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# The impact of pension financing on company performance

## A comparison between the PRI-method and the Alecta-method

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# *Abstract*

The aim of this study is to examine whether the risk and return of Swedish companies differ depending on the way they meet their pensions obligations. In particular we compare the two possible solutions for financing ITP2, that is the PRI-method, where pension provisions are invested in the companies' assets and kept as a liability on the balance sheet, and the Alecta-method, where pension provisions are invested in a pension fund by the insurance company Alecta. We also investigate whether the relative benefit of choosing one method over the other differ across industries.

In order to measure the risk and return, we use return on equity and to evaluate our hypothesis we use the paired sample t-test, binomial test and rank sum test. We use data from 46 Swedish comparable companies between 1961-2016. We find that companies that use the PRI-method perform marginally better than companies using the Alecta-method. We also find that companies using the Alecta-method have more volatile returns than companies using the PRI-method. However, neither of these differences are significant. Furthermore, we do not find any evidence that companies within a particular sector benefit more by using one method over the other.

*Key words:* Pensions, ITP2, Discount rate, PRI, Alecta

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# 1. Introduction

*If your own company would outperform whatever pension fund available and would give a higher return on money invested than the interest rate payments offered by them, why then would you like to give this money away? Are you possibly lacking faith in the vitality of your firm? Certainly not! ...but securing the pension liabilities in a pension fund will lead to a more diversified placement of the engagement and thus minimize the risk for the employees to lose their pensions. But what if there was an insurance that would create risk shifting so that the former employees will receive their pensions anyhow? Tell me more!*

In Sweden the legislation on pension systems has divided the pension liabilities into different classes and sub-classes. One of these classes, concerning the pension of officials born before 1979, is called ITP2. The management of these pension liabilities from the companies' point of view can either be transferred to Alecta which has a special mandate from the state to invest the capital in financial assets providing diversification and then assure reliable payments, or it can be kept at the firm's own Balance Sheet using the model called Pension i Egen Regi (PRI) which is insured by Pensionsregistreringsinstitutet (PRI NGO) in order to enable the capital to keep working in the company. The latter solution implies in other words that the pension liabilities are being part of the operating capital of the firm instead of being transferred to Alecta to be invested by them.

Keeping the pension liabilities on the Balance Sheet means that they must be valued at fair value using a discount rate. PRI NGO uses a fixed discount rate of 4 percent to value the pension liabilities now and in the future. PRI NGO also use this rate when they charge the company for the insurance they offer. This discount rate is supposed to represent the Swedish Treasury Bond rate which it also did when it was established in the 1990ies by PRI and several other institutions in the Swedish society. Since then, the treasury bond rate has fallen steadily, and has thereby put the discount rate used by PRI NGO into question.

The magnitude of the pension liability in the balance sheet implies that small changes in the discount rate has large impact on the valuation of that liability. Thus, a discount rate that is inadequately high creates an undervaluation of liabilities and hence an overvaluation of

equity. Earlier research shows that accounting and funding of pension plans plays a significant role in the valuation of equity (Parkhomovsky, 2010).

Nevertheless, PRI NGO refers to a discussion paper (Keating, 2010) which advocates that the discount rate should not mirror the Treasury Bond rate but rather the company's return on equity. PRI means that the discount rate of 4 percent is well below the PRI-companies return on equity and accordingly, the pensions liabilities are not undervalued.

Keeping the provisions for pensions on the Balance Sheet is motivated by PRI as an important source of internal financing. Yet, choosing to do so also implicates greater financial risk due to additional leverage which, in accordance with financial assumptions (Modigliani and Miller, 1958), leads to a higher expected return on equity.

The purpose of the thesis is to elaborate on whether there is any empirical foundation to this last statement. The formulated question is interesting because it might contribute to giving an answer on whether keeping pension liabilities on the balance sheet generates a higher return compared to transferring them to a pension fund like Alecta. The question also sheds light on the long-term return for Swedish companies in general and companies following the PRI method in particular. Thus, the relationship between return on equity and pension funding, the long-term level of return on equity and the validity of PRI's discount rate will be investigated.

The research presented in this thesis finally manages to confirm the idea that the companies following the PRI method seem to produce a higher return on equity. This result holds for what concerns individual groups of companies belonging to the same Global Industry Classification Standard group (GICS) where, in many of the presented cases, the companies choosing to keep their pension commitments on the balance sheet have a higher return on equity than the ones transferring the responsibility of the pensions to Alecta. The same result is also confirmed by the entire group of companies in general, that is, all the companies that take part in the investigation combined.

From the beginning of the PRI method in 1961 we can see this pattern but by making visible this fact we do not claim that the choice of method for dealing with pension liabilities is the only reason for this outcome. A general higher leverage ratio in the companies that have

chosen the PRI method and with it, the internal source of financing it provides, might also be part of the reason for the higher ROE presented.

Because of this, the thesis does not claim that the sole reason for the higher perceived ROE of the PRI companies is their choice of keeping the pension liabilities on the balance sheet and borrow this money from their pensioners. Yet, it is one of the many choices available to all enterprises concerned in this thesis. This leads to it being a fact that the possibility of this change in capital structure of the companies is restrained primarily by the decisions of the owners and the contracts with existing debtholders. This being a fact we investigate whether it is a profitable idea for the companies to choose the PRI model, since it's an option available to all meaning that it implies alternative costs for the companies choosing to deal with their pension obligations for ITP2 in another way.

# 2. Background

## 2.1 In the aftermath of a war

In the beginning of the 1960's, the temperature in the Swedish economy was high. Striking demand from countries whose capital was destroyed in World War 2 created large pressure on Swedish industry (Berner, 2018). This created substantial capital needs in the Swedish industrial companies. Yet, the capital and credit markets were constrained at this time and it was difficult for capital to flow across borders.

For the context given, a pension solution called Pension I Egen Regi was presented in 1961 as a means of promoting internal financing for Swedish companies, especially for engineering and heavy-industry companies. The solution implied that the companies could now keep pension liabilities for officials / white collar (ITP) on the balance sheet to fund the operating capital of the business and have it insured by an insurance company (PRI NGO) instead of being transferred to a pensions fund.

In other words, the PRI method allows the money that must be put aside for pensions to be kept in the company and not transferred anywhere else which will mean that the company employing this method will be borrowing this money from their future pensioners. The purpose of this solution was to give companies a possibility to meet their needs of financing from other directions than from a financial market that couldn't meet their demands.

In Sweden, Alecta has a monopoly in the external managing of ITP pensions. By choosing the PRI-model, the company must nevertheless sign a credit insurance which insures the employee. Thus, the PRI-model is not riskier than Alecta from the employee's point of view. However, from the company's point of view, the PRI-model does not transfer risk to Alecta but rather keeps it on the part of the company.

The positive effect is that capital is released and can be used for investment activities. Yet doing so will also affect the capital structure of the companies choosing to do so, which

remains an important aspect to take into consideration since this has implications for the perceived risk of the company as well as its ability to attract financing from external sources. The thesis investigates whether this choice has been beneficial for the companies that have decided to so, both in general, on average across the different sectors as well as within the different business sectors studied.

## 2.2 The Enron Scandal

Companies managing the pension liabilities themselves investing them in their own stock (assets) by keeping them at the company's balance sheet, seems to be a risky way to go for any enterprise and the infamous entrepreneur of the deregulated American energy market, Enron showed the world in the beginning of this millennia just how bad it could go in this aspect, not mentioning the several other devastating effects that developed in the aftermaths of the scandal.

In the Enron scandal the pension plan assuring stable payments for the retired employees of the company, valued to a recognized value of 2 billion dollars, completely disappeared leaving the pensioners empty handed. This was because the company chose to give as security for their pensioners their own company stock. The problem was that the stock they had was largely inflated due to deceptive book keeping and fake companies and transactions being a large part of the value presented in the books.

The disaster this resulted in for Enron's pensioners made a global impact and showed the world the importance of an assurance for the pensioners so that they are not the risk takers of the added leverage or the company's risks in general. The frightening case is thus promoting the PRI method, even if it might seem discouraging at first it is also important to remember that PRI NGO are also the ones that insure the pensioners payments. (Gibney 2005) (BBC 2002).

## 2.3 RR29

The shock to the system caused by the Enron Scandal, eventually forced the world to adapt regulation in order to prevent a similar catastrophe to reoccur in the future. In the United States this regulation was represented by the Sarbanes Oxley Act passed by the Bush government in the end of the year 2002.

With this thesis focusing on the Swedish market and primarily describing the situation presented to Swedish companies, having the possibility to choose between the PRI solution or the Alecta pension fund, the Swedish response to the Sarbanes Oxley Act is of a higher interest.

The Swedish institution Redovisningsrådet (Bokföringsnämnden), responded quickly to the Sarbanes Oxley Act by presenting the Swedish regulations in December 2002. The extensive recommendation is called RR 29 (Redovisningsrådet's Recommendation 29) and has been of utter importance to PRI, not least in the contact they have with their customers and the transparency they need to embody ever since.

The purpose of RR 29 stated in its beginning is to give directives on how remuneration to employees, and thereby pensions shall be dealt with regard to book keeping and practice. It describes that remuneration after ended employment should be classified either as contribution plans or benefit plans. It clearly states the conditions for money to be transferred to solutions like Alecta and how this is to be dealt with concerning accounting issues.

Regarding the PRI alternative it states that alternatives of this sort might be done either fully or partly, leaving some parts of the pensions obligations to a pensions fund while keeping others on the balance sheet. It does, in other words, allow a hybrid alternative.
Witnessing of the connection to the Sarbanes Oxley Act and thereby the Enron scandal are the limitations and guidelines to in what way a company might remunerate by distributing its own stock. (RR29) (Bush 2002) (United States Securities and Exchange Commission 2002).

## 2.4 The four percent discount rate

Another hallmark that is given a high importance in the industry, by PRI and others, is the 4 percent discount rate which seems to be to some extent omnipresent. PRI NGO is presently using it as the discount rate of the pension liabilities in the companies that follow their method. It is used by several institutions and is sometimes referred to as the ASEK discount rate (Analysmetod och SamhällsEkonomiska Kalkylvärden), just a few of the institutions that are using it are: Naturvårdsverket, Trafikverket, Skogsstyrelsen and many others.

The four percent discount rate was established by ASEK in 1994 and presented as the level at which the 10-year Swedish Treasury Bond Rate would stagnate and be fixed around for many years to come. This was presented in a time when the Swedish 10-year Treasury Bond rate was in recession and the assumption seemed to hold in general for the first decade of the second millennium (Lilieqvist, 2010) (Trading Economics 2018).

Using the four percent discount rate would come to be one of the principles of PRI since many years and an integral part of their method.

A well-known international propagator for the model used by PRI is Dr Keating, Head of Research at Brighton Rock Group, an insurance company for pension schemes. Dr Keating is not seldomly cited by PRI for this purpose (Keating 2010).

Keating's idea on the four percent discount rate is a bit different though. Dr Keating claims that the discount rate of pension liabilities should mirror a company's return on equity rather than the interest rate for long-term government bonds. In the same discussion paper mentioned above, dr. Keating claims that:

*This [ROE] is the only rate which does not distort the company's balance sheet.*

This is due to the fact that a discount rate should reflect the opportunity cost of investing the money. If the provisions for future pension payments were placed in a bank account, the appropriate discount rate would be the interest rate on that bank account. However, if the

provisions were instead invested in the equity of the firm (its assets), the appropriate discount rate would be the company's return on equity.

Thus, the market value of the pension liability today is the sum of future discounted cash-outflows given that provisions for future pension payments is invested in the own company. Based on this argument, the discount rate of 4 percent would not distort the balance sheets of PRI's customers (undervaluing debt and overvaluing equity), given that their return on equity is equal to or higher than 4 percent.

PRI themselves have a hypothesis that the discount rate of 4 percent is well below long-term return on equity of Swedish companies and hence the PRI-companies. In this way, they justify keeping this level of discount rate. This thesis will test the legitimacy of that discount rate by studying long-term return on equity for Swedish companies. Since PRI-companies and Alecta-companies are compared, it will be possible to see the return on equity for the PRI-companies separately.

# 3. Theoretical framework and literature

As stated in the introduction to this paper, the aim of the thesis is to investigate whether the return on equity and fluctuation in return on equity differs between Swedish companies depending on the way they are funding their pensions.

The main hypothesis is that dealing with pension engagements by investing the money put aside as pension liabilities in the own companies' assets creates additional leverage (financial risk) compared to transferring the pension liabilities off the balance sheet and in to a pension fund.

Based on financial theories in the field, we will argue how this additional leverage might affect the company's return on equity.

The theoretical framework starts by explaining the connection between expected return and risk, followed by an explanation of risk-transferring through insurance, in the context of pension funding.

Thereafter, the issue of how additional leverage might affect liquidity for companies across industries is discussed, followed by an explanation of the trade-off theory between business risk and financial risk.

At last, pensions accounting is introduced in order to facilitate the reader's understanding of the background of this thesis and the discussions about the discount rate that the thesis treats.

## 3.1 Return on equity (leverage formula)

$$R_E = R_A + \frac{D}{E}(R_A - R_D)$$

The formula above describing return on equity (ROE) is central in describing the connection between expected return and risk. When a firm is unlevered, its return on equity equals its return on assets. As the firm adds on more leverage, return on equity becomes equal to return on assets plus the second term in the above formula. Fluctuations in return on assets is called operational risk or business risk, while the degree of leverage is called financial risk. Given a constant amount of business risk, adding financial risk increases investors' risk premium and thus expected return on equity.

"The levered equity return equals the unlevered return, plus an extra "kick" due to leverage. This extra effect pushes the returns of levered equity even higher when the firm performs well ($R_A > R_D$), but makes them drop even lower when the firm does poorly ($R_A < R_D$). The amount of additional risk depends on the amount of leverage, measured by the firm's market value debt-equity ratio, D/E." (Berk and DeMarzo, 2017).

The formula is more commonly described as Modigliani-Miller Proposition II as:

*The cost of capital of levered equity increases with the firm's market value debt-equity ratio.*

Even though Modigliani-Miller Proposition II concerns the return on *market* value of equity, the formula is equally relevant for describing return on *book* value of equity (Johansson & Runsten, 1975).

In the context of this essay, we choose to use the formula for book value of equity since we are studying how the companies' fundamentals are affected by their choice of pension funding. Hence, we are not interested in share price data (market value of equity).

Applying the theory above to the field of this essay, the methods of managing pension liabilities in ITP 2 can be viewed as being subject to financial risk to different degrees.

Transferring the pension liabilities to a pension fund (Alecta) eliminates the liability from the balance sheet and thus decreases the leverage ratio. Keeping the liability in the balance sheet (PRI) and investing it in the operating business however, increases the leverage and thus financial risk.

According to Alecta, the former method implies that *Alecta står den finansiella risken och eventuellt överskott går tillbaka till kunderna* (Alecta stands the financial risk, and any excess return is given back to the customers) while the latter method implies that *företaget själv står den finansiella risken och kan använda överskottet i den egna verksamheten* (The company itself stands the financial risk and has the possibility to invest the excess return in the company's business).

Applying the leverage formula to the field of this essay, thus suggests that companies that choose the PRI-method will have a relatively higher ROE and a higher fluctuation in ROE compared to comparable companies that choose the Alecta-method.

## 3.2 Transfer of risk

Investing pension labilities in a pension fund via Alecta does not only reduces financial risk for the company that holds the pension liabilities but also transfers the added financial risk caused by the pension liabilities, to Alecta as earlier mentioned. Thus, investing the liabilities in Alecta works as an insurance - a transfer of risk from the company to Alecta. The company becomes the insured party and Alecta the insurance company.

As with all kinds of insurances, they are not free but come with premiums. Thus, a company that has its pensions insured in Alecta pays premiums to Alecta in exchange for the transferring of risk that takes place. This issue is very well concluded by Rampini and Viswanathan (2010) who state that:

*Engaging in risk management and conserving debt capacity have an opportunity cost – current investment is foregone. This cost is higher for more constrained firms.*

The magnitude of pension premiums to Alecta is ambiguous but there is a trend showing that they are increasing. According to PwC (2010), the premiums for new customers in Alecta increased by 15% from March 1st 2017, which suggests that the premiums can dilute some of the companies' profitability.

Hence, this theory also suggests that the PRI-method may lead to higher ROE and higher fluctuations in ROE than the Alecta-method. However, this theory not only suggests that the PRI-method may cause higher ROE because of additional leverage but also because the PRI-method may be a relatively cheaper source of financing since it's price might not be justly prices due to the fact that the monitoring of the lenders, the company's pensioners, is not made thoroughly since it might lack proper organization since its stakeholders are many and not necessarily formed in the topic. This issue, that different sources of financing come with different costs is further addressed below.

## 3.3 Pecking Order Theory

According to this theory, different sources of financing comes at various costs. Due to an increasing extent of asymmetric information between lender (investor) and borrower (issuer), internal financing is the cheapest form of financing, equity is the most expensive, and debt is in between (Myers, 1984).

Asymmetric information in this context means that the more difficult it is for the provider of capital to evaluate the receiver of capital, the more risk the capital provider will experience. The well-organized capital provider will thus require a premium to offset the risk which makes borrowing more expensive. In this context, it is cheaper for the company to borrow money from itself from retained earnings (or from the companies' pensioners) than borrowing from a bank or the public market because of a lesser degree of asymmetric information.

With regards to the field of this essay, keeping pension liabilities in the firm instead of transferring them to a pension fund increases the internal capital that can be used for financing the firm. Thus, if a company is large and hence has a large pension liability, keeping the liability on the balance sheet will equate a substantial contribution to internal funds. Large corporations like Ericsson have historically had a pension liability exceeding 25% of total debt (Nilsson, 2018). The pecking order theory hence suggests that the PRI-method might provide cheaper financing costs than the Alecta-method which further suggests that these companies may have a relatively higher profitability and thus ROE.

This matter is addressed by PRI themselves:

*Genom att låta pensionspengarna stanna i företagen kan kapital frigöras. Pengar som kan läggas på produktutveckling, expansion och investeringar, utan att riskera den framtida pensionen.*

(By allowing the money for pensions stay in the company, capital can be liberated. Money can be put on product development, expansion and investments, without putting at the risk the future pensions)

The matter is also addressed in the earlier mentioned quote by Rampini and Viswanathan (2010) in the sense that risk management such as investing money in Alecta implies that "current investment is foregone" and "this cost is higher for more constrained firms". Constrained firms in this context means firms that are in great need of capital, thus firms with high investment needs having, for diverse reasons, a difficulty finding external financing.

In other words, it seems like Pension Egen Regi leads to higher liquidity and a larger amount of internal financing in comparison to the Alecta model. Thus, Pension Egen Regi might be a particularly useful solution for companies with high investment needs.

Until now, the theories described have suggested mainly advantages of the PRI-method but no real drawbacks. However, increasing financial risk through the PRI-method might come with additional costs due to the fact that there is always an optimal level of debt for a company. If this optimal level is exceeded, the costs of incurring additional leverage will exceed the benefits. This theory is discussed below.

## 3.4 Trade-off theory

According to Kraus & Litzenberger (1973) there is an optimal level of debt for any firm, which maximizes the value of the firm.

$$V^L = V^U + PV(Interest\ tax\ shield) - PV\ (financial\ distress\ costs).$$

If the firm does not have any leverage, it does not exploit the tax shield that comes from leverage. That is, the more leverage a firm incurs, the more interest rate costs can be deducted which shields the tax costs.

However, as the firm incurs more and more leverage, there will be a point where the costs of leverage will exceed the benefits. This is due to financial distress costs, which vary by industry and thus, the optimal leverage varies by industry. Distress costs can for example be a decreased credit rating of the firm as it incurs additional leverage which implies a higher cost of capital.

The present value of financial distress costs for a firm is determined for example by its volatility in returns and its ability to recover from a crisis. That is, a real estate firm has typically a high leverage because its cash-flows are fairly stable under normal conditions and it can liquidate assets relatively easily in a crisis. However, a manufacturing firm has typically a lower leverage because it is more cyclical and has large assets which are more specialized and difficult to liquidate (Berk and DeMarzo, 2017). Thus, there is a trade-off between business risk and financial risk.

With respect to this thesis, keeping pension liabilities on the balance sheet, the PRI method, implies additional financial risk which need to be weighed against the business risk according to the trade-off theory.

The firms that use the Pension Egen Regi are primarily the classical Swedish engineering industry and heavy industry companies. These firms typically have both cyclicality (due to high fixed costs) and specialized (non-liquid) assets. Does this suggest that they are not suitable for incurring the additional financial risk that Pension Egen Regi implies? Indeed, the

optimal firm, that is the firm that would benefit the most from using the PRI-method would in this context have:

1. Low business risk
2. A large number of employees (a large pension liability)
3. High investment needs.

Whether the type of firm that benefits most from using the PRI-method will have any of these characteristics will be examined in the thesis.

So far, the theories described have emphasized that pension liabilities are comparable to ordinary liability and that keeping it in the balance sheet therefore implies additional financial risk.

However, the pension liability is a specific kind of liability in the sense that it is a liability that the company owes its own employees and it comes with many accounting issues which affect its valuation. These issues, and their connection to the background of this thesis is addressed below.

## 3.5 Pensions accounting

The accounting for pension provisions is described in IAS 19 which says that a pension liability in the balance sheet must be valued at fair value.

*In its simplest form, the way to calculate this pension liability is to calculate the present value of all future pension obligations to the employees. The difference between the liability at year-end and the liability at the beginning of the year is the pension cost. The company has to cover losses but will also receive possible gains from value changes in the liability.*

*These gains/losses occur due to changes in so-called actuarial assumptions. Changes in actuarial assumptions are: change in yearly salary increases, the discount rate, the number of employed and the mortality rate. The gains/losses must be included in other comprehensive income (OCI).* (Malmqvist, 2018)

An actuarial assumption that has particularly large impact on the valuation of pension liability is the discount rate. A change in the discount rate of 1 percentage unit can make the value of pension liability change by more than 20 percent. This is due to large cash-flows that are discounted far into the future (Berner, 2018). This phenomenon can be illustrated by the formula:

$$PV = \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \cdots + \frac{CF_n}{(1+r)^n}$$

Where:

r = Discount rate

CF = Cash (out)flows due to pension provisions

PV = Present value of future cash (out)flows

If the discount rate changes, the present value of future cash flows is more affected if there are large cash flows far into the future than if there are large cash flows in a near future, because of compound interest. Since pension provisions are very long-term, this implies that a minor change in the discount rate has large impact on the present value, thus the market value of the pension liability. A more well-known context of this formula is when discounting

future cash flows with weighted average cost of capital in order to obtain the fair price of a stock. Due to a three-decade long spiral of falling interest rates, the stock market has seen strong growth compared to assets which don't discount cash flows, such as commodities (Iwarsson, 2017). He claims that, if this spiral is about to turn around, commodities are the winners, while early-stage companies are the losers since their expected cash-flows are very long-term and thus largely decreased due to compound interest.

The discount rate for pension liabilities is generally based on the 10-year Swedish Treasury Bond rate and is thus fluctuating. This will cause large fluctuations in the pension liability from year to year which is an uncomfortable feature for the actuary's or accountant's point of view, according to Nils Berner, actuarian at PRI. PRI themselves have avoided this inconvenient feature by using a fixed discount rate of four percent.

In a long-term perspective, this discount rate is not exceptionally high. The truth is that the 10-year Swedish Treasury Bond rate has been falling for three decades (Affärsvärlden, 2016). In February 1987, it was 11,5 percent which even makes PRI's 4 percent seem low in relation.

However, nowadays the 10-year Treasury Bond rate is close to zero and subsequently, the rate of 4 percent that PRI uses is being questioned. A discount rate this far from the market price of its traditionally considered best approximation, the 10y T-bond rate, creates a considerably higher liability than if the market-based interest was used. This, in return implies that shareholder's equity becomes overvalued. Parkhomovsky (2010) shows that accounting and funding of pension plans have significant impact on valuation of equity.

In PRI's case, this would mean that the equity in the companies that use the PRI-solution are overvalued. This potential overvaluation is by PwC (2017) considered a hidden risk in the sense that companies don't realize the magnitude of the pension liability. If the discount rate is too high, this implies a hidden cost and thus a hidden risk.

This is due to the fact that a fall in the interest rate implies a value increase in the pension liability, and a positive value change between two years implies a cost for the firm. The higher the value change in the pension liability from one year to another, the higher cost. If the discount rate that PRI uses proves to lack foundation, this can be considered a financial shenanigan, e.g. an accounting gimmick used to inflate earnings. If management chooses a too aggressive discount rate, the recorded pension expense will be smaller, and profits will be

inflated (Shilit & Perler, 2010). The easiest way to spot these problems is by comparing the discount rate with peers in the market. In this way, the deviousness of American company Delphi was revealed in 2002, when Delphi used a discount rate of 10 percent compared to its peers who used 8,1 percent.

In the light of this well-recognized financial shenanigan and the significantly lower discount rate used by the PRI-companies peers, the PRI-interest rate of 4% is being questioned. However, PRI motivates their relatively high discount rate the doctrine of Keating discussed previously in this thesis.

# 4. Hypothesis

With respect to the conclusions made by applying the theoretical framework to the field of the essay, the hypothesis of the thesis is as follows:

1) *Does the choice of pension funding impact the degree and the fluctuation of a company's return on equity and does it differ across industries?*
2) *What is the long-term return on equity for the companies in the sample?*

# 5. Method

## 5.1 Choice of key ratio

We aim to study the difference between companies' profitability over a long timeframe, using Alecta or the PRI method. As relevant Key Performance Indicator to compare between the different companies, this study uses Return on Equity. This specific KPI has been chosen since it enables us to make visible the different aspects of the additional leverage the keeping of the pension liabilities on the balance sheet implies. It has also been chosen for its practicality to use and to find in a data sample in many years depicted only by a pdf. version balance sheet.

If needed ROE is also easily converted into other KPIs such as ROA using the conversion formula for leverage called "Hävstångsformeln" (Johansson Runsten 1975).

## 5.2 Timeframe

The relevant timeframe is rather extensive. Since an official/ white collar employee concerned by the ITP2 normally works for 40 years and lives 20 years after that, a perspective of approximately 60 years is justified and will be useful for this purpose.

As PRI NGO was founded in 1961, and their system has been used in the Swedish market since this particular year we have decided to use 1961 as starting year for the research. When there is no data to be found the general test of the two time-series of average ROE of the sample does not take this into consideration adjusting for this.

For what concerns the binomial test on the other hand, the years where there is no data to be found for one of the two choices of dealing with the pension liabilities, these years have been eliminated from the data sample. This has been done so that ROE from these years does not equal zero, leading to a deceptive result for these years.

How these tests were performed is described in detail in chapters 5.7 to 5.9.

## 5.3 Sampling and grouping

Two different samples are chosen from the same population and compared against one another. One sample for companies which use PRI and one sample for comparable companies which use Alecta. To ensure that the two samples meet a comparative standard and to decrease the misrepresentation due to erroneous selection we have decided to use a paired (or matched) sample.

In matching our sample, we have created several under groups of companies. In this selection we have primarily looked upon the different Global Industry Classification Standards codes to make sub categories. Secondly to remove outliers and other non-matching companies that could create disequilibria within the sample a specific regard to the number of employees has been taken. This is also since the number of employees is of utter importance regarding size of pension liabilities.

GICS-code is an international standard which divides companies into sectors. It is similar to the Swedish SNI-code but is primarily used for public companies. GICS divides companies into 11 broad sectors.

Table 5.1, Description of the 11 GICS groups, the first classification level according to the system used.

| *Number* | *Sector Name* |
|---|---|
| *10* | *Energy* |
| *15* | *Materials* |
| *20* | *Industrials* |
| *25* | *Consumer Discretionary* |
| *30* | *Consumer Staples* |
| *35* | *Health Care* |
| *40* | *Financials* |
| *45* | *Information Technology* |
| *50* | *Telecom* |
| *55* | *Utilities* |
| *60* | *Real Estate* |

The data is collected from the consolidated balance sheets in the annual reports of the different company groups. In order to find a useful number of employees, the number of employees in the Swedish parts of the conglomerate have been used.

For reasons of accessibility and right to share the results, the research has been made on companies with a considerate number of employees. All companies, with exception of the real estate companies of group 60 have at least 100 employees and most of them have a number of employees that exceeds by far 100 persons.

Applying the described choices for selection in using big, public, companies present at the Stockholm Stock Exchange have led to an overrepresentation of companies that follow the modus operandi of PRI and keep the pension liabilities on the balance sheet to increase leverage and profit.

To deal with this problem the matching within the sub groups having the same GICS code and a similar number of employees has been taking place in a ratio of 1 to 4. This means that one company that uses Alecta to deal with the pension liabilities is matched with four companies that have decided to keep the pensions on their balance sheet using the PRI model. Each of the companies in the subgroup using the model that PRI NGO proposes will then be weighted with 0,25.

## 5.4 Description of Group number:

The first of the three numbers divided by colons describes the GICS code that the companies in the group belong to.

The second of the three numbers divided by colons describes the subgroup within the GICS code of the group.

The third of the three numbers divided by colons describes whether the company uses the PRI method or not.

If a company has not chosen the PRI method the last part of the group number will be the digit 1. (That is, if the company deals with their pensions by investing the money in Alecta).

If a company has chosen the PRI method the last part of the group number will be the digit 2.

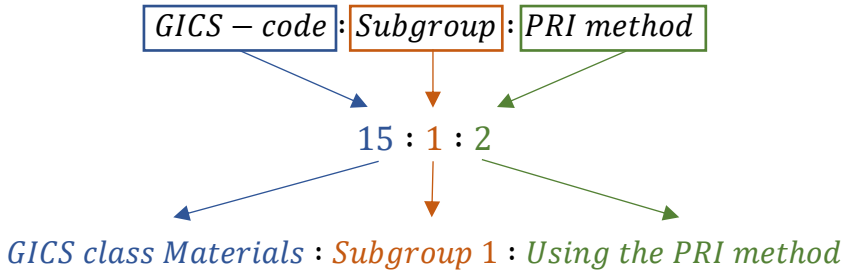



Figure 5.1, Description of the group numbers given to the different groups in the thesis and how they are to be understood in the following study.

## 5.5 Presentation of Companies and Groups

In the following table the companies used for the tests in thesis are presented. Except for company name you will also find the grouping of the companies, the years they are present in the data sources used and the number of employees as well as their organizational number which might be of use to identify the companies despite the abbreviated names.

Table 5.3 Presentation of the companies and groups used in the research

| Classification number | Company name (abbreviated) | Organisational number | Years present in data | Swedish employees by 1961 | Swedish employees by 2016 |
|---|---|---|---|---|---|
| 15:1:1 | Bofors / Nobel | 556204-1904 | 1961-2014 | 12 517 | 281 |
| 15:1:2 | AGA | 556009-1331 | 1961-2015 | 11 200 | 1 004 |
| 15:2:1 | Holmen (Modo) | 556001-3301 | 1961-2016 | 6 394 | 2 989 |
| 15:2:2 | SCA | 556012-6293 | 1961-2016 | 15 889 | 46 171 |
| 15:2:2 | Stora Enso | 556173-3360 | 1961-2015 | 13 215 | 274 |
| 15:3:1 | Bergs timber | 556052-2798 | 1980-2015 | N/A | 190 |
| 15:3:2 | Ahlstr. Munksjö | 556000-2262 | 1961-2013 | 2 405 | N/A |
| 15:3:2 | Billerud Korsnäs | 556025-5001 | 1961-1992<br>1997-2016 | 4 230 | 4 274 |
| 15:4:1 | Fagersta | 556001-9035 | 1961-1985 | 6 185 | |
| 15:4:1 | SSAB | 556016-3429 | 1986-2016 | | 16 381 |
| 15:4:2 | Uddeholm | 556321-5754 | 1961-1984<br>1997-2010 | 14 540 | 853 |
| 15:4:2 | Gränges | 556001-6122 | 1961-1981<br>1997-2016 | 6 901 | 1 154 |
| 15:4:2 | Boliden | 556231-6850 | 1961-1986<br>1997-2015 | 4 463 | 2 901 |

| Classification number | Company name (abbreviated) | Organisational number | Years present in data | Swedish employees by 1961 | Swedish employees by 2016 |
|---|---|---|---|---|---|
| 20:1:1 | Trelleborg | 556006-3421 | 1962-2015 | 4 270 | 1 200 |
| 20:1:2 | Volvo | 556012-5790 | 1961-2016 | 8 600 | 20 200 |
| 20:1:2 | SAAB Kockums | 556205-5623 | 1964-1979<br>1997-2015 | 1 033 | N/A |
| 20:1:2 | SAAB SCANIA | 556036-0793 | 1961-1990<br>1997-2016 | 12 639 | 12 000 |
| 20:2:1 | Alfa Laval | 556587-8054 | 1961-1990<br>2001-2016 | 17 124 | 2 100 |
| 20:2:2 | ABB (ASEA) | 556029-7029 | 1961-2015 | 9 065 | 9 000 |
| 20:2:2 | Atlas Copco | 556014-2720 | 1961-2016 | 2 212 | 4 200 |
| 20:2:2 | SKF | 556240-8301 | 1961-2016 | 11 082 | 2 700 |
| 20:2:2 | Sandvik | 556000-3468 | 1961-2016 | 8 978 | 10 400 |
| 20:3:1 | Esab | 556005-7738 | 1961-1993<br>1997-2015 | 1 422 | 451 |
| 20:3:2 | Bulten (Kanthal) | 556078-3648 | 1962-1982<br>1990-2000<br>2006-2016 | 4 722 | N/A |
| 20:3:2 | Hegaxon | 556601-9773 | 1968-2016 | 141 | 200 |
| 20:3:2 | Haldex (Garphytte) | 556010-1155 | 1961-2016 | 582 | 2 045 |
| 20:3:2 | Gunnebo | 556324-9183 | 1961-1987<br>1995-2016 | 558 | 214 |
| 20:4:1 | PEAB | 556061-4330 | 1985-2016 | N/A | 13 712 |
| 20:4:2 | Skanska | 556000-4615 | 1961-2016 | 49 746 | 42 903 |
| 20:5:1 | Enea | 556209-7146 | 1987-2016 | N/A | 410 |
| 20:5:2 | Ångpanneföreningen | 556120-6474 | 1983-2016 | N/A | 8 115 |

| Classification number | Company name (abbreviated) | Organisational number | Years present in data | Swedish employees by 1961 | Swedish employees by 2016 |
|---|---|---|---|---|---|
| 25:1:1 | Borås Wäfveri | 556108-9052 | 1961-2008 | 1 590 | N/A |
| 25:1:1 | Hennes (HM) | 556042-7220 | 1974-2016 | 1 817 | 114 586 |
| 25:1:2 | Electrolux | 556009-4178 | 1961-2016 | 2 978 | 2 200 |
| 25:2:1 | Bahco | 556577-4501 | 1961-1991<br>1995-2015 | 3 564 | N/A |
| 25:2:1 | Esselte | 556011-4554 | 1961-2001<br>2005-2015 | 5 930 | N/A |
| 25:2:2 | PostNord Strålfors | 556062-0618 | 1982-2016 | N/A | 41 |
| 25:3:1 | Beijer Ref | 556040-8113 | 1982-2016 | N/A | 2 667 |
| 25:3:2 | Bergman o Beving | 556034-8590 | 1980-2016 | N/A | 2 642 |
| 30/35:1:1 | Swedish Match | 556015-0756 | 1961-1988<br>1996-2015 | 4 651 | 5 070 |
| 30/35:1:1 | Getinge | 556408-5032 | 1980-2016 | N/A | 15 543 |
| 30/35:1:2 | Astra (Astra Zeneca) | 556011-7482 | 1961-2015 | 5 583 | 5 000 |
| 45:1:1 | Geveko | 556024-6844 | 1981-2015 | N/A | N/A |
| 45:1:2 | Ericsson | 556016-0680 | 1961-2016 | 36 600 | 17 000 |
| 60:1:1 | Hufvudstaden | 556012-8240 | 1961-2016 | 73 | 113 |
| 60:1:2 | Fabege | 556049-1523 | 1980-2015 | N/A | 143 |

## 5.6 Comments to the group selection:

**Group 15:1**

*Gas and explosive materials.* This group of GICS codes beginning by 15 is most closely approximated by the complete GICS code 15101040 which is a subgroup to number 15 (materials) describing industrial gases.

**Group 15:2**

*Forestry, refined.* This group of GICS codes beginning by 15 is most closely approximated by the complete GICS code 15105020 which is a subgroup to number 15 (materials) describing paper products. *Note: nowadays, most of Swedish forestry companies have moved along the value chain from forestry products to consumer products. However, we assess that Holmen, SCA and Stora were the leading companies in this refining process.*

**Group 15:3**

*Forestry, not as refined as group 15:2.* This group of GICS codes beginning by 15 is most closely approximated by the complete GICS code 15105010 which is a subgroup to number 15 (materials) describing forest products.

**Group 15:4**

*Metals and other materials.* This group of GICS codes beginning by 15 is most closely approximated by the complete GICS code 151040 with its subgroups 10; 20; 50 describing aluminum and steel, diversified metals and mining.

*Note: The reason why steel manufacturer Fagersta only has data to 1986 is because it was acquired by investment company Kinnevik. Since SSAB, is also a steel manufacturer and only has data from 1986, these companies are grouped. Gränges would nowadays most likely qualify for group 20 since they focus on intercoolers for the vehicle industry. However, we choose to emphasize their history as a manufacturer of aluminum which qualifies as material.*

**Group 20:1**

*Vehicle industry.* This group of GICS codes beginning by 20 is most closely approximated by the complete GICS codes 20106010 and 20101010 which are subgroups to number 20 (industrials) describing vehicles such as heavy trucks, aerospace and defense. Trelleborg started as a manufacturer of tires and refining of rubber (Materials) but nowadays they focus on sealing solutions and anti-vibration solutions for different industries such as vehicles (Industrials).

**Group 20:2**

*Among the most notable and classical Swedish companies in the engineering industry.* This group of GICS codes beginning by 20 is most closely approximated by the complete GICS code 20103010 which are a subgroup to number 20 (industrials) describing construction and engineering.).

**Group 20:3**

*Engineering industry, smaller companies.* This group of GICS codes is most closely approximated by the complete GICS code 20202010 a subgroup to number 20 (Industrials) describing Building products.

**Group 20:4**

*Construction industry.* This group of GICS codes is most closely approximated by the complete GICS codes 20103010, a subgroup to number 20 (Industrials) describing construction and engineering.

**Group 20:5**

*Consulting.* This group of GICS codes is most closely approximated by the complete GICS code 20202020 a subgroup to number 20 (Industrials) describing research and consulting services. Even if ÅF is a consultant in industry, energy and infrastructure while Enea is an IT-consultant, we assess that their business models are similar and therefore group them together.

**Group 25:1**

*Household goods*. This group of GICS codes is most closely approximated by the complete GICS codes 25203030 and 25201040 subgroups to number 25 (Consumer Discretionary) describing textiles and Household Appliances. Even if Electrolux white goods are more discretionary compared to Hennes and Borås Wäfveri which produce clothes/garments, they are still somewhat similar among the companies in our sample based on the market they serve.

**Group 25:2**

*Discretionary goods, both for consumers and industries.* This group of GICS codes is most closely approximated by the complete GICS codes 25401040 and 25504030, subgroups to number 25 (Consumer Discretionary) describing Publishing and Home Improvement Retail. Bacho is a manufacturer of hand tools, Esselte produces office material and Strålfors used to produce office material but nowadays, they are more of an IT-company.

**Group 25:3**

*Industrial retailers.* This group of GICS codes is most closely approximated by the complete GICS code 25501010 which is a subgroup to number 25 (consumer discretionary) describing retailing within this same field. These companies could also qualify as group 20. However, we emphasize their resemblance with other retailing companies and thus view them as discretionary goods even if they do not resell consumer goods.

**Group 30/35**

*Drugs and health care.* This group of GICS codes is most closely approximated by the complete GICS codes 30203010 which is a subgroup to number 30 (Consumer Staples) describing tobacco and GIGS codes 35202010 and 35103010, subgroups to number 35 (Health Care) describing Pharmaceuticals and Health Care Technology. Astra Zeneca and Swedish Match both produces drugs in different forms. Astra Zeneca produces medicines and Swedish Match produces tobacco. Getinge could qualify as group 20 but we choose to emphasize its health care focus (medicine technique).

Simon Danielsson, 23562
David Elvingsson, 23561

**Group 45**

*Others.* Ericsson could qualify as group 20 since it is an engineering company. However, its focus on telecommunications makes it different. Geveko manufactures road marks for infrastructure and is also difficult to match with a comparable company. Group 45 has become a representant of companies that were hardly put into another group and in this unique case the group number does not perfectly reflect the major GICS code for the companies involved.

**Group 60**

*Real estate.* This group of GICS codes is most closely approximated by the complete GICS codes 60101040 and 60101070, subgroups to number 60 (Real Estate) describing Equity Real Estate in form of Offices and Retail properties.

## 5.7 Paired sample t-test

In order to compare the return on equity of the PRI-sample and Alecta-sample over time, the paired sample t-test is used as hypothesis test.

The null hypothesis tested against a one-sided alternative is the following:

$$\frac{1}{55} * \sum_{i=1}^{55} ROE_{PRI} \leq \frac{1}{55} * \sum_{i=1}^{55} ROE_{ALECTA}$$

Thus, we want to reject the null hypothesis and prove that ROE is higher (and more volatile) for PRI-companies. We use samples of 26 companies and 19 companies as estimates for $ROE_{PRI}$ and $ROE_{ALECTA}$ respectively.

The motivation to group the data into a paired sample was primarily done to promote comparability in the research. This gives a more balanced representation of the data and by that we can decrease the risk of the companies choosing the PRI method being of one sort, more prone to higher ROE, than the companies that chose to put their ITP 2 pension liabilities in a pensions fund, represented by Alecta in the Swedish setting.

A paired sample was in this case created with the companies choosing to follow the PRI method as starting point. These same enterprises were then matched and equally weighted against an equivalent set of companies from the same GICS group with, on average, a comparable number of employees. Our grouping resulted in 15 different matched sample sets. The ROE, year by year, of the companies in these 15 groups were then weighted in such a way so that a relationship of, for example, the average ROE of four PRI companies was matched against the ROE from one Alecta company.

The difficulties with this method were most associated with the lack of available data. The data streams provided through Serrano did not reach further back than, at most, 1997. Professor Erik Eklund at Stockholm School of Economics provided further data streams from his personal collection between the years 1980 and 1996.

This meant that we had to choose between the limited number of scanned annual reports provided by Swedish House of Finance for all data between 1980 and 1961. For these 19 years we were obliged to retrieve the data from pdf version of the annual reports manually and then make the calculations on our own.

Resulting from this was the fact that we had to restrict the number of companies used in the research, adapting to the data available. This also affected the selection of the companies which then became analogous to the annual reports provided by Swedish House of Finance. In the end we read thorough and calculate data from around 900 annual reports, that is 45 companies' times 20 years. A considerable effort was put in to the gathering of these numbers. See further information in the Data-section of this thesis.

## 5.8 Binomial test

So that the differences between the test groups can be made visible a binomial test is being performed on the same data that had already been collected for the paired sample t-test. The purpose of this test is to see how the PRI method is performing, sub group per sub group and thereby provide an indicator if the method seems to be more suitable for some of the different sectors that it is for others.

The test was done in such a manner that the average ROE of each year for each company subgroup within the test group e.g. $\overline{15:2:1}$ was compared to the same average result of that same year from the responding sub group $\overline{15:2:2}$.

That is, the average of the companies choosing the PRI alternative within a specific subgroup a specific year was compared to the companies choosing the Alecta alternative within that same sub group from the same year.

If the PRI companies had a higher ROE a certain year, that same year was attributed a number 1. The PRI method is considered victorious within a subgroup if the years being part of the study, attributed a 1 outnumber the years designated a 0.

Difficulties encountered during this test consisted in the missing years of the sample. This was partly due to some companies being younger than 57 years, that is, founded after 1961 but also because of companies whose data is, for different reasons, missing from the Serrano data streams.

## 5.9 Rank sum test

According to the theoretical framework, it seems like the type of industry (or firm) that would benefit most from using Pension Egen Regi would have:

1. high investment needs
2. a large number of (Swedish) employees and thus a large Swedish pension liability
3. low business risk

In order to examine the correlation by these three factors and the relative outperformance of PRI-companies against Aleca-companies across groups, we make a rank sum test of these factors.

Business risk consists of both idiosyncratic and systematic risk (Investopedia, 2018). In our case, we choose beta from Avanza and similar public information as a proxy for systematic risk. We neglect unsystematic risk because we want to see the correlation primarily on industry level, not on firm level. In cases where the company is not listed due to an acquisition, we have found a proxy by taking beta from the acquirer.

To rank the groups by capital intensity, Majher (2014), Hammar (2014) and Investopedia is used. According to these sources, telecom and energy usually top the list, followed by mining, real estate and healthcare.

Hammar studies Swedish firms specifically and concludes for example that Astra Zeneca employs 4,5 MSEK in fixed assets per employee, ABB employs 2 MSEK and H&M employs 0,3 MSEK. Based on these three sources the groups in our sample are ranked by capital intensity. However, this ranking is somewhat subjective since the specific firms in a sample group might vary in capital intensity. For example, Astra Zeneca is probably more capital intensive than Swedish Match (due to large investments in immaterial fixed assets) even though they are in the same group.

# 6. Data

In order to match PRI-companies against comparable Alecta-companies, a list of PRI-companies, that is the customers of PRI NGO was obtained.

Thereafter, the available databases were screened in order to find the PRI-companies that had the most data available. The databases that were screened were Serrano and pdf-format Annual Reports Archive from Swedish House of Finance. Apart from this, fresh data from Erik Eklund at Swedish House of Finance was given to us.

Based on this data, we selected the PRI-companies that had available data of return on equity for every year, without exception, between 1961-2016. Then, comparable Alecta-companies were chosen, given the data available.

However, these criteria left us with only 19 companies in our sample. Therefore, we decided to loosen the criteria somewhat. Yet still, we did not accept any company in our sample that had more than 20 years missing during the 55-year-long period. Our definite sample left us with 46 companies; 26 PRI-companies and 19 Alecta-companies.

In order to obtain data between 1997 and 2016, Serrano was used. Serrano had already calculated data of return on equity which facilitated our work.

Between 1980 and 1996, fresh data from Erik Eklund was used. Here, the company data was provided but we had to calculate key ratios (return on equity on our case) manually. The formula used was: *profit (ending balance)/book value of equity (opening balance).*

Between 1961 and 1980, there was no digital data available. Here, we used the annual reports from the Annual Reports Archive to calculate return on equity manually. These annual reports did not follow the standardized outline of today, but we managed to collect the data needed. The same formula as above was used. Here we also found the number of employees during 1961. The number of employees 2016, we found in Business Retriever.

# 7. Result and Analysis

The following section starts by displaying the results of the paired sample t-test, the binomial test and the rank sum test. The results are analyzed with respect to the theoretical framework and hypothesis. Thereafter, the validity of our study with regards to causality and potential omitted variables is discussed.

## 7.1 Paired sample t-test shows insignificant PRI-dominance

The result from the paired sample t-test is displayed in table 7.1 and graph 7.1. These show a slightly higher ROE for the PRI-sample than for the Alecta-sample. The p-value is 8,4 percent which implies that the difference is not significant at 5 percent level. A thing that is notable is that the average ROE for both the PRI sample and the Alecta-sample is well above 4 percent (13,95 percent for the PRI-sample and 13,0 percent for the Alecta sample). Detailed information about the results on a year-to-year-basis is shown in table 7.1a in Appendix.

Table 7.1b: Result of the paired sample t-test across periods 1961-2016, 1961-1986, 1987-2016 respectively.

| | PRI ROE | Alecta ROE |
|---|---|---|
| Mean 1961 - 2016 | 13,95% | 13,0% |
| T-statistic (p-value) | 0,07953473* | |
| Std dev 1961 - 2016 | 0,04916547 | 0,06815442 |
| Mean 1961 - 1986 | 13,42% | 9,9% |
| T-statistic (p-value) | 0,00013294** | |
| Std dev 1961 - 1986 | 0,03276509 | 0,0493377 |
| Mean 1987 - 2016 | 14,41% | 15,7% |
| T-statistic (p-value) | 0,06753445*** | |
| Std dev 1987 - 2016 | 0,06009438 | 0,07157787 |

*: The null hypothesis displayed in section 5.7 is rejected at a significance level > 7,95 percent

**: The null hypothesis displayed in section 5.7 is rejected at a significance level > 0,01 percent

***: The nyll hypothesis displayed in section 5.7 is rejected at a significance level > 6,75 percent

The standard deviation of the PRI-sample is lower than for the Alecta-sample which is shown in table 7.1, thus our hypothesis that the PRI-sample would have a more volatile ROE did not find evidence for its case. A potential reason for this could be that return on assets for the PRI-companies is consistently higher than the cost of debt, apart from the period in the beginning of the 90's called the 90'ies crises.

Thus, the magnifying effect of leverage does not cause any large fluctuations in return on equity because the leverage effect is generally positive. However, during 90-talskrisen, one can see in graph 7.1 that the PRI-sample had lower returns than the Alecta-sample.

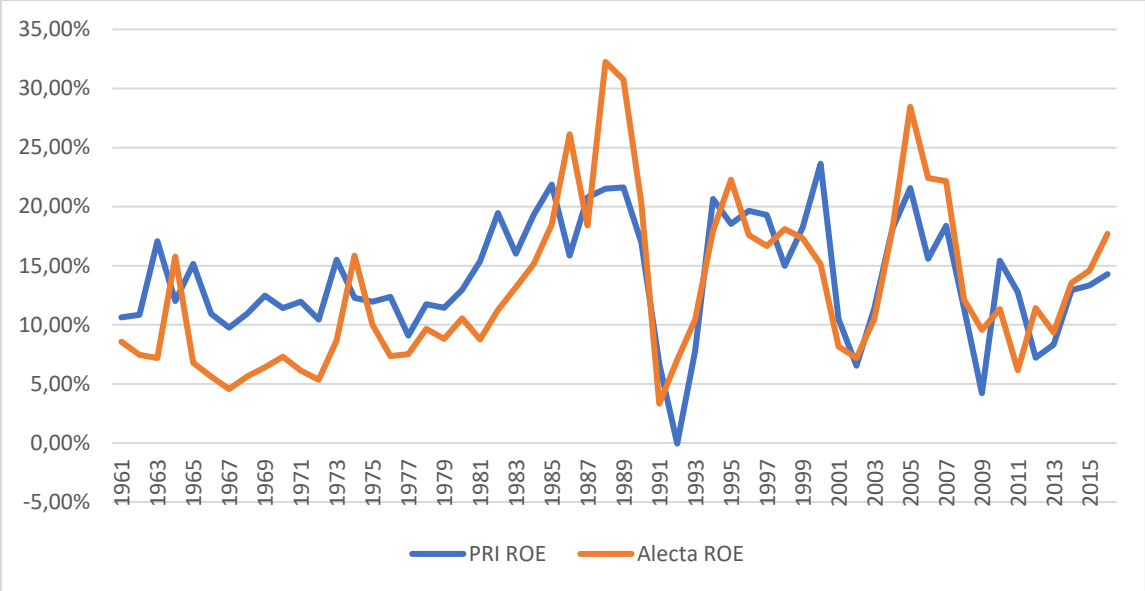
This suggests that the PRI-sample has a larger leverage effect. However, the bearish market during the 90'ies crisis only represents a minor fraction of the period 1961-2016. Thus, the leverage effect, fortifying the fluctuations, doesn't create as large fluctuations in returns if times are consistently good (for the PRI-sample).

Another potential reason to the higher volatility of the Alecta-sample could be that the Alecta-sample has fewer companies and therefore, extreme values can have a larger effect. For example during 1988, the PRI-sample has an ROE of 22 percent compared to 32 percent for the Alecta-sample. When looking closely at the data, one finds that the Alecta-company Enea has abnormal returns of 172 and 105 percent 1988 and 1989 respectively.

These abnormal returns can be seen in the light of the internet-revolution at this time, where Enea was the backbone of all internet traffic in the Nordics. Since the PRI-sample is larger, such abnormal effects don't have as much impact there.

The last statement is explaining that the volatility of the PRI companies might be lower also because they are most of the time evaluated after having been grouped together in groups of four and thus weighted with 0.25 meaning that an extreme result from one of these companies would only affect the result of the group by 0.25. We would have to deal with something that could be named a diversification bias of the result.

Graph 7.1: Return on equity between 1961-2016 for the PRI-sample and the Alecta-sample.




*Note that PRI performs consistently better than the Alecta-sample between 1961 and 1986. Also note the bearish market during the 90'ies which affected the entire Swedish economy.*

When splitting the period in 2, one can see that the PRI-sample has substantially higher ROE than the Alecta-sample 1961-1986 and the difference is significant at 1% significance level while the Alecta-sample has slightly higher ROE 1987-2016.

Since some of the original companies have been acquired or merged over time starting in 1988 with Asea by international groups, company data in 1987-2016 might be somewhat inaccurate. The group might transfer money between subsidiaries which creates volatile and deceptive earnings in subsidiaries regarding the narrower scope of only the Swedish parts, this thesis takes.

This might be one of the reasons for the higher standard deviation in ROE 1987-2016, both for the PRI and Alecta-sample. In the light of this, the period 1963-1986 may be more accurate in describing the cause we need to answer the questions posed in the hypothesis of the thesis. However, the number of companies is lower in this period than 1987-2016, due to e.g. certain companies being founded after 1961 which lowers the period's legitimacy.

## 7.2 Mergers and acquisitions – implications on ROE

Since 1988 when Asea was merged with the Swiss company BBC, seven of the companies in the sample have been acquired or merged by foreign companies during the years treated by the study. As we are interested in the Swedish pension solutions, we have chosen to look at the Swedish subsidiary in these cases.

This decision may come with some complications, since group accounting often involves group contributions between subsidiaries which can cause large fluctuations in returns of the subsidiaries, as mentioned above. Table 7.2 and 7.3 address this issue. In these tables, return on equity has been divided into intervals and denoted with numbers (see notes to the tables).

Table 7.2 shows that extreme values on ROE (1 or 5) were more common between 1987-2016 than between 1961-1986, just like table 7.1 seems to insinuate. There were 6 observations with a ROE below -20 percent between 1961-1986 but 39 such observations between 1987-2017.

However, this doesn't necessarily have to do with group accounting in the consolidated balance sheets being made in a way so that money is transferred across borders in a misleading way for our study. Other factors that had impact was "90-talskrisen" in the beginning of the 90's where all the Swedish economy faced a bearish market and the bankruptcy of Borås Wäfveri, a company that faced some years of deteriorating returns before the bankruptcy in 2010. Table 7.2 also shows that the number of observations of ROE greater than 60 percent were only 7 between 1961-1986 but 23 between 1987-2016.

Table 7.2: Distribution of ROE of individual companies in the sample, sorted by year.

| Year | 1 | 2 | 3 | 4 | 5 | ∑ | Year | 1 | 2 | 3 | 4 | 5 | ∑ | Year | 1 | 2 | 3 | 4 | 5 | ∑ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1961** | | | 29 | 1 | | 30 | **1980** | | 1 | 32 | 5 | | 38 | **1999** | | 2 | 29 | 12 | 1 | 44 |
| **1962** | | | 30 | 2 | | 32 | **1981** | 1 | 3 | 25 | 10 | | 39 | **2000** | 1 | 2 | 24 | 15 | 2 | 44 |
| **1963** | | | 28 | 3 | 1 | 32 | **1982** | 1 | 4 | 23 | 9 | 1 | 38 | **2001** | 2 | 3 | 32 | 7 | | 44 |
| **1964** | | | 30 | 2 | 1 | 33 | **1983** | 1 | 2 | 24 | 12 | | 39 | **2002** | 3 | 5 | 26 | 9 | | 43 |
| **1965** | | | 30 | 2 | 1 | 33 | **1984** | | | 27 | 12 | | 39 | **2003** | 1 | 6 | 24 | 10 | 1 | 42 |
| **1966** | | | 29 | 4 | | 33 | **1985** | | 1 | 22 | 15 | 1 | 39 | **2004** | | 1 | 26 | 15 | 1 | 43 |
| **1967** | | | 32 | 1 | | 33 | **1986** | | 1 | 22 | 14 | 1 | 38 | **2005** | | 2 | 14 | 26 | 1 | 43 |
| **1968** | | | 32 | 2 | | 34 | **1987** | | | 25 | 14 | | 39 | **2006** | 2 | 5 | 14 | 22 | 2 | 45 |
| **1969** | | | 31 | 3 | | 34 | **1988** | | | 16 | 20 | 2 | 38 | **2007** | 3 | 3 | 17 | 19 | 3 | 45 |
| **1970** | | | 33 | 1 | | 34 | **1989** | | 1 | 14 | 21 | 1 | 37 | **2008** | 3 | 9 | 14 | 15 | 1 | 42 |
| **1971** | | | 31 | 3 | | 34 | **1990** | 1 | | 24 | 11 | 2 | 38 | **2009** | 2 | 12 | 21 | 9 | | 44 |
| **1972** | | | 33 | 1 | | 34 | **1991** | 4 | 6 | 19 | 7 | | 36 | **2010** | 2 | 4 | 22 | 14 | | 42 |
| **1973** | | | 30 | 4 | | 34 | **1992** | 5 | 7 | 15 | 6 | 1 | 34 | **2011** | 2 | 6 | 23 | 10 | 1 | 42 |
| **1974** | | | 28 | 6 | 1 | 35 | **1993** | 2 | 6 | 19 | 6 | 1 | 34 | **2012** | 2 | 4 | 24 | 10 | | 40 |
| **1975** | | | 33 | 2 | | 35 | **1994** | 1 | | 21 | 11 | 1 | 34 | **2013** | 2 | 4 | 28 | 8 | | 42 |
| **1976** | | 3 | 30 | 2 | | 35 | **1995** | 1 | 1 | 14 | 19 | 1 | 36 | **2014** | | 5 | 26 | 8 | | 39 |
| **1977** | 2 | 2 | 28 | 3 | | 35 | **1996** | | | 23 | 13 | 1 | 37 | **2015** | | 4 | 26 | 9 | | 39 |
| **1978** | | 3 | 28 | 4 | | 35 | **1997** | | 3 | 27 | 14 | | 44 | **2016** | | | 17 | 9 | | 26 |
| **1979** | 1 | 1 | 30 | 3 | | 35 | **1998** | | 3 | 25 | 16 | | 44 | **2017** | | | 1 | 1 | | 2 |

| **Table summary** | | | |
|---|---|---|---|
| ∑ (1) | 45 | ∑ (4) | 512 |
| ∑ (2) | 125 | ∑ (5) | 30 |
| ∑ (3) | 1 400 | Grand total | 2 112 |

*Explanation to numbers*

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| ROE < -20 % | 0% > ROE > -20% | 20% > ROE > 0% | 60% > ROE >20% | ROE > 60% |

In order to conclude if the increased number of extreme values between 1987-2016 has to do with group accounting in groups owned by foreign companies, we study table 7.3. This table shows no particular difference in extreme values between companies that were merged/acquired by foreigners and those who were not.

The three companies that have the largest number of extreme values are Fabege (6 observations), Bulten (5 observations) and Ahlstrom-Munksjö (5 observations). Of these, Munksjö was acquired by Irish Jefferson Summit in 2002 and merged with Finnish Ahlstrom in 2013, while Fabege and Bulten was not acquired or merged. Thus, the larger fluctuation in ROE during 1987-2016 does not seem to be a result of group accounting, which increases the reliability for the period.

Table 7.3 Distribution of return on equity of individual companies in the sample across time, sorted by company.

| Company | 1 | 2 | 3 | 4 | 5 | ∑ | Company | 1 | 2 | 3 | 4 | 5 | ∑ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ABB (ASEA)** | 1 | 2 | 38 | 14 | | **55** | **Geveko** | 2 | 6 | 17 | 7 | | **32** |
| **AGA** | | 1 | 45 | 9 | | **55** | **Gränges** | 2 | 4 | 27 | 7 | | **40** |
| **Munksjö** | 3 | 5 | 32 | 8 | 2 | **50** | **Gunnebo AB** | | 5 | 29 | 13 | 2 | **49** |
| **Alfa Laval** | | | 29 | 17 | | **46** | **Haldex** | 2 | 2 | 40 | 11 | 1 | **56** |
| **AstraZeneca** | | | 33 | 20 | 2 | **55** | **Hexagon** | 1 | 1 | 38 | 10 | | **50** |
| **Atlas Copco** | | | 35 | 20 | 1 | **56** | **HM (Hennes)** | | | 2 | 41 | 1 | **44** |
| **B & B Tools** | | | 20 | 17 | | **37** | **Holmen (Modo)** | | 2 | 49 | 5 | | **56** |
| **Bahco** | 2 | 1 | 33 | 14 | 2 | **52** | **Hufvudstaden** | | 2 | 43 | 10 | 1 | **56** |
| **Beijer Ref** | | 1 | 27 | 7 | | **35** | **PEAB** | 1 | | 19 | 12 | | **32** |
| **Bergs timber** | | 13 | 18 | 5 | | **36** | **PostNord Strålfors** | 3 | 4 | 22 | 2 | | **31** |
| **Billerud Korsnäs** | | 3 | 40 | 9 | | **52** | **SAAB Scania** | | 1 | 41 | 8 | | **50** |
| **Bofors / Nobel** | 1 | 6 | 36 | 9 | 1 | **53** | **SAAB Kockums** | | 2 | 30 | 1 | 2 | **35** |
| **Boliden** | | 1 | 25 | 19 | | **45** | **Sandvik** | | 3 | 36 | 17 | | **56** |
| **Borås Wäfveri** | 2 | 5 | 39 | 2 | | **48** | **SCA** | | | 50 | 5 | 1 | **56** |
| **Buntel Kanthal** | 4 | 3 | 30 | 4 | 1 | **42** | **Skanska** | 1 | 1 | 27 | 27 | | **56** |
| **Electrolux** | | | 33 | 23 | | **56** | **SKF** | 1 | 4 | 41 | 10 | | **56** |
| **Enea** | 2 | 3 | 8 | 15 | 2 | **30** | **SSAB** | | 5 | 17 | 8 | | **30** |
| **Ericsson** | 2 | 1 | 40 | 13 | | **56** | **Stora Enso** | 2 | 9 | 40 | 3 | 1 | **55** |
| **Esab** | 2 | 3 | 31 | 13 | | **49** | **Swedish match** | | 4 | 34 | 6 | 4 | **48** |
| **Esselte** | | 3 | 32 | 13 | 1 | **49** | **Trelleborg** | 1 | 3 | 42 | 8 | 1 | **55** |
| **Fabege** | 5 | 4 | 18 | 8 | 1 | **36** | **Uddeholms AB** | 4 | 7 | 25 | | | **36** |
| **Fagersta** | | | 22 | 2 | | **24** | **Volvo** | | 4 | 32 | 20 | | **56** |
| **Getinge** | | | 10 | 14 | 2 | **26** | **ÅF** | 1 | 1 | 25 | 6 | 1 | **34** |

| **Table summary for tables 7.2 and 7.3** | | | |
|---|---|---|---|
| ∑ (1) | 45 | ∑ (4) | 512 |
| ∑ (2) | 125 | ∑ (5) | 30 |
| ∑ (3) | 1 400 | Grand total | 2 112 |

*Explanation to numbers*

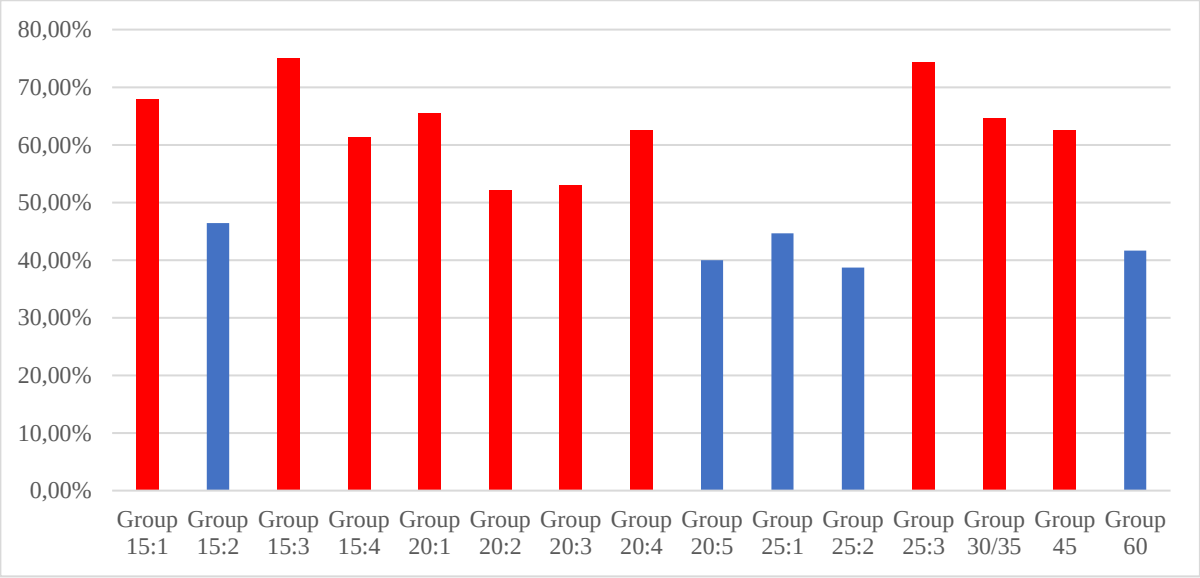
| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| ROE < -20 % | 0% > ROE > -20% | 20% > ROE > 0% | 60% > ROE >20% | ROE > 60% |

## 7.3 Binomial test enhances PRI-companies' dominance

Concerning the binomial test, the results are presented in graph 8.2. The graph shows that the PRI-sample is the winner in 10 of 15 groups in the binomial test. This means that the PRI-sample has a higher ROE than the Alecta-sample more often than the opposite, in 10 of 15 study groups. Looking at the GICS groups the companies belong to we see that only the GICS-groups 25 and 60 manifests a win for the Alecta alternative.

The conclusion of this is that the PRI-sample tends to be more profitable than the Alecta-sample over time in the different sectors in regards to ROE. In order to investigate this, the thesis elaborates more extensively further down on whether the theoretical framework has any implications in practice.

Graph 7.2: PRI percentage of wins in binomial test across groups. Red bar indicates that the PRI-method in a particular group have more wins than the companies using the Alecta-method in the same group.




*The binomial test indicates that the PRI-companies tend to outperform the Alecta-companies within a separate group. The PRI-companies perform better than the Alecta-companies in 10 groups out of 15. The relative outperformance is largest in group 25:3 (industrial retailers) and 15:3 (unrefined forestry).*

## 7.4 Does the impact of PRI differ across sectors?

By combining the results from the rank sum test and the binomial test, we study whether there is any correlation between relative PRI-dominance and the nature of the firms in a particular group. For a detailed result of the rank sum test, please see table 7.4 in Appendices.

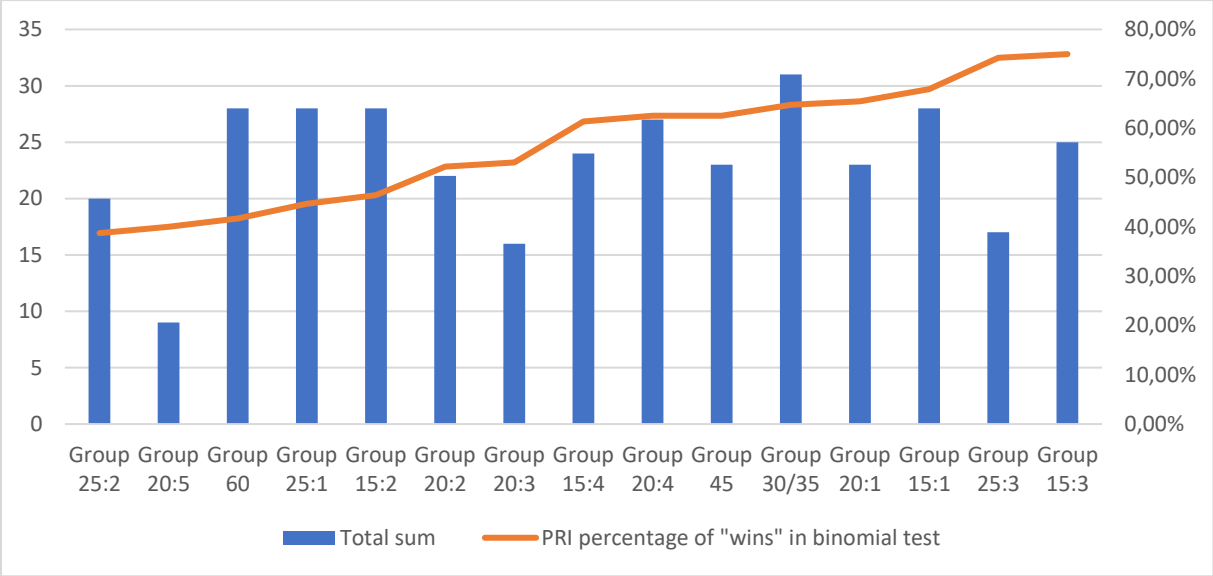
According to graphs 7.3 and 7.4, there is no strong indication that a particular type of firm should benefit relatively more from using Pension Egen Regi compared to Alecta. The hypothesis was that firms in industries that are capital intensive in combination with a large pension liability (large number of employees) and low systematic risk (beta) should benefit the most from using the PRI-solution. Even if there is a positive relationship between these factors in a group and the relative PRI-dominance, the relationship is very small. $R^2$ is only 0,044 in graph 7.4 which indicates that the three industry-specific factors only explain 4,4 percent of the relative PRI-dominance.

However, even if the trade-off theory suggests that industries (or firms) with a high systematic risk (beta) might suffer more than they gain by incurring additional financial risk through the PRI-solution (due to financial distress costs), this effect does not seem to be very substantial in our sample.

Since most of the companies in our sample are well-established, stable Swedish companies, one can assume that they are able to incur substantial leverage without experiencing the financial distress costs described in the theoretical framework. From this perspective, the correlation between relative PRI-dominance and low systematic risk might not be very accurate in our sample.

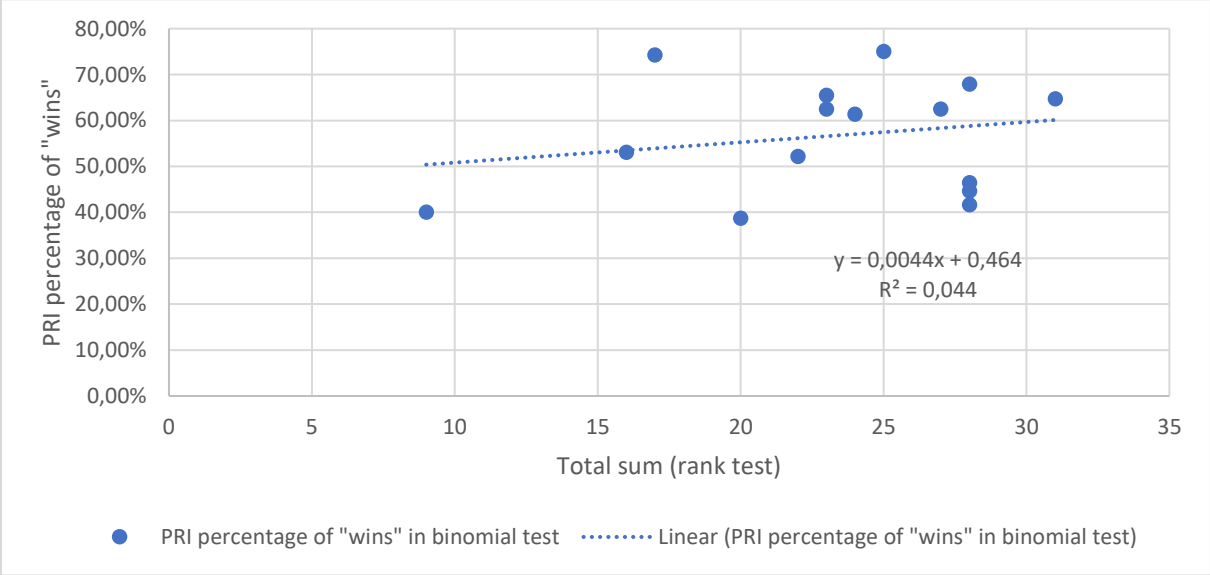
Moreover, the nature of the firms have changed over the years. For example, some Swedish forestry companies were much more cyclical in the past than they are today, due to less refined goods, and therefore today's beta might not be representative for the whole period 1961-2016. Therefore, we test the theory again, but we remove the beta variable. This time, there is still a positive correlation and $R^2$ is slightly higher (graph 8.5). It is still low though, roughly 8 percent.

Graph 7.3: Total sum, rank sum test across groups (left axis), Relative PRI-dominance in bin. test (right axis).



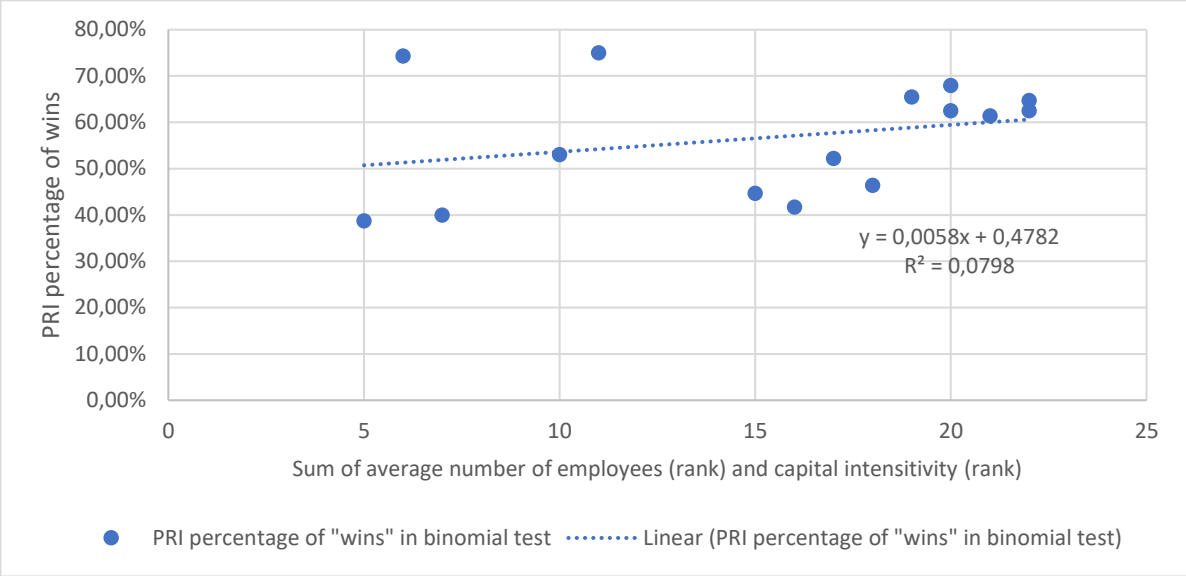

*Note that group 60 (real estate) has a high total sum due to high capital intensity and low beta value. However, the sector does not seem to benefit from the PRI method due to its low number of employees and hence small pension liability. Also note that group 30/35 and group 15:1 seem to benefit from the PRI due to high capital intensity and high number of employees.*

Graph 7.4: Relative PRI-dominance in binomial test as a function of total sum of rank sum test, 1961-2016.




*The graph shows a weak positive correlation. This means that the higher a group scored on the rank sum test, the higher the relative PRI-dominance will be. Thus, there is a weak indication that PRI-dominance depend on industry characteristics. The more capital-intensive, the lower business risk and the more employees (larger pension liability) an industry has, the greater is the PRI-dominance. However, the correlation is weak.*

Graph 7.5: Relative PRI-dominance in binomial test as a function of rank sum of average number of employees and capital intensity across groups, 1961-2016.




*Comments: When removing the beta-variable from the rank sum, the correlation increases slightly.*

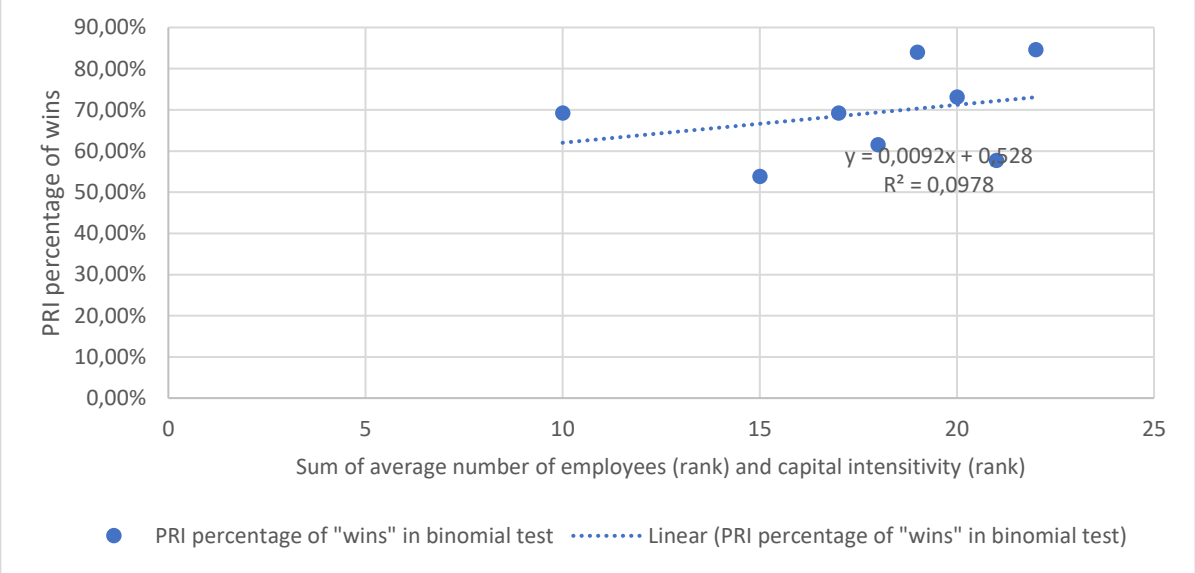
In the last regression, we focus our investigation on the correlation for the period 1961-1986. This is because the Swedish credit market was deregulated in 1985 and during this time, the internationalization of Swedish companies was not yet substantial.

This suggests that the relative importance of using the PRI-solution was larger up until 1985 than for the period 1987-2016, partly because the credit market was constrained which increased the importance of financing solutions like PRI, and partly because the relative size of Swedish operations and thus the relative size of the Swedish pension liability in relation to total debt was larger.

In an article in Affärsvärlden 2016, Per Lindvall suggests that the number of Swedish employees and thus the relative magnitude of the Swedish pension liability has decreased in the well-established Swedish engineering companies, especially during the last 20 years (Affärsvärlden, 2016). For example, ABB's Swedish employees dropped from 26.000 in 1996 to 9000 2015 while Ericsson's Swedish employees dropped from 44.000 to 17.000 over the same period. This further indicates that the relative importance of the PRI-solution might have decreased in 1987-2016 compared to 1961-1987.

The result is shown in graph 7.6. However, some groups have too few observations during this period and therefore the sample is reduced which of course impacts the legitimacy. However, graph 7.6 shows that $R^2$ increases further, in line with our expectations. It is now roughly 10 percent.

Graph 7.6: Relative PRI-dominance in binomial test as a function of rank sum of average number of employees and capital intensity across groups, 1961-1983




*Comments: When studying the period 1961-1983, the correlation increases slightly in line with our analysis. However, due to limited data, the number of groups observed is now only 8 instead of 15 which has negative impact on the legitimacy of the regression.*

Even though the data from companies between 1961-1986 is limited and even though the relationship described above is vague ($R^2$ of only 10 percent) it is not too unreasonable to assume that the additional leverage and capital created by Pension Egen Regi have affected the return on equity for the PRI-companies positively during this period. After all, the initial paired sample t-test showed an average return on equity of 13,42 percent in the PRI-sample compared to 9,9 percent in the Alecta-sample over this period. The difference is significant even at 0,1 percent significance-level (see table 7.1a).

## 7.5 Causality and omitted factors

Our study shows that some industries seem to benefit more by using Pension Egen Regi compared to Alecta. Industries that are capital intensive and have a large number of employees seem to outperform its Alecta-peers on an even stronger basis, especially in the period 1963-1986. This is completely in line with the initial background of PRI in the sense that PRI was very much needed in the 60's because of rocketing capital needs and constrained capital markets.

However, our study also shows that these factors only explain 10 percent of the PRI-companies' outperformance. This indicates that there are other omitted factors that explain the dominance of PRI-companies which do not necessarily have anything to do with the PRI-solution being superior but with other firm-specific factors.

One factor that we have not investigated is whether the firms in the PRI-sample for some reason have higher leverage (apart from the additional leverage incurred by the pension liability). It might also be so that the semi-internal financing that comes from the fact that the PRI-companies borrow money from their pensioners might be done at a cheaper price than market value due to weak monitoring on behalf of the pensioners.

Another reason can be that the PRI-companies perform better because they have good management or a very successful business model. Atlas Copco might perform well, not because they use Pension Egen Regi, but because they simply are Atlas Copco. But are there any tangible factors that can explain the Atlas-Copco effect?

## 7.6 The monopoly-bias

According to Porter (1979), there are five forces that determine the profitability of an industry. One of these forces is the rivalry among existing competitors. The fewer and larger players in an industry, the more profitable the industry will be. This is also known as oligopoly or monopoly if there is only one large player. Lindvall (2016) argues that both Sandvik and Atlas Copco have a substantial pricing power against their customers since they are the only suppliers in their market Rock and Mining Technology.

Lindvall further argues that many other Swedish companies in the engineering industry has a substantial market share in their specific niches. He also mentions Alfa Laval, Assa Abloy, SKF and Hexagon in addition to Atlas Copco and Sandvik as having some degree of monopoly power in their specific niche markets. In the Materials sector, SCA is mentioned as having a niche within hygiene products and tissue paper (today's Essity). Also, Holmen and Stora Enso are mentioned as having a niche within consumer paperboard. Since both PRI-companies (e.g. Atlas Copco) and Alecta-companies (e.g. Alfa Laval) are mentioned as having oligopoly/monopoly-status, there is no indication that this phenomenon could explain the outperformance of PRI-companies compared to Alecta-companies.

Nevertheless, since the companies mentioned are all represented in our sample it can be a potential reason for why the return on equity showed in our sample was relatively good (13,5 percent). Thus, our sample might not be random but rather it might be an overrepresentation of the monopoly or oligopoly-companies mentioned above. This also implies that the PRI-sample might not be a representation of how the PRI-companies perform on average.

However, this is not to say that the actual return on equity would be lower than 4 percent for the average PRI-company. Our study has looked at the long-term performance of the largest PRI-companies and should therefore serve as a good benchmark. Thus, the discount rate of 4 percent should not be questioned in this context even if our sample mean of 13,5 percent might be somewhat inflated.

## 7.7 The Wallenberg-bias

According to Leiser & Lyttkens (2017), publicly traded companies where the major part of the ownership is limited to a narrow group of shareholders, tend to outperform companies where the stockholders are more diluted and of institutional nature. Their study showed that companies on the Swedish stock exchange that fulfilled the criteria above, generated substantial abnormal stock returns. Assuming a high correlation between company fundamentals and stock returns, it is reasonable to presume that this effect is also significant in company fundamentals such as ROE.

Looking at the PRI-sample in our thesis, one notices for instance that the Wallenberg sphere has had a large ownership in Atlas Copco for a long time, Christer Gardell holds a large stake in ABB and, until recently, Volvo, Melker Schörling holds a large stake in Hexagon.

Yet, this ownership structure is also seen in Alecta-companies in our sample such as Fredrik Lundberg's Holmen and Stefan Persson's H&M. Thus, this "Wallenberg-bias" might not help to explain why the PRI-companies tend to outperform the Alecta-companies but rather why both our PRI-sample and Alecta-sample shows such a good return on equity over time, just like in the case of a "monopoly-bias".

The reason for the PRI-dominance could of course be that the Wallenberg and monopoly-biases are more substantial in the PRI-sample. However, it needs to be emphasized that these arguments are very vague and speculative. The actual reason to the PRI-companies outperformance of Alecta-companies on return on equity will be left for future research.

# 8. Concluding remarks

In conclusion, our study has showed that companies who use the PRI method for their pension funding tend to outperform comparable companies who deal with their pension obligations by investing them with Alecta. The reason to this outperformance is not clear but we can see that the outperformance is more substantial and statistically significant during 1961-1986 than during 1987-2016.

However, it is not possible to make any deeper conclusions based on this. Even though it is possible to find arguments in our theoretical framework, which suggest the significant PRI-performance during 1961-1986 being a direct effect of the PRI method, our sample has some drawbacks which inhibit this conclusion. Our sample is limited, it might not be randomly selected and it has potential omitted variables. Thus, we can not exclude that there are other variables than the PRI method itself which explain the substantial PRI-dominance during the years 1961-1986.

Regarding the questioned discount rate of 4 percent which PRI uses, our study shows that the long-term return on equity for the companies in our sample is 13 percent, thus considerably higher than 4 percent. This is in line with PRI NGO's hypothesis. Even though our sample might suffer from upward biases, we argue that it is still fair to use our study as a good benchmark for the return on equity of Swedish companies. After all, our sample consists of the large well-established companies which have been the driving forces in the Swedish economy for a long time. Therefore, it is reasonable to use these companies as a benchmark. Many of these old companies are still contributing significantly to the Swedish economy even if they are getting more and more global.

The substantial historical contribution of these "crown jewels" of the Swedish economy is well quoted by CEO of Alfa Laval, Tom Erixon: "Det är nog unikt för Sverige med så gamla företag på börsen. Går man tillbaka till 70-talet och tittar på A-listan i USA är de flesta storbolagen borta." (Sweden is probably unique in having so many companies still on the stock exchange. If you go back to the 1970'ies and have a look at the US A-list, most of the Large Cap. companies are gone by now)

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# 10. Appendices

Table 7.1a: Return on equity for PRI-sample and Alecta-sample from year to year between 1961-2016.

| Year | PRI ROE | Alecta ROE | Year | PRI ROE | Alecta ROE | Year | PRI ROE | Alecta ROE |
|---|---|---|---|---|---|---|---|---|
| 1961 | 10,64% | 8,6% | 1980 | 12,95% | 10,5% | 1999 | 18,24% | 17,3% |
| 1962 | 10,84% | 7,5% | 1981 | 15,36% | 8,8% | 2000 | 23,63% | 15,1% |
| 1963 | 17,07% | 7,2% | 1982 | 19,46% | 11,3% | 2001 | 10,48% | 8,2% |
| 1964 | 12,01% | 15,8% | 1983 | 16,02% | 13,2% | 2002 | 6,53% | 7,2% |
| 1965 | 15,17% | 6,8% | 1984 | 19,32% | 15,2% | 2003 | 11,42% | 10,5% |
| 1966 | 10,93% | 5,6% | 1985 | 21,88% | 18,5% | 2004 | 18,12% | 18,0% |
| 1967 | 9,78% | 4,6% | 1986 | 15,85% | 26,1% | 2005 | 21,57% | 28,4% |
| 1968 | 10,92% | 5,6% | 1987 | 20,78% | 18,4% | 2006 | 15,58% | 22,4% |
| 1969 | 12,46% | 6,4% | 1988 | 21,53% | 32,2% | 2007 | 18,38% | 22,2% |
| 1970 | 11,41% | 7,3% | 1989 | 21,63% | 30,8% | 2008 | 11,42% | 12,1% |
| 1971 | 11,95% | 6,1% | 1990 | 16,96% | 20,3% | 2009 | 4,20% | 9,6% |
| 1972 | 10,45% | 5,3% | 1991 | 6,71% | 3,3% | 2010 | 15,43% | 11,3% |
| 1973 | 15,52% | 8,7% | 1992 | -0,06% | 7,0% | 2011 | 12,78% | 6,2% |
| 1974 | 12,29% | 15,9% | 1993 | 7,79% | 10,5% | 2012 | 7,23% | 11,4% |
| 1975 | 11,96% | 10,0% | 1994 | 20,66% | 18,0% | 2013 | 8,33% | 9,4% |
| 1976 | 12,37% | 7,3% | 1995 | 18,55% | 22,3% | 2014 | 12,94% | 13,6% |
| 1977 | 9,08% | 7,5% | 1996 | 19,64% | 17,6% | 2015 | 13,35% | 14,6% |
| 1978 | 11,74% | 9,7% | 1997 | 19,31% | 16,7% | 2016 | 14,28% | 17,7% |
| 1979 | 11,44% | 8,8% | 1998 | 14,99% | 18,1% | 2017 | | |

Table 7.4: Result of rank sum test and comparison with binomial test across groups.

| Group | Average number of employees 1961-2016 | Beta average | Average number of employees (rank) | Beta average (rank) | Capital intensity (rank) | Total sum* | PRI percentage of "wins" in binomial test |
|---|---|---|---|---|---|---|---|
| **Group 15:1** | 6 251 | 1,06 | 7 | 8 | 13 | 28 | 67,92% |
| **Group 15:2** | 14 155 | 0,96 | 12 | 10 | 6 | 28 | 46,43% |
| **Group 15:3** | 2 775 | 0,84 | 5 | 14 | 6 | 25 | 75,00% |
| **Group 15:4** | 6 672 | 1,23 | 8 | 3 | 13 | 24 | 61,36% |
| **Group 20:1** | 10 323 | 1,20 | 11 | 4 | 8 | 23 | 65,45% |
| **Group 20:2** | 8 291 | 1,20 | 9 | 5 | 8 | 22 | 52,17% |
| **Group 20:3** | 1 188 | 1,18 | 2 | 6 | 8 | 16 | 53,06% |
| **Group 20:4** | 39 027 | 1,15 | 15 | 7 | 5 | 27 | 62,50% |
| **Group 20:5** | 4 263 | 1,25 | 6 | 2 | 1 | 9 | 40,00% |
| **Group 25:1** | 24 840 | 0,86 | 13 | 13 | 2 | 28 | 44,64% |
| **Group 25:2** | 2 394 | 0,55 | 3 | 15 | 2 | 20 | 38,71% |
| **Group 25:3** | 2 655 | 0,90 | 4 | 11 | 2 | 17 | 74,29% |
| **Group 30/35** | 10 218 | 0,98 | 10 | 9 | 12 | 31 | 64,71% |
| **Group 45** | 32 533 | 1,29 | 14 | 1 | 8 | 23 | 62,50% |
| **Group 60** | 79 | 0,87 | 1 | 12 | 15 | 28 | 41,67% |

**: Sum of column 4, 5, 6.*