two parts, Systematic and Unsystematic risk. Systematic risk occurs due to overall market risk such as changes in the economy, tax reform, exchange rate fluctuation, interest rate fluctuation, stock market crash, earthquake, changes in the world energy situation and so on. These risks affect all securities and consequently cannot be diversified away by any investment; therefore, it is the only type of risk that investors will pay to avoid (Olowe, 1997).

Unsystematic risks are caused by factors that are unique to a particular company, for example strikes, changes in management, competition, shortage of raw materials, changes in technology and so on. Since these risks do not affect all securities, which means with efficient diversification these risks can be reduced or even eliminated.

The optimal asset allocation for a pension fund involves several complexities, the accumulated pension funds are normally invested in financial markets or real estate, the purpose is to secure returns that will be paid back to workers at their retirement period. Financial markets consist of three assets: a riskless asset, a stock and a bond, which can be bought and sold without incurring any transaction costs or restriction on short sales.

Table 1 The Evolution of Risk management by Financial Institutions

Area	1970	1980	1990
Regulation	Rates regulated	Deregulation	Globalization
Strategy	Grow	Deal with disintermediation	Consolidate and integrate
Technology	Mainframe	PCs	Powerful PCs in networks
Financial innovations	Futures	Swaps, options, mortgage backed securities	Structured production Exotic Derivatives
Credit markets	Inflation	High risks to	Stability low rates
Risk concerns	Aggregation of Data	Measurement	Enteprice risk
Risk management tools	Portfolio Aggregation	Duration	Value at Risk (VAR)

Adopted from Ambuchtsher (1988)

The table above describes the process of risk management evolution in the financial industry. Starting from regulation, implementation, to the application of risk management tools which aids organization in managing and controlling risk. The process involves identification of risk and designing effective method to handle the risk. The twenty first century exposes a new risk trend that devastates global economy; this risk is financial meltdown that led many financial institutions to bankruptcy status. The overall effect of the economic recession open new chapter of managing risk not only by the financial organizations (pension funds inclusive), but also by non financial institutions.

In broader perspective, pension fund investment faces two major classes of risks; firstly, financial market risks which relate to the asset price and includes among others exchange rate exposure which affects overall firms` value. Secondly, the background risks, which consist all risks outside the financial market like salary and inflation. The main background risk is associated with worker contributions which are akin to the labor income for workers. Below is the brief explanation on some risks associated with pension fund investment.

3. 1 Labor Income Risk

Wage fluctuations and possible job termination are one of the risk factors that affect contributions of workers to pension fund. Since salary is the determining factor of contribution particularly in DC plan, which is commonly, practiced by most countries. Pension fund computation normally assumes stable growth of income, where reverse is the case, computational complexity arise, which eventually affects retirement plan. Empirically, individuals' saving rates as well as the share of savings invested in stocks depend strongly on income. In particular, members of the two bottom quintiles of the income distribution do typically not invest in stocks, neither directly or indirectly. In contrast, members of the highest quintile invest about 55% of their portfolio in stocks. This suggests that optimal risk management of old-age provision varies, indeed, substantially with income (Binswanger, 2007)

3.2. Inflation Risk

Demand-pull theory suggests that inflation is caused by the increase in demand. On the other hand cost-push theory implies that inflation is caused by the increase in production costs, which are passed on to final goods prices. Common stocks are for long being regarded as an effective inflation hedge because stocks represent ownership of physical capital whose real value is independent of the rate of inflation. However, the study by Fama and Schwert (1977) which estimated the relation between stock returns and proxies of expected and unexpected inflation. Contrary to other assets, such as real estate, stock returns were found to be a poor hedge against both expected and unexpected inflation for the 1953 – 1971 period in the United States. These results were confirmed for other major stock markets by e.g. Solnik (1983) and Gultekin (1983). Instead of being an inflation hedge, stock holdings turned out to suffer from considerable exposure to inflation risk.

There is no doubt that pension fund investment, as any other investment cannot be exonerated from inflation risk given the fact that the time horizon for pension fund investment is longer. The possibility of inflation to reduce the optimal value cannot be ruled out even in countries with high macroeconomic stability. Hence Individuals saving for retirement must make sure their wealth finances their expenses in retirement, whatever the inflation scenario. The liabilities of pension funds and endowments are likely to increase in nominal terms with inflation.

3.3. Interest rate risk

Interest rate volatility affects expected return of the pension fund investment. Realistically, long-term fixed-income securities, such as bonds and preferred stock, subject their owners to the greatest amount of interest rate risk. Short-term securities, such as Treasury bills, are influenced much less by interest rate movements. Common stock prices are also affected by changes in interest rates,

although the linkage is less clear than is the case with debt securities and preferred stock. However, Penman and Nissim (2003) claim that equities do not provide a complete hedge against changes in inflation (nor, indeed, against changes in real interest rates), and therefore challenge the interpretation that the negative relation between changes in interest rates and stock returns is due to market inefficiency. Penman and Nissim (2003) therefore, conclude that the net effect of changes in interest rates on equity value is negative, consistent with the documented negative association between changes in interest rates and contemporaneous stock returns. Yourougou (1990) report that for every subset of securities interest rate risk is present.

Thus, Berk et al (1999) recommended that periods of high interest rates should be followed by lower risk premia in equities because fewer high-risk investments will have been undertaken. Interest risks as part of the systematic risks therefore need to be analyzed properly by pension funds manager in order to make proper investment at the right time.

3.4. Investment and annuity risk

A recent model for DC pension scheme in discrete time is proposed by Haberman and Vigina (2001). In particular, they study both the "investment risk", that is the risk of incurring a poor investment performance during the accumulation phase of the fund and the "annuity risk", that is the risk of purchasing an annuity at retirement in a particular recessionary economic scenario involving a low conversion rate. Annuity is a stream of payments at a specified rate that may have some provision for inflation proofing, payable until some contingency occurs usually the death of the beneficiary or a surviving dependent. In other words, it is the contract that guarantees income right up to the point of death (Butler and Teppa, 2007).

Consider a case of an employee who at each period **t** contributes a constant proportion of his salary to a personal pension fund (DC). At the time of retirement **T**, the accumulated pension fund will be converted into annuity. The process involves investment by the pension fund managers, which requires proper and sound investment decisions to avoid high risk. The accumulated fund at the retirement needs to be tactifully converted into worthy annuity. Failure to observe this may jeopardize the stream cash flow of the employee at the retirement period.

3.5. Pension funds managers' risk not being company owners

Pension fund managers who happened to be institutional investors are deprived the opportunity to take ownership of the companies even if they possessed greater percentage of the shares. This poses a great risk to the operation of the pension fund managers because they cannot be part of the decision making body of the company they have high stake. Hutton (1995) argues that pension funds have become classic absentee landlords, exerting power without responsibility and making exacting demands upon companies without recognizing their reciprocal obligations as owners. Short and Keasy (1997) suggest that once pension funds are locked in, it is costly to get involved in monitoring and they cannot exit in case they are considered to trade on insider information. Murphy and Van Nuys (1994) argue that pension funds are run by individuals who do not have the proper incentives to maximize fund value.

Going by this trend, it clearly shows that pension funds are exposed to hidden risks, because they may not have access to the relevant information about their substantial investment and cannot offer any valuable suggestions as per the management affairs concerned. This may lead to unwarranted loss, which subsequently may affect workers pension plan.

3.6. Longevity risk

In the context of retirement investing, longevity risk refers to the probability of investors outliving their assets or under living their assets i.e. not fully enjoying their assets due to the under-spending (Jacobsen et al, 2009). Viewing longevity risk from a traditional asset/liability perspective highlights the factors that may increase or decrease an investor's exposure to the risk. On the asset side of the equation, participants' contribution rates and portfolio return characteristics are key variables; on the liability side, major drivers include during-retirement income requirements, portfolio returns, and life expectancy. Therefore, Jacobsen et al (2009) advocate that a common method of evaluating longevity risk is to make assumptions about participant income, contribution rates and distribution rates and then simulate asset returns to generate terminal wealth distributions, or the likely range of wealth levels at either the point of retirement or expected mortality.

3.7. Lack of intergenerational-risk transfer

In a competitive financial market, the inability of current generations to share their risks with those who are not born yet makes these markets incomplete, thus inefficient. This point was made by Gottardi and Kubier (2006). In a funded system with individual pension accounts, the absence of any intergenerational sharing of individual portfolio risk implies that workers face high uncertainty on their

future pension wealth. In the recent past, many workers had to reduce drastically their standard of living and to work longer after sizeable down turns of financial markets, this inability of market to allocate risk efficiently across generations has been used to argue in favor of more public intervention, in particular, in the form of stronger pay- as- you go (PAYG) systems.

By using their financial reserves efficiently, pension funds according to Goller (2007) can smooth shocks on their asset returns and can thus facilitate intergenerational risk sharing. In addition to the primary benefit of improved time-diversification, this form of risk allocation affords the additional benefit of allowing these funds to take better advantage of the equity premium, which also favors the consumers. Goller (2007) estimate that the certainty equivalent return of the pension saving scheme goes from 3.23% per year to 3.76% when intergenerational risk-sharing is introduced

3. 8. Asset mix policy risk (asset portfolio)

The portfolio theory developed by Markowitz (1952) suggests that a rational risk averse investor selects securities based on the risk return trade off that maximizes his expected value of returns given a level of risk. In Markowitz framework, diversification eliminates unsystematic risk leaving the systematic risk among securities untouched. Pension funds face enormous risk arising from optimal portfolio problem. Portfolio construction involves combination of risky and riskless securities that optimize returns.

In order to achieve optimal portfolio, Battocchio and Menoncin (2004) suggest that (i) the wealth percentage of pension fund invested in stock shall decrease through time (ii) on the opposite the wealth percentage invested in the riskless asset shall increase through time (iii) the optimal percentage invested in the bond decreases. This means that the fund managers must have a more aggressive investment strategy in order to accumulate higher revenues during the first period, while he can reduce the portfolio riskiness as the retirement approaches.

Generally, on the financial market there are one stock, one bond and a riskless asset. A pension fund manager must use knowledge and experience in constructing portfolio. As noted by Battocchio and Manoncin (2004) inflation process changes the riskless assets into a risky asset. In fact, the original risky assets are no more able to guarantee a riskless return because it cannot hedge against inflation risk.

3.9 Exchange rate risk

As discussed above substantial portion of the pension funds investment are often channeled either into capital or money market. The bulk of the funds are invested on the stock market which is consistently exposed to several risks. The performance of pension funds largely depend on the stock market performance since the accumulated stock returns realized over specific period of time is part of what is computed as final annuity for workers at their retirement period. In essence whatever affects the firms` value of quoted companies equally affects the overall value of pension fund investment, hence the implications of exchange rate volatility needs to be considered when making investment decision.

Foreign exchange exposure has been defined as the sensitivity of the market value of the firm to unanticipated exchange rate movements. Therefore according to Doukas, Hall and Lang (2003) exchange-rate effects are dependent upon the firm's (i) foreign exposure (i.e., determined by its operating revenue, cost exposure and its operating cash flow margin), and (ii) use of foreign currency hedging instruments. Dumas (1978) also argues that currency exposure contains an ''operational'' element that accounts for the firm's responsiveness to exchange-rate movements that may lessen the exchange-rate effect on the firm's market value.

However, firms with low foreign international involvement are more likely to have low foreign currency exposure and consequently be less affected by exchange-rate fluctuations. Domestic firms may also be affected by unexpected exchange-rate fluctuations through changes on aggregate demand or on the cost of imported inputs; domestic firms that Compete against importing firms will also be exposed to exchange-rate volatility.

The growing emphasis on exchange risk management, the extensive use of foreign currency derivatives and other hedging instruments by corporations to protect their foreign currency denominated cash flows from unexpected exchange rate volatility, implies that the market value of the firm is sensitive to exchange rate variability. One important issue which needs to be clarified precisely is whether contemporaneous or non-contemporaneous relationship do exist between unexpected exchange rate volatility and firm`s value? Bartov and Bodnar (1994) argue that current stock price adjustments are influenced only by lagged exchange-rate movements, while Doukas, Hall and Lang (2003) found in their study a significant relationship between Japanese stock returns and unanticipated yen fluctuations.

From the empirical evidence highlighted above it can be clearly understood that there is the need for the pension fund managers to always consider possible exchange rate risk in constructing pension

funds investment portfolio in order to secure optimal returns. It is worthy to note that pension fund investment is not restricted to only domestic firms that operate solely within a defined territory of domestic economy rather it is extended to Multinational corporations that operate in several countries and are vulnerable to enormous risk of exchange rate volatility.

4 Measuring Pension Fund Risk

According to Ambuchtsheer (1998) a good pension fund risk management tool must be able to deal with the conceptualization and measurement of asset mix policy risk. He suggested the following techniques of measuring risk.

(1) The Right Return Metrics: Asset mix policies risk will depend on the potential deviation between a funds policy return and fund liability return (estimated return on a portfolio of default-free bonds with the same duration and inflation sensitivity as the pension liabilities)

(2) Estimation Return Shortfall Magnitudes: The key metrics are the volatilities of the two sets return deviation (that is, deviations between policy and liability return and between actual and policy return). In both cases, a negative deviation will lower the pension plans funded ratio.

(3) Converting to meaningful Economic consequence: A useful first step is to convert the estimated return deviation volatility associated with any contemplated decision into an adapted value-at risk (VAR) metric.

(4) Decision Monitory and Assessment: Risk exposure decisions should be made on the expectation that the payoff from undertaking a given level of risk will be sufficiently rewarded. This requires that actual risk exposure be monitored against decided (or maximum permitted) risk exposure, and that the actual value being created by the fund be monitored against expected or required value.

5 Mitigating Risk

Mitigating risk is one of the most complex jobs of managers that demands careful attention. Unlike in the other businesses where absolute investment freedom is accorded, pension funds investment is strictly guided by government regulatory agency to avoid taking excessive risks. In many countries, investment into equities by pension funds is restricted to a certain fixed percentage. This is done to ensure risk reduction and safe returns to retirees. For example, in USA investment in equity by pension funds manager is not exceeding 35%, in Nigeria 25% and UK 80%. Even though investment ceiling on equity has its own predicament because riskless securities attract meager returns, the idea is good, it hedge against excess shortfall in return as a result of stock market crash, just as it happened in the last two years. A recent survey conducted by National Association of pension funds (2009) shows that DB plans will be severely affected by the financial crisis, which led to closure of DB schemes currently open to new employees.

Furthermore, it has been suggested that funds, which switch to safer investments as the member nears retirement would be redesigned to ensure that people are protected from very severe falls at key switching point, hence;

DB scheme members would gain if investment risks were reduced, returns are increased and/ or scheme administration costs are reduced as schemes benefit from scale economies.

DC members would benefit from larger pensions if the investment strategy is better and costs are less as tends to be the case with larger schemes.

More often than not, pension funds managers should persistently pay attention to the exchange rate risk effect by investing their funds in firms that effectively hedge against unwarranted exchange rate volatility, this in turn would enhance the risk management techniques and safeguard workers retirement funds against severe losses. Firm particularly Multinational corporations (MNC) who incorporate financial derivatives stand better chance of mitigating currency exposure and thereby provide less risky investment opportunities for pension fund

Government regulators and the pension industry must work together to mitigate the drags in pension provision. Some countries established pension funds protection schemes in order to safe guard retirees' funds, an example Pension Benefit Guaranty Corporation in US and Pension Protection Fund in UK.

6 Conclusions

In this paper, we tried to investigate the common risk factors that are associated with pension investment. Several literatures were reviewed to articulate the different risks. Two major risks were

identified, background risks and financial market risks. The former relate to salary and inflation risk and the other non-financial market risk, while the later refers to the risks associated with asset pricing. Portfolio construction problems and ownership deprivation of pension funds of the company they own high investment are two key risk factors that were highlighted. Moreover, exchange rate risk which permeates through all kinds of investment were equally analyzed in relation to pension funds investment, the finding reveals significant relation between exchange rate exposure and value of pension fund equity. Method of measuring risk of pension funds investment has been concisely described. It is recommended that there is the need for the pension funds managers to exploit more of the real estate market benefits, because the rate of volatility is minimal compared to equity market. Moreover, pension funds companies should endeavor to establish an ERM unit to be managed by risk and investment expert who can accurately evaluate risks and conduct investment analysis no matter what cost. This will marginally reduce the amount of risk incurred by the pension funds managers.

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