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COMPETITION IN THE SWEDISH MUTUAL FUND INDUSTRY

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ABSTRACT

The mutual fund industry plays an important role in the Swedish society where a part of the future income for all people is linked to the return of Swedish mutual fund industry and its assets. The purpose of this thesis is to investigate the competitiveness in the Swedish premium pension system. We use publicly available data on market values, entry and exit to estimate the degree of competition in the premium pension system. By constructing a structural competition model we find that market value of mutual funds is negatively correlated by the concentration of the market. The premium pension system is characterized by a high degree of entry over the study period, 2001-2013. Mutual funds with lower market value are more likely to both enter and exit. Our findings suggest that the probability of exit does not increase when more mutual funds are added into the premium pension system.

KEYWORDS: premium pension system, mutual funds, competition

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Acronyms

AIC Akaike Information Criterion. 27, 32, 37

CR Concentration Ratio. 15, 38

HHI Herfindahl-Hirschman Index. 16, 17, 25–27, 34–38, 42, 43

OLS Ordinary Least Square. 20, 23

1 Introduction

The mutual fund industry plays a vital and integrated role in today's society and acts as a crucial role in securing future consumption for many people. In recent years, more and more of individual's retirement capital has been allocated to mutual funds through governmental actions and agreements between labor unions and employer representatives. Since 2000 the Swedish government invest a fraction of the public retirement capital for individuals in the mutual fund market.[1] The mutual fund industry has been highlighted in media in the last couple of years where the focus has primary concerned mutual fund fees, active versus passive management and profitability of the mutual fund managers.

This thesis investigates the competitiveness in the Swedish mutual fund industry and the behavior of companies managing mutual funds in the Swedish premium pension system between 2001 and 2013. The Swedish mutual fund industry has experienced a dramatic growth the past years. The number of Swedish registered mutual funds in the entire industry have more than doubled; going from 889 in 2005 to 1809 by the end of 2013 while the total market value increase from 1319 billion SEK to 2410 billion SEK during the same time period (Fondbolagens Förening, 2014).

The premium pension system is a part of the Swedish mutual fund industry and like the total Swedish mutual fund industry it has experienced a large increase in both market value and number of mutual funds during the study period. The market value of the premium pension system has increased from 65 billion SEK in 2001 to 605 billion SEK in the end of 2013.

No other country in the world has a higher percentage of people investing in mutual funds as in Sweden; currently 94 percent of people in Sweden are mutual

[1] 2.5 percent of all salaries up to a certain limit

fund investors(Fondbolagens Förening, 2014). About one half of the mutual fund industry is related to retirement capital such as the premium pension system and other insurance-savings and the other half is related to households and corporation direct investments (Swedish Competition Authority, 2013).

One condition for making a good mutual fund-investment decision is that the investor has good knowledge and understanding about the product. Despite its great importance, Swedish mutual fund investors have insufficient knowledge and interest to make rational mutual fund investment decision and experiences low opportunities to negotiate term of contracts (Swedish Competition Authority, 2013). A recent survey suggests that over 50 percent of all people use advisors for making the mutual fund investment decisions on their behalf (TNS Sifo Prospera, 2012).

Recent studies made by the Swedish Competition Authority (2013) and AMF Pension (2013) suggest that the fees in the mutual fund industry has in general remained the same but has increased for some segments of the markets. The four major banks; Handelsbanken, Nordea, SEB and Swedbank control about 60 percent of the mutual fund industry, down from 85 percent during the 1990s (Swedish Competition Authority, 2013).

The creation of the mutual fund industry makes it possible for all people to access the financial markets worldwide and benefit from the growth in the economy. The mutual fund industry offers an uncountable variety of investment opportunities with different assets, geographic focus, risk exposures and allow people to diversify risks cost effectively. The expected return on mutual fund investments generally depends on the return on the underlying market and the fees involved with the investment (Swedish Competition Authority, 2013).

A mutual fund company acts under the same circumstances as ordinary companies whose primary goal is to maximize profits. A mutual fund investor generally desires good risk-adjusted return at low cost which could potentially cause conflicts of interest between the mutual fund investor and the mutual fund company (Coase, 1937).

The mutual fund industry is characterized by high barriers of entry which can potentially threaten effective competition in the industry (Swedish Competition Authority, 2013). New entrants must access distribution networks for marketing and delivering the mutual funds. Some of these distribution networks are controlled by the major banks and some independent distributor that may be competing for the mutual fund investor. Economies of scale are significant in the mutual fund industry. The mutual fund industry are characterized by high fixed cost when entering the market and small variable cost making larger mutual funds more profitable than smaller ones. Regulatory authorities monitor the Swedish mutual fund industry and new entrants must fulfill a number of requirements for entering the market.[2]

The competition in the mutual fund industry is very important to investigate since there are many people who lack in both knowledge and interest about investing their current financial capital. Because of the long investment period and the large market value of the mutual fund industry, small changes in fees or delivered quality could potentially cause severe impacts in future consumption.

We present dynamic models explaining both the determinants of the market value of mutual funds and the determinants of entry and exit by studying measures of competition in the premium pension system. All data has been complied and arranged on a monthly basis from the Pensionsmyndigheten (2014).

[2]Finansinspektionen

The data reveals that new mutual fund entry has occurred frequently from 575 in 2001 to 853 at the end of 2013. For 2003, 2007, 2008, 2011 the number of mutual fund exits has exceeded the number of mutual fund entry in the premium pension system. By excluding the publicly managed alternative the market concentration measured by concentration ratio CR_4 has decreased from 12.1 percent in 2001 to 9.3 percent at the end of 2013 while the Herfindahl-Hirschman Index has decreased from 81 to 52 during the same time.

The results show that the probability of entry and exit are higher for mutual fund managers with lower market values and that the probability of entry increases when the total number of funds in the premium pension system decreases. The probability of mutual fund exit in the premium pension system does not increase as the number of mutual fund increases and the probability of mutual fund entry is positively correlated with the total market value of the pension system.

The disposition of the thesis is as follows: first, in Section 2 is a brief literature review will be given about previous research on the mutual fund industry followed by Section 3 describing the data used and the calculations of different measures of competition. Section 4 defines and constructs the modeling framework used to estimate the competitiveness in the mutual fund industry. The empirical results of the regressions made on the modeling framework will be discussed in the Section 5. The study ends by a conclusion summarizing the findings and most significant results.

2 Literature review

The literature on the mutual fund industry is quite extensive, where most papers focus on the US market and some conducts cross-border research. The focus of academic research in recent years has been on measuring performance in the mutual fund industry (Sirri and Tufano, 1998). Historically the study of competition in the mutual fund industry has not been viewed as an area of its own but rather being a part of the competition in the banking industry (Baumol et al., 1989). No previous research on competition in the mutual fund industry in Sweden has been found. In general, the academic studies of competition can be separated into two parts, structural and non-structural, where structural research explicitly modeling the assuming causality between industry concentration and market performance (Bikker and Haaf, 2002a).

Economist's usually defines a competitive market as a market where there are many producers and consumers participate trading in a standardized product or service. Market entry is associated with zero or low costs, and consumers have sufficient information to evaluate the characteristics of the traded good (Carlson et al., 2004). Competitive markets are characterized by two important features: (i) that new market players entering the market, and (ii) that this entry makes the incumbent players change their behavior (Wahal and Wang, 2011).

Khorana and Servaes (1999) investigate factors that play an important role in the process of new mutual fund entry in the US mutual fund market using a sample of US mutual funds entry during the period 1979 to 1992. Four major determinants of importance were obtained. First, there is a positive correlation between market size and new mutual fund entry; the bigger the specific category the more likely is it that new mutual fund entry occurs. Second, more mutual fund openings tend to occur in categories with a larger proportion of overhang. Khorana and Servaes

(1999) define overhang as a measure of the difference between the current value and the acquisition price of the mutual fund or the total capital gains for the mutual fund investor.

Third, asset managers who had performed well historically are more likely to start new mutual funds. Fourth, and last, Khorana and Servaes (1999) conclude that significant economies of scale exists in the US mutual fund industry based on their discovery that large asset managers and asset managers with a history of many new mutual fund starts will start more funds in the future.

The existence of economies of scale, described above, in the mutual fund industry makes larger markets players more profitable than smaller market players (Baumol et al., 1989). Gains from economies of scale might not be transferred to the mutual fund investors through lower prices or higher quality (Freeman and Brown, 2001). A survey made by the Swedish Competition Authority (2013) suggests that when a mutual fund is reaching a capital over estimated 1 billion SEK, economies of scale are significant. This implies that up to this breaking point revenues and cost are going hand-in-hand and the capital of the mutual fund excessing 1 billion SEK is more profitable and therefore benefiting larger asset manager in the market.

Past performance and fees are two important determinants when a mutual fund investor chooses which mutual funds to allocate his or her money. Past performance is of greater importance than fees (Wilcox, 2003). This is being supported by Sirri and Tufano (1998) whom conclude that mutual funds with greater historical performance experiences larger capital inflows in their mutual fund. Past performance and fees are not independent of one another. High fees reduce the possibility for asset managers to achieve good return to its investors. Performance tends to be more volatile than fees over time (Trczinka and Zweig, 1990).

Wahal and Wang (2011) examine how new entry affect the competition in the mutual fund industry regarding management fees, cost levels, performance and other variables. A large sample US mutual funds, money market- and bond mutual funds excluded, over a period between 1981 and 2005 are being used. Wahal and Wang (2011) use an approach by observing the overlap in holdings of mutual funds as a measurement of competitiveness in the market. Overlap is simply a measure of the degree of similarities in portfolio holdings between mutual funds.

Mutual funds with large similarities in their holding experiences both price competition and quantity competition. This results in lower mutual fund fees of the fund but this is being offset to a larger extend of an increase in distribution fees for the price competition and for quantity competition with lower invested capital (Wahal and Wang, 2011). Arguments are being made that if costs increase this should affect performance of the mutual funds. Performance seems unaffected by the measure of overlap when observing the sample for the entire period but when observing the sample prior to 1998, a small negative correlation exists (Wahal and Wang, 2011).

The mutual fund industry experiences price competition and a number of different other factors influences markets shares in the industry (Khorana and Servaes, 2012). Of great importance is that front-end and back-end loads are associated with entry and exit for an investor in the mutual funds are positively related with market share. When loads of these kinds are being increased the market shares also increases. Sirri and Tufano (1998) make the same conclusion that past performance is also an important factor maintaining markets shares.

Khorana and Servaes (2012) use a data based on the market shares and fees and investigating on a period of over 30 years, 1976 to 2009 using a sample consisting of US mutual funds. By moving a mutual fund with a fee belonging to the fourth

with lowest fees to the fourth with the highest fee the market share of that mutual fund will fall by almost 20 per cent (Khorana and Servaes, 2012).

Fees and other expenses are of great importance for future performance (Carhart, 1997). A mutual fund with high fees decreases its ability to achieve superior performance relative to other mutual funds with lower fees (Elton et al., 1993). Literature suggests that a, historically, underperforming mutual fund will likely be underperforming in the future, and the same is valid for over performing mutual funds (Grinblatt and Titman, 1992). Sirri and Tufano (1998) and Khorana and Servaes (2012) conclude that prior mutual fund performance is positively correlated with larger market shares and greater capital inflows in the mutual fund.

Investors are facing an uncountable number of choices when investing in mutual funds. The mutual fund market offers a large variety of different mutual funds with different characteristics offered by many asset managers (Coates and Hubbard, 2007). Search costs are related to the decision making process where an investor must find information about mutual fund possibilities and their attributes which is often related some kind of costs (Sirri and Tufano, 1998). Sirri and Tufano (1998) investigates how mutual fund capital flows are behaving when taking search costs into account, something most other model do not consider.

Search costs are interpreted as attention in the media, costs related to distribution and marketing and last size of the managing firm. That size of managing firm should decrease search costs cannot be concluded even though results show that large firm grows faster than the overall market. The results show that there is a positive correlation between media coverage and capital inflows in mutual fund market but Sirri and Tufano (1998) argue that there could be a reverse relationship where capital inflows cause media coverage and not the other way around.

Mutual fund managers are interested in differentiate their mutual funds to decrease the importance of price competition (Hortacsu and Syverson, 2004). The price competition among mutual funds increases when underlying mutual fund holdings are similar (Wahal and Wang, 2011). Hortacsu and Syverson (2004) examines one of the worlds most traded and standardized mutual fund market, the S&P 500 Index mutual fund where the asset managers have small possibilities to differentiate their product.

Hortacsu and Syverson (2004) discovered that large differences in price between the S&P 500 Index mutual funds exist and the average fee has increased from the year 1995 to 2000. This depends on the fact that S&P 500 index mutual funds entering the market charges higher fees than the incumbent mutual funds. Hortacsu and Syverson (2004) explain these discoveries with investors costs of finding and assessing the S&P 500 index mutual fund, the fact that asset managers may offer other related services and that a new generation of younger investors with insufficient knowledge about mutual funds has entered the market.

In general mutual fund investors and the mutual fund managers have different objectives. Mutual fund investors overall goal is to maximize return on investments taking the risk of the investment into account and mutual fund managers are interested of maximizing profits by increasing revenues (Khorana and Servaes, 2004). This may cause conflicts of interest since the mutual fund manager can increase its fees charged to the mutual funds decreasing the potential return for the mutual fund investor (Elton et al., 1993).

Mutual funds charging high fees have lower market shares while mutual fund managers that charges the mutual fund for marketing and distributing experiences higher markets shares (Khorana and Servaes, 2004). Evidence suggests that prior performance has become more important determinant for mutual fund investor

since Morningstar started evaluate mutual funds in 1992. Differentiating and innovative mutual fund managers experiences higher market share but this effect has decreased over time, possibly because the mutual fund industry is maturing (Khorana and Servaes, 2004).[3]

It is clear that competition affects the ability for mutual fund managers to set prices without taking the fees set by its competitors into account (Coates and Hubbard, 2007). This conclusion is based upon the fact that the mutual fund industry experiences low barriers to entry and that entry has occurred constantly over the previous decades. Market concentration, measured as Herfindahl-Hirschman Index,[4] has fallen and market shares of incumbent firms are constantly changing during that same period. The existence of competition in the mutual industry implies that mutual fund fees should be determined by market structures and not be affected by regulatory actions from governments (Coates and Hubbard, 2007).

Money market mutual funds are a segment of the mutual fund market that is particularly affected by price competition.[5] The returns for this segment of mutual funds are strongly and almost explicitly depended on the fees charged by the mutual fund managers (Coates and Hubbard, 2007). Over the last decade a majority of the mutual fund managers have reduced their charged fees by around half (Christoffersen, 2001).

[3]Morningstar is an independent rating company for mutual fund

[4]Herfindahl-Hirschman Index is a market concentration measurement taking all mutual fund managers into account. See data section.

[5]Mutual funds with fixed income asset with less than one year to maturity

3 Data

Pensionsmyndigheten (2014) provides data on current portfolio holding within the premium pension system on a monthly basis. The fundamentals of this project are built upon market values for all available mutual funds and many variables have been derived using those market values. Every mutual fund has some characteristics such as specific mutual fund manager and category. The variables used are presented in Table 1.

Table 1: Definition of variables[1]

Variable	Definition
Time (t)	Monthly data from January 2001 to December 2013[1]
Category	Each fund i is categorized in Equity funds, fixed income funds and mixed funds
Mutual fund manager	The firm f managing the fund
Market	The market j that belong to category C $\{M_j \in C\}$
Market value ($mv_{i,t}$)	The value of fund i at time t
Total market value (MV_j)	The total market value $MV_j = \sum_{i=1}^{N} mv_i$, where N are the funds in the specific market j
Market share ($s_{i,j}$)	The share of mutual fund i on the specific market j $s_{i,j} = \frac{mv_i}{MV_j}$
Number of funds ($n_{j,t}$)	The number of funds in market j at time t , $n_{j,t} = \#M_{j,t}$
Entry (en_t)	The number of funds that satisfies $\{en_t \notin M_{t-1} \vert en_t \in M_t\}$
Exit (ex_t)	The number of funds that satisfies $\{ex_t \in M_t \vert ex_t \notin M_{t+1}\}$

[1]Source of data: Pensionsmyndigheten (2014).

Note: Missing data from June 2006.

Every mutual fund available in the data is classified into three different categories based on their current objective and stated investment strategy. One important reason for choosing relatively few categories is due to the fact that categories may change over time, and previous, or changes, in a mutual fund category have been unable to access over time. One would expect that changes in category, over time, to be smaller if fewer and less specific categories are chosen. The three different categories are equity mutual funds, fixed income mutual funds and mixed mutual funds. Mixed mutual funds are mutual funds that fail to be categorized either as

an equity mutual fund, a fixed income mutual fund or being a combination of the two. There are other methods of classifying mutual funds that can be used (Kim et al., 2000).

Presented in Table 1 the definition of an entry is when a new mutual fund occurs in the data set, and respectively, an exit occurs when a mutual fund disappears from the data set. As a result of these definitions combined with limited information it is not possible to determine mergers between mutual funds in the premium pension system. If two mutual funds merge into one new mutual fund this will be counted as two exits and one entry and if two mutual funds merge into one of the existing mutual funds which implies that, in our data, there will only be one exit.

The premium pension system is constructed in a way that allows individuals to allocate their retirement capital into many different mutual funds corresponding to their attitude to risk, expected return and other individual preferences. For those individuals not making a choice, the state automatically provides a publicly managed mutual fund where the equity to fixed income ratio decline when reaching a certain age. The publicly managed mutual fund is by far the biggest mutual fund in the system, holding a significantly larger market share than any other mutual fund in the market over time (Pensionsmyndigheten, 2014).

As in Table 2, the market value for the publicly managed mutual fund has almost grown tenfold from 19 to 180 billion SEK between 2001 and 2013. The market share has been fairly constant around 30 percent of the total market since the start implying that the growth in the total market value is approximately, the same as the growth in the publicly managed mutual fund.

Table 2: Market value and market share for the publicly managed mutual fund[1]

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Market value	19.0	18.7	29.9	40.1	58.1	78.9	87.4	62.7	89.7	110.1	104.6	130.4	181.6
Market share	0.29	0.31	0.32	0.32	0.30	0.29	0.28	0.27	0.26	0.27	0.27	0.28	0.30

[1]Source of data: Pensionsmyndigheten (2014)

Note: Market value is measured in billions SEK and market share in percentage.

3.1 Industrial dynamics

Market dynamics, presented in Table 3, show market values, number of mutual funds, number of entry and exit for all defined categories. Entry- and exit rates have been calculated by dividing entry and exit, respectively, by the total number of mutual funds existing in the beginning of each year.

The market value has increased significantly, almost tenfold, since the premium pension system started in the late 2000s. Only three years have shown a decline in market value, 2002, 2008 and 2011 which can depend on the decline in the equity markets around these years (see Figure 1). The market value has gone from 65 billion SEK in 2001 to over 600 billion SEK 2013 and the increases are across all categories. Fixed income has grown by a multiple of 22, equity by 7 and mixed income by 11. The market values are depending on the return of the investments being made and new capital allocated to the premium pension system. By the end of 2013 equity mutual funds and mixed mutual fund was by far the biggest categories accountable for about 95 percent the total market value and the other 5 percent is allocated to the fixed income category.

The number of mutual funds have increased over the years, from 575 in 2001 to 853 at the end of 2013. The increase holds for all categories, the percentage increase within all categories lies between 45-65 percent from the start. For only three years 2003, 2008 and 2011, the total change in number of mutual fund have been negative.

Table 3: Number of mutual funds and market dynamics[1]

			Year											
Item	Category	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Market	Equity	33.3	28.1	45.9	60.7	99.2	141.2	162.9	105.2	179.5	215.0	161.7	192.6	240.3
value	Fixed income	1.2	1.9	2.7	3.7	4.9	7.5	12.9	24.2	21.3	23.5	28.0	24.3	27.0
	Mixed	30.4	29.2	45.3	60.3	88.3	118.7	132.6	101.2	139.4	169.9	203.9	253.7	334.6
		65.0	59.3	93.9	124.8	192.4	267.4	308.3	230.6	340.2	408.4	393.6	470.5	601.9
Number	Equity	403	438	430	487	513	572	576	580	575	568	544	554	587
of funds	Fixed income	85	103	107	116	117	122	122	108	111	119	117	126	139
	Mixed	87	94	79	78	81	83	81	79	88	95	109	125	127
		575	635	616	681	711	777	779	767	774	782	770	805	853
Entry	Equity	100	62	58	85	49	76	45	63	35	39	59	46	63
	Fixed income	25	22	18	10	9	13	11	6	6	12	9	16	20
	Mixed	3	11	2	7	4	9	1	2	14	11	23	27	10
		128	95	78	102	62	98	57	71	55	62	91	89	93
Exit	Equity	8	28	66	27	23	16	46	56	38	46	84	37	29
	Fixed income	5	4	14	1	8	7	12	21	2	4	11	7	7
	Mixed	1	4	17	8	1	7	3	7	2	4	9	14	5
		14	36	97	36	32	30	61	84	42	54	104	58	41
Entry	Equity	—	0.15	0.13	0.20	0.10	0.15	0.08	0.11	0.06	0.07	0.10	0.08	0.11
rates	Fixed income	—	0.26	0.17	0.09	0.08	0.11	0.09	0.05	0.06	0.11	0.08	0.14	0.16
	Mixed	—	0.13	0.02	0.09	0.05	0.11	0.01	0.02	0.18	0.12	0.24	0.25	0.08
Exit	Equity	—	0.07	0.15	0.06	0.05	0.03	0.08	0.10	0.07	0.08	0.15	0.07	0.05
rates	Fixed income	—	0.05	0.14	0.01	0.07	0.06	0.10	0.17	0.02	0.04	0.09	0.06	0.06
	Mixed	—	0.05	0.18	0.10	0.01	0.09	0.04	0.09	0.03	0.05	0.09	0.13	0.04

[1]Source of data: Pensionsmyndigheten (2014)

The table presents an overview of market dynamics by the end of each year.

The rate of entry and exit fluctuates heavily between 2001 and 2013. Some remarks can be of importance. Between 2007 and 2013 the rate of entry felt and exit rates rose for equity mutual funds, making the number of equity mutual funds fairly constant over the period. During 2011 and 2012 the number of mixed mutual funds increased by almost 25 percent annually, the highest entry rate in the data.

3.2 Market concentration ratio

The Concentration Ratio (CR) is calculated with using the formula shown in equation (1), where k is the number of market share observations, s_i is the market share of the mutual fund sorted in descending order (Cabral, 2000).

$$CR_k = 100 \sum_{i=1}^{k} s_i \tag{1}$$

The Concentration Ratio $(\text{CR})_4$ only measures the concentration amongst the four largest mutual funds in the premium pension system, it can therefore only be used as partial information about the mutual fund industry. The index ranges from 0 to 100 percent, where 100 percent corresponds to the entire mutual fund market covered by the top four mutual funds which is likely to be an oligopoly or possibly even a monopoly. A ratio towards 0 percent corresponds to many small market players having no significant influences in the industry. An oligopoly is often defined as a market in which the top four businesses have a concentration ratio above 40 percent (Mahajan, 2006).

Table 4 shows that all concentrations ratios (CR_4) in our data are lower today compared to the start (2001). Four mutual fund managers control 60 percent of the market which indicated an oligopoly-characterized market (Mahajan, 2006). About 10 percent of the market is being controlled by the top four mutual funds.

An adjusted index has been used to describe concentration ratios without taken the biggest, publicly managed mutual fund, into account. The category for equity mutual funds has, over the entire period, been the less concentrated category and has experienced the smallest decrease in concentration ratio from the start. Both fixed income and mixed mutual funds has decreased its concentration by approximately ten percent.

Table 4: Market concentration by concentration index (CR_4)[1]

		Year											
CR_4	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Mutual fund	38.75	39.99	40.50	41.28	39.19	38.54	36.62	34.77	34.06	35.03	33.72	34.74	37.31
Mutual fund[2]	12.10	11.00	11.45	11.94	11.72	11.67	10.48	9.37	9.62	9.85	9.33	9.28	9.30
Asset manager	66.78	68.34	69.94	70.20	67.65	67.10	65.14	65.51	61.37	59.94	60.93	59.86	60.83
Equity	23.59	23.22	23.45	24.53	22.71	22.11	19.84	20.53	18.22	18.71	19.93	19.89	20.61
Fixed income	43.39	40.11	38.53	41.55	40.75	44.76	46.31	38.37	45.93	50.01	37.03	33.34	34.44
Mixed	73.50	74.91	78.64	78.75	77.61	77.64	76.86	72.65	74.06	73.51	63.00	61.88	64.34
Mixed[2]	35.89	38.80	46.27	44.66	41.29	40.14	38.80	35.29	33.34	30.73	28.63	26.26	26.47

[1]Source of data: Pensionsmyndigheten (2014)

[2]An adjusted index measuring the mutual funds $k \in [2, 5]$, or $CR_4^1 = CR_5 - CR_1$.

3.3 Herfindahl-Hirschman Index

Since the concentration ratio only takes the k largest mutual funds into account it is necessary to introduce the Herfindahl-Hirschman Index (HHI) to capture the distribution of market shares for all mutual funds in the premium pension system. The HHI is calculated with the following formula, where n is the number mutual funds in the market, and s_i is the market share of each mutual fund (Cabral, 2000). The formula is given by equation (2).

$$HHI = 10,000 \sum_{i=1}^{n} s_i^2 \tag{2}$$

The HHI ranges from zero to ten-thousand, where a small number of the index indicates a fragmented market with many market players with small market shares.

On the contrary, a high number of the HHI indicates a market with relatively few market players with large market shares. Since the HHI is a square of market shares, larger market players are given higher weight than small market players in the index (Cabral, 2000).

The HHI plays an important role in the decision making process whether to allow horizontal mergers in the United States (Bikker and Haaf, 2002a). The United States Justice Department classify market with a HHI up to 1,500 as unconcentrated markets and markets above as either moderately or highly concentrated (United States Justice Department, 2010).

The HHI for our data is presented below in Table 5. Most of the defined markets can be categorized as unconcentrated with a low number of the HHI with exception for mutual fund manager and mixed mutual funds. The reason for a high HHI for mixed mutual funds is due to the fact that the publicly managed mutual fund lies within this category. When excluding the publicly managed mutual fund the HHI falls significantly. This is consistent with the Swedish Competition Authority (2013) investigation of the Swedish mutual fund market that the industry experiences competition due to the fact that HHI has decreased over time.

Table 5: Market concentration by Herfindahl-Hirschman Index[1]

	Year												
Item	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Mutual fund	939	1,062	1,086	1,107	982	938	864	794	752	782	762	821	963
Mutual fund[2]	81	72	76	73	70	68	61	57	57	56	55	54	52
Mutual fund manager	1,554	1,646	1,675	1,693	1,568	1,536	1,455	1,429	1,306	1,253	1,336	1,329	1,443
Equity	252	244	238	233.6	207	196	171	179	161	162	164	171	181
Fixed income	706	611	577	608.3	579	704	777	520	687	782	509	457	447
Mixed	3,974	4,127	4,414	4,495	4,402	4,479	4,410	3,901	4,199	4,242	2,743	2,711	3,020
Mixed[2]	66	66	81	74	69	65	64	71	58	51	91	84	74

[1]Source of data: Pensionsmyndigheten (2014)

[2]An adjusted index excluding the mutual fund with the biggest market share, i.e. $H^1 = \sum_{n=2}^{N} s_n^2 \cdot 10,000$.

3.4 Evaluation of concentration and OMX30 index

As previously mentioned, Figure 1 shows changes in measures of the market concentration and the number of mutual funds compared to an equity index representing the return of the 30 biggest companies in the Swedish equity market (OMX30).

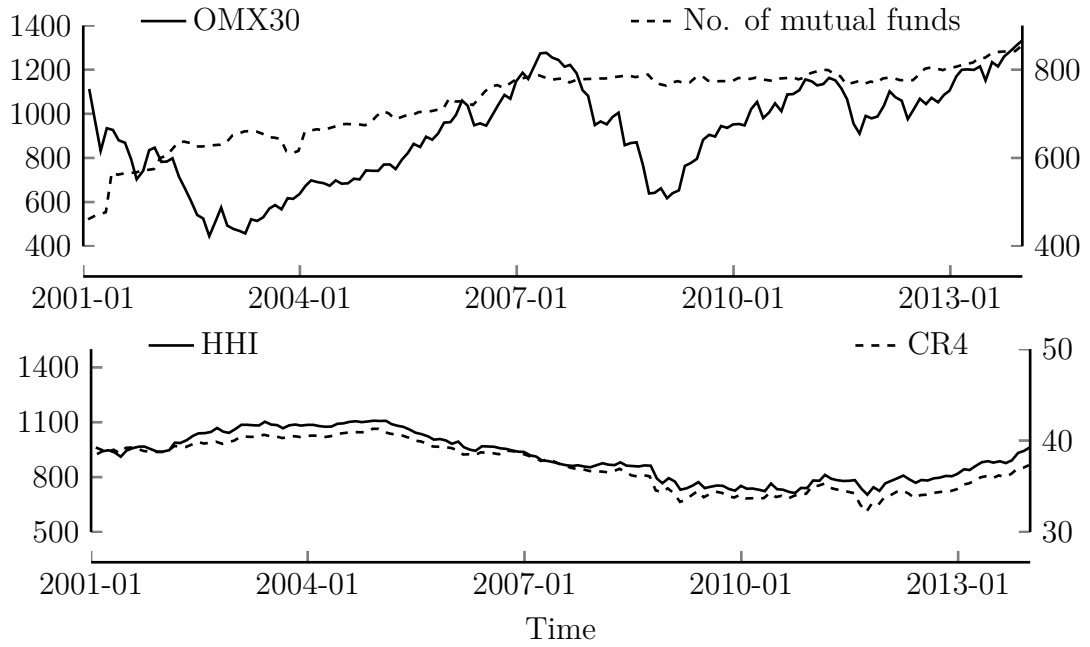

Figure 1: Equity index compared with various measures over time
*Source of data: Pensionsmyndigheten (2014) and Yahoo finance (2014)

Two large declines in the Swedish equity market have occurred during the lifetime of the premium pension system. Firstly the burst of the technology bubble in the early 2000s and secondly the financial crisis in 2008. The total number of mutual funds increased fast during the first years of the premium pension system (2001-2007). After the financial crisis in 2008 the total number of mutual funds was fairly constant but seems to increase at the end of the study period. The total number of mutual funds appears not to be influenced by the development of the Swedish equity market.

Both the Herfindahl-Hirschman Index and the concentration rate (CR_4) appears in a wave-like movement over time with small changes relative to each other. Concentration ratio by the fourth biggest firm correlates strongly with the Herfindahl-Hirschman Index (Bailey and Boyle, 1971).

4 Theoretical Framework

In order to answer the question, "Is the market competitive?", we should ask ourselves "How does the market affect the mutual funds?". In this section we study how external variables can be used to describe the change in market values of individual mutual funds. This section also investigates what market dynamics are beneficial for new mutual funds to enter as to what environment that is more likely to drive mutual funds out of business.

To answer these questions, different regression analyses are used for which different models are constructed. This way, we can determine how different variables affect the mutual fund's performance in different market environments. Regression models using Ordinary Least Square (OLS) will be used, together with logistic regression.

4.1 Adjustments for time variable and market return

Changes in asset prices in the financial markets affect the total value of the mutual fund market and the individual mutual fund. Since the focus of this paper is to investigate the competition it is reasonable to isolate variables explaining competition and adjust for changes in the markets value caused by the changes in asset prices. Thus, some limited economic causality may exist since high fees will have a negative effect on market values of the mutual funds and the total market value (Carhart, 1997).

The that market values in the premium pension system may change mainly due to three things; (i) the performance of the financial markets (i.e. asset prices), (ii) new capital being allocated to the premium pension system in December and (iii) how individuals choose to allocate their capital in terms of expected return.

Since we are interested in how the market affects the mutual funds, the regressions are compensated for time by the variable $\boldsymbol{\Upsilon T'}$ as seen in equation (3). The variable $\boldsymbol{T}$ consists of $\boldsymbol{\mathcal{M}}$ and $\boldsymbol{\mathcal{Y}}$, where $\boldsymbol{\mathcal{M}}$ are all the month (Jan-Dec) and $\boldsymbol{\mathcal{Y}}$ are all the years in the period 2001-2013 treated as dummy variables. The variable $\boldsymbol{\Upsilon}$ consists of the market return coefficients. This removes any time aspect that may be the same for all the mutual funds in the market, which gives us a better estimate for how the market affects the different mutual funds.

$$\boldsymbol{\Upsilon T'} = \begin{bmatrix} \boldsymbol{\Upsilon}_m & \boldsymbol{\Upsilon}_y \end{bmatrix} \begin{bmatrix} \boldsymbol{\mathcal{M}} \\ \boldsymbol{\mathcal{Y}} \end{bmatrix} = \boldsymbol{\Upsilon}_m \boldsymbol{\mathcal{M}} + \boldsymbol{\Upsilon}_y \boldsymbol{\mathcal{Y}} \tag{3}$$

4.2 Competition and market value

We want to model how the market value changes for different mutual funds by studying the market dynamics. For this, we need to construct a model that explains the market value of each mutual fund given certain characteristics of the mutual fund and the entire market. By carefully selecting the variables known to relate to the competition, we may analyze the result in a similar manner.

Traditionally, the marginal revenue or the size of the firm is analyzed with respect to the market dynamics as in Bikker and Haaf (2002b). In this case, the true revenue from each mutual fund is not easily available. Instead the size of the mutual fund is used, since the revenue is proportional to the market value of the mutual fund . The formula that describes the market's impact on the mutual fund market values is shown in equation (4)

$$\log_e(mv_{i,t}) = \beta_0 \log_e(MV_{t-1}) + \beta_1 \log_e(n_{t-1}) + \beta_2 \log_e(CR4_{t-1}) + \boldsymbol{\beta_3 C} \log_e(CR4c_{t-1}) + \boldsymbol{\beta_4 C} + \boldsymbol{\Upsilon T'} + \epsilon_{i,t}. \quad (4)$$

The market value ($mv_{i,t}$) of each mutual fund i at time t is explained by the following variables at time $t-1$. The total market value (MV_{t-1}), the number of mutual funds in the market (n_{t-1}) and the concentration ratio $CR4_{t-1}$ are all characteristics of the market and are the same for every mutual fund. The concentrations ratio ($CR4_{t-1}$) is interpreted as the competition variable. Basic intuition tells us that, if the mutual fund market is competitive, an increase in total number of mutual funds should imply that there will be less value for each mutual fund indicating a negative value of β_1. Other parameters in the regressions such as the total market value that is expected to yield a positive value for β_0 as there will be more value in the mutual fund market. Some variables are expressed as natural logarithm since the percentage value is more interesting than absolute values. The coefficient for these variables should be interpreted as elasticity.

The category of mutual funds ($\boldsymbol{C} = [C_{equity} \quad C_{mixed} \quad C_{fixed}]^T$) is taken into consideration as a categorical dummy variable, resulting in three different estimates for $\boldsymbol{\beta_3}$ and three different estimates for $\boldsymbol{\beta_4}$. The index $CR4c_{t-1}$ is the concentration ratio for the specific category, meaning that β_2 gives the estimate of the effect of the total CR_4 whereas the estimate $\boldsymbol{\beta_3}$ estimates the effect of the concentration ratio in the specific category. Special care needs to be taken when analyzing these variables because of the market relation; the CR_4 indicates that the top four mutual funds have increased their market value relative the other mutual funds which means it could be positive for some mutual funds and negative to others.

Variation in the model explained by other variables are expressed by a market share shock factor $\epsilon_{i,t}$ for every mutual fund i at time t. $\epsilon_{i,t}$ is assumed to have no correlation with past or present data. As explained in subsection 4.1, $\boldsymbol{\Upsilon T'}$ explains changes in market returns.

4.3 Probability of entry and exit

The probability for an entry or an exit to occur cannot be estimated with the OLS method because entry and exit is a binning variable. We want a binary response model, for which we can calculate the probability of entry and exit under certain market conditions. For this, we will use logistic regression.

Assuming that we have a probability of an event to occur $p \in [0, 1]$, and to not happen $q = 1 - p$. The logistic function is derived by taking the natural logarithm of the odds function in equation (5), Wooldridge (2012), to achieve the link function seen in equation (6).

$$\log(\frac{p}{1-p}) = \alpha + \beta_{\mathbf{0}}\mathbf{x_0} + ... + \epsilon \tag{5}$$

$$Pr(x = 1|X) = \Phi(\alpha + \beta_0 x_0 + ...|\boldsymbol{X}) = \frac{e^{(\alpha+\beta_0 x_0+...)}}{1 + e^{(\alpha+\beta_0 x_0+...)}} = p \tag{6}$$

The marginal effect in equation (7), can be found by differentiating the link function with respect to the variable of interest. Similarly, if we have the natural logarithm of the variable the marginal effect is expressed as in equation (8).

$$\frac{d}{dx_i}\Phi(\mathbf{x}'\beta + \epsilon) = \frac{e^{(\mathbf{x}'\beta+\epsilon)}}{(1 + e^{(\mathbf{x}'\beta+\epsilon)})^2}\beta_i = \frac{dp}{dx_i} \tag{7}$$

$$\frac{d}{dx_i}\Phi(...\beta_{\mathbf{i}} \log \mathbf{x_i} + ...) = \frac{e^{(\mathbf{x}'\beta+\epsilon)}}{(1 + e^{(\mathbf{x}'\beta+\epsilon)})^2}\frac{\beta_i}{x_i} = \frac{dp}{dx_i} \tag{8}$$

4.4 Determinants of entry and exit

The reason for a mutual fund to exit the market may be dependent on different aspects both endogenous and exogenous. In this model an assumption is being made that the market environment is more competitive as the market concentration increases, resulting in a higher probability for an exit. Likewise, the probability for an exit can be assumed to increase as more mutual funds are present having all other market characteristics the same since mutual funds compete for a limited amount of capital.

The probability of an exit to occur can be described by the total value of the market at time $t-1$, MV_{t-1}, and the value of the mutual fund manager $MVm_{i,t-1}$ for mutual fund i at time $t-1$. $\boldsymbol{\Upsilon T'}$ consists of categorical variables for the year and month as explained in subsection 4.1. Like before, $\epsilon_{i,t}$ are shocks for mutual fund i at time t, that explains variation not related to the model and that are not correlated with present or past data. The model is seen in equation (9).

$$Pr(\text{Exit} = 1|\boldsymbol{X}) = \Phi(\alpha + \beta_1 MV_{t-1} + \beta_2 MVm_{i,t-1} + \boldsymbol{\Upsilon}\mathbf{T}' + \epsilon_{i,t}) \tag{9}$$

It is believed that the coefficients β_1 is negative, as the chance of an exit to occur would decrease with more money in the market. The coefficient for the market value of the mutual fund manager is more difficult to interpret. Larger mutual fund managers are more likely to handle external market events better.

Another model, taking the natural logarithm of the previous variables is seen equation (10). Modeling the natural logarithm of variables gives a different marginal effect to the model, and gives a broader picture on how the market affects the exit of the mutual funds. As before, MV_{t-1} is the total value of the market at time $t-1$, $MVm_{i,t-1}$ is the value of the mutual fund managers for mutual fund i at

time $t-1$ and n_{t-1} is the number of mutual funds in the market at time $t-1$.

$$Pr(\text{Exit} = 1|\boldsymbol{X}) = \Phi(\alpha + \beta_1 \log_e MV_{t-1} + \beta_2 \log_e n_{t-1} + \beta_3 \log_e MVm_{i,t-1} + \boldsymbol{\Upsilon}\mathbf{T}' + \epsilon_{i,t}) \tag{10}$$

$\boldsymbol{\Upsilon T'}$ consists of categorical variables for the year and month to adjust for seasonality and trends in the data. $\epsilon_{i,t-1}$ are shocks for mutual fund i at time $t-1$ that are not correlated with present or past data, and explain variation in the data not related to the model.

Just as before, we expect the coefficient for the total market value to be negative as with more money in the market we would have a lower probability of exit. The coefficient of the market value of the mutual fund manager can give us very much information on how the mutual fund managers behaves in the market. The coefficient β_2, indicating the behavior of the number of mutual funds in the market on exit among the mutual funds is thought to be negative, since generally more competitors increases the competitions.

Considering the entry in the market, we have to look at the market environment of the mutual funds entering. We can model the market concentration by the Herfindahl-Hirschman Index (HHI) and the number of mutual funds, as seen in equation (11). Here HHI_{t-1} is the HHI at time $t-1$, and n_{t-1} are the number of mutual funds in the market at time $t-1$. Further, we have that MV_{t-1} is the market value of the total market at time $t-1$, and $MVm_{i,t-1}$ is the market value of the mutual fund managers at time $t-1$.

$$Pr(\text{Entry} = 1|\boldsymbol{X}) = \Phi(\alpha + \beta_1 HHI_{t-1} + \beta_2 MV_{t-1} + \beta_3 n_{t-1} + \beta_4 MVm_{i,t-1} + \boldsymbol{\Upsilon T'} + \epsilon_{i,t}) \tag{11}$$

Once again, $\boldsymbol{\Upsilon T'}$ consist of categorical variables for the year and month as explained in 4.1 and $\epsilon_{i,t}$ are uncorrelated shocks.

As HHI is a market concentration measure, β_1 is believed to be negative if competition affects entry. This is because with a higher value of HHI, we expect to have a lower probability of entry, or likewise, with a lower value HHI we expect to have a higher probability of entry. β_2 is believed to be positive, since when the market grows so would the number of mutual funds.

In this regression, we take the natural logarithm of HHI_{t-1} and MV_{t-1}. n_{t-1} is the number of mutual funds in the market at time $t-1$ and $MVm_{i,t-1}$ is the market value of the mutual fund manager of the mutual fund i at time $t-1$. The models is seen in equation (12).

$$\begin{aligned} Pr(\text{Entry} = 1|\boldsymbol{X}) = \Phi(\alpha + \beta_1 \log_e HHI_{t-1} + \beta_2 \log_e MV_{t-1} + \\ \beta_3 n_{t-1} + \beta_4 MVm_{i,t-1} + \boldsymbol{\Upsilon T'} + \epsilon_{i,t}) \end{aligned} \tag{12}$$

Adjustments for seasonality and trends are made with the coefficients $\boldsymbol{\Upsilon T'}$ and the uncorrelated shocks are modeled with $\epsilon_{i,t}$. Even if the natural logarithm is applied to HHI and the total market value, these coefficients β_1 and β_2, are still believed to be positive.

4.5 Construction of modeling framework

In the process of constructing the modeling framework, some important aspects have been considered. To avoid misleading relationships in the regression models special care has been taken to create models based upon economic arguments. Mainly three different statistical measures of regression models are used; (i) ad-

justed R-square, (ii) statistical significance and (iii) Akaike Information Criterion (AIC).

The adjusted R-square is a statistical measure between 0 and 1 that gives information about how much of the total variation in the regression that can explained by the model, i.e. how well the regression approximates the data. It represents the percentage of the variance of the data that can be explained by knowing the dependent values.

The relevance of individual parameters and estimates in the regression models is determined by student's t-test and is obtained by dividing the β coefficient by the standard error of the regression model. Statistical significance indicates that the effect of a dependent variable is not only due to just chance alone and is an important key in sensitivity analysis (Wooldridge, 2012).

A relative measure for determine the goodness of fit for a specific regression model and its parameters can be calculated by using AIC (Steckel-Berger et al., 1985). The model is, $\text{AIC} = 2k - 2\log_e(L)$, where k is the number of parameters in the regression model and L is the maximized likelihood function for the model.

5 Results

This section presents the results from performing regressions based on the constructed equations described in the previous section.

5.1 Competition and market value

The performance of the market value for mutual fund i is investigated from interpreting external market factors according to equation (4) and the results is seen in Table 6.

The total market value for the premium pension system at $t-1$ affects the individual market value for mutual fund i. In the model we notice that a percentage change in the total market value will result in a 0.8 percent change in the market value for mutual fund i. This result might seem surprisingly since the sum of all market values of mutual fund i should be equal to approximately the total market value at time $t-1$.

This result can be explained mainly by two things; (i) new capital is allocated on a year basis to the premium pension system, but is not evenly distributed among the mutual funds and (ii) the market value for mutual fund i and the total market value depend to a great extent on the returns on various assets in the global financial markets. Since mutual fund carries different characteristics in terms of expected return and volatility they may perform differently, resulting in a shift between the growth in the total market value the growth of the mutual fund i.

Results show that if more mutual funds are added to the premium pension system the market value for mutual fund i decreases since there will be less market value for each mutual fund to compete for. Expanding the number of mutual funds by

Table 6: Results of the market value regression

Explanatory variable	Estimate	Std. Error	t value	Pr(>|t|)
Log_e of total market value$_{t-1}$	0.8000	0.1048	7.64	0.0000
Log_e of number of mutual funds$_{t-1}$	-4.1769	0.3352	-12.46	0.0000
Log_e of $CR_{4,t-1}$	-1.3871	0.5944	-2.33	0.0196
C_{equity}	21.4131	3.0405	7.04	0.0000
C_{mixed}	27.7316	3.1815	8.72	0.0000
C_{fixed}	29.7959	3.0140	9.89	0.0000
C_{equity} $\log_e$ $CR_{4,t-1,equity}$	1.8408	0.1857	9.91	0.0000
C_{mixed} $\log_e$ $CR_{4,t-1,mixed}$	0.1210	0.2873	0.42	0.6737
C_{fixed} $\log_e$ $CR_{4,t-1,fixed}$	-0.8637	0.1884	-4.58	0.0000
Adj. R^2	0.9781			
No. of observations	110,225			
Trend and seasonal adjustment[1]	Yes			

Results from the regression in eq. (4), without the coefficients for the market return adjustments. Note that all natural logarithms variables should be interpreted as elasticity. To remind the reader, the model is shown below
$\log_e(mv_{i,t}) = \beta_0 \log_e(MV_{t-1}) + \beta_1 \log_e(n_{t-1}) + \beta_2 \log_e(CR4_{t-1}) + \boldsymbol{\beta_3 C} \log_e(CR4c_{t-1}) + \boldsymbol{\beta_4 C} + \boldsymbol{\Upsilon T'} + \epsilon_{i,t}$
[1]The data is adjusted for external market conditions that may affect the market value of the mutual fund

one percent will result in a decrease of 4.18 percent in market value for mutual fund i, indicating a clear effect of entry and exit.

The variable CR_4 in equation (4) is, as described in the previous section, interpreted as a measure of market concentration is assumed to represent the degree of competition in the premium pension system. An increase in the value of the market concentration (CR_4) implies that the four biggest mutual funds increase their market shares and vice versa. The results of the regression on equation (4) reveals that the market value of the mutual fund i is affected by the market concentration. The relationship between market value and market concentration is negative implying that as the market becomes more concentrated the mutual funds will have less market value compared with a less concentrated market. An

increases of the market concentration by 1 percent decreases the market value for mutual fund i by almost 1.4 percent.

The estimates for the category C_i can only be interpreted as relative measure of average market value within each category. Mutual funds belonging to the equity category have the lowest average market value while mixed mutual funds has the highest average market value and fixed mutual funds have an average market value between equity- and mixed mutual funds.

Even though the estimates for the competition variable show a reverse relationship between market value for mutual fund i and market concentration (CR_4) the relationship within each of the created categories are affected unevenly. As the market becomes more concentrated, the market value of equity- and mixed mutual funds also increases. For equity mutual funds the change of 1 percent in the competition variable implies an increase in market value of slightly 1.8 percent. Mixed mutual funds show little response to changes in market concentration and an increase of 1 percent in the competition variable affects the market value by 0.12 percent but this result in not statistically significant. Fixed mutual funds are negatively affected and experience a negative relationship between market concentration and market value. If the market concentration increases by 1 percent the market value falls by 0.86 percent for fixed mutual funds.

The result of this model is based upon 110,225 observations and adjustments have been made for dummy variable time and month. Almost 98 percent of the total variation in the model can be described by the chosen variables. A large proportion of this variation is related to the adjustments for market return; variable $\boldsymbol{\Upsilon}\mathbf{T}'$.

5.2 Determinants of exit

Modeling the historical exit of mutual funds in the market, by previous market conditions, yields the results seen in Table 7. We find that, with a negative intercept we have a very low probability of an exit. We also find that with more money in the market, we have a lower probability of exit. This makes economic sense, as there would be a larger potential of making profits when there is more money in the mutual fund market. However, the coefficient is not significant to the 5 percent level.

The coefficient for the variable of the market value of the mutual fund manager is negative. This tells us that mutual funds managed by corporation with large market value will have a smaller probability of an exit. We still do not know the market value of the mutual fund, but we know that as the mutual funds grow in market value so will the mutual fund managers. The coefficient is significant to the 1 percent level, indicating a very small chance of exit not being affected by the market value of the mutual fund manager.

Table 7: Exit regression

Explanatory variable	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-6.3752	0.3463	-18.41	0.0000
Total market value$_{t-1}$	-3.257e-12	0.0000	-1.42	0.1563
Market value of manager$_{i,t-1}$	-2.109e-11	0.0000	-5.26	0.0000
AIC	8 059.3			
No. of observations	110 225			
Trend and seasonal adjustment[1]	Yes			

Results from the regression in eq. (9), without the coefficients for the market return adjustments. To remind the reader, the model is shown below
$Pr(\text{Exit} = 1|\boldsymbol{X}) = \Phi(\alpha + \beta_1 MV_{i-1} + \beta_2 MVm_{i,t-1} + \boldsymbol{\Upsilon}\mathbf{T}' + \epsilon_{i,t})$
[1]The data is adjusted for external market conditions that may affect exit

The model is compensated for trend and seasonality, and the full regression results

can be seen in Appendix B. Investigating these results for a mutual fund manager with a market value of 50 MSEK tells us that the probability of an exit would be about 0.12 percent. The marginal effect, as described in Section 4.3, is larger for the variable describing the market value of the mutual fund. However, we know that the market value of the total market will fluctuate more in absolute number than would the market value of a mutual fund manager. For a mutual fund manager with a market value of 50 MSEK, we find that the marginal effect is nearly insignificant.[6]

Modeling the natural logarithm of the variables allows us to look into the percentage change of the variable with respect to the probability of an exit. In the model, we have the natural logarithm of the market value of the mutual fund i at time $t-1$, the natural logarithm of the number of mutual funds at time $t-1$. We also describe the probability of an exit to occur by the natural logarithm of the market value of the mutual fund manager of mutual fund i at time $t-1$. This expression models the probability of an exit better than the previous model, as seen by the lowered AIC that was 8,059 for the previous regression and is now 7,881. The results are seen in Table 8.

The negative mutual fund specific coefficient tells us that as the two market values increase the probability of exit decreases. This is in line with the previous result, and is what we expected to happen. Mutual funds that have a larger market value would most likely be more profitable and thus would have a smaller probability of exit. The same logic goes for mutual funds with larger mutual fund managers, especially as they could very well be less sensitive to external market conditions.

It is surprising that with more mutual funds in the market, we have a lower prob-

[6]The marginal effect of the probability of an exit to occur is -3.8237e-05 percent / MSEK as for changes in the total market value, and -2.4760e-04 percent / MSEK for changes in the market value of the mutual fund manager.

ability of exit. This coefficient is just significant to the 5 percent level, but does still indicate a sign that goes against what we previously expected. It is, however, likely that more mutual funds enter the market when the market conditions are beneficial for mutual funds, which at the same time, would be a time when few mutual funds would want to exit the market. This scenario would explain why there would be a lower probability of an exit when the mutual fund market is expanding in mutual funds.

Table 8: Extended exit regression

Explanatory variable	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	21.9622	12.5499	1.75	0.0801
Log_e Market value$_{i,t-1}$	-0.1492	0.0180	-8.31	0.0000
Log_e Number of mutual funds$_{t-1}$	-3.9195	2.0103	-1.95	0.0512
Log_e Market value of manager$_{i,t-1}$	-0.0972	0.0199	-4.88	0.0000
AIC	7,880.7			
No. of observations	110,225			
Trend and seasonal adjustment[1]	Yes			

Results from the regression in eq. (10), without the coefficients for the market return adjustments. To remind the reader, the model is shown below
$Pr(\text{Exit} = 1|\boldsymbol{X}) = \Phi(\alpha + \beta_1 \log_e MV_{t-1} + \beta_2 \log_e n_{t-1} + \beta_3 \log_e MVm_{i,t-1} + \boldsymbol{\Upsilon}\mathbf{T}' + \epsilon_{i,t})$
[1]The data is adjusted for external market conditions that may affect exit

Predicting an exit of a mutual fund at the market conditions in December 2013, with a market value of 40 MSEK and a mutual fund manager with market value of 50 MSEK tells us that there would be a 0.15 percent probability of an exit. Looking into the marginal effect of the variables as described in Section 4.3, we find that a percentual increase change in the market value of the mutual fund yields a change in the probability of an exit with -0.02 percent. An increase in the number of mutual funds at time $t-1$, with 1 percent results in a decrease of the exit probability by 0.58 percent.

The marginal effect on the increasing number of mutual funds does not make sense out of a competitive view point. It would, however, be possible to imagine that if the market is doing well at a certain time $t-1$ more mutual funds would enter the mutual fund market and few mutual funds would want to exit. Likewise, when the market is doing poorly we would have more exit.

The similar results in the two regressions implies that the result is robust.

5.3 Determinants of entry

The probability of a mutual fund to entry the market is modeled by several different market characteristics at time $t-1$. Additionally, entry is modeled by a the mutual fund manager that can have other mutual funds in the market and thus already some market value at time $t-1$. The results are presented in Table 9.

The probability of entry is negatively correlated with the total number of mutual funds in the premium pension system and is positively correlated with the market concentration measure Herfindahl-Hirschman Index. As the premium pension system becomes more concentrated the probability of entry increases and is against our initial beliefs that the probability of entry should increase when market concentration HHI decreases. This coefficient is statistical significant to the 1 percent level.

With a higher total market value of the premium pension system we find a higher probability of entry. The previous exit regressions showed a higher probability of exit as the total market value decreased, which is consisted with this result. Additional market value of the premium pension system gives opportunities for more mutual funds, which could explain the increased probability of entry. The coefficient is not statistical significant to the 1 percent level.

We also find that the probability of entry are higher for mutual fund managers with smaller total market value. This result is similar to the exit regressions, indicating that smaller mutual fund managers are more frequent in entering and exiting in the premium pension system. Not knowing the market value of the mutual funds, it is believed that larger mutual fund managers are more profitable, because of economies of scale in the industry, and thus experiences a lower frequency of entry and exit.

Table 9: Entry regression

Explanatory variable	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	5.1102	1.2969	3.94	0.0001
Herfindahl-Hirschman Index$_{t-1}$	0.0037	0.0013	2.83	0.0046
Total market value$_{t-1}$	3.02e-12	0.0000	1.50	0.1336
Market value of manager$_{i,t-1}$	-3.24e-11	0.0000	-7.35	0.0000
Number of mutual funds$_{t-1}$	-0.0248	0.0021	-11.55	0.0000
AIC	11,667			
No. of observations	110,225			
Trend and seasonal adjustment[1]	Yes			

Results from the regression in eq. (11), without the coefficients for the market return adjustments. To remind the reader, the model is shown below
$Pr(\text{Entry} = 1|\boldsymbol{X}) = \Phi(\alpha + \beta_1 HHI_{t-1} + \beta_2 MV_{t-1} + \beta_3 n_{t-1} + \beta_4 MVm_{t-1} + \boldsymbol{\Upsilon T'} + \epsilon_{i,t})$
[1]The data is adjusted for external market conditions that may affect entry

Investigating the result at the market levels of December 2013 shows that there is a probability of 1.242 percent for an entry for a mutual fund with no previous market value of the mutual fund manager.

It is important to keep in mind that investors in the mutual fund market are generally slow moving. The horizon of these investments are, for many people several decades. Together with the entry barriers in the mutual fund market, there are many variables these regressions don't show.

Modeling the entry in the market by the same variables, but applying the natural

logarithm of the HHI and the total market value indicates a similar result. The coefficients for the number of mutual funds at time $t-1$ and the coefficient for the market value of the mutual fund manager are similar to the previous entry regression. As before, the coefficients are significant to the 1 percent level indicating that the entry are affected by the variables. The result is seen in Table 10.

The difference lies in the coefficient of the intercept and the variables where the natural logarithm has been applied. Making the same prediction as before, for the market conditions of December 2013 and a market value of the managing firm of 0 SEK gives a consistent results with the previous prediction. We find that the probability of an entry is 1.240 percent.

Table 10: Extended entry regression

Explanatory variable	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-53.9378	12.6455	-4.27	0.0000
Log_e Herfindahl-Hirschman Index_{t-1}	4.3187	1.1867	3.64	0.0003
Log_e Total $\text{market value}_{t-1}$	1.3701	0.3870	3.54	0.0004
$\text{Market value of manager}_{i,t-1}$	-3.26e-11	0.0000	-7.38	0.0000
$\text{Number of mutual funds}_{t-1}$	-0.0263	0.0022	-11.99	0.0000
AIC	11,654			
No. of observations	110,225			
Trend and seasonal adjustment[1]	Yes			

Results from the regression in eq. (12), without the coefficients for the market return adjustments. To remind the reader, the model is shown below
$Pr(\text{Entry} = 1|\boldsymbol{X}) = \Phi(\alpha + \beta_1 \log_e HHI_{t-1} + \beta_2 \log_e MV_{t-1} + \beta_3 n_{t-1} + \beta_4 MVm_{t-1} + \boldsymbol{\Upsilon T'} + \epsilon_{i,t})$
[1]The data is adjusted for external market conditions that may affect entry

Investigating the marginal effect of the Herfindahl-Hirschman Index (HHI) and the total market value shows the importance of the HHI. For a possible mutual fund entry with a mutual fund manager with market value of 0 SEK, the marginal effect of a percentage increase in HHI indicates a change in the probability of an entry by 0.0537 percent. A percent increase in the total market value results in an

increase of 0.016 percent in the probability of an entry. An increase of one mutual fund results in a decrease if 0.03 percent in the probability of entry.

Applying the natural logarithm to the HHI and the total market value fits the entry slightly better as seen by the lowered AIC. Overall, the regressions shows statistical significant results that are consistent with our economic theory. The different regressions shows similar results, indicating that the results are robust.

6 Conclusion

This report investigates the level of competition among the mutual funds in the premium pension system by modeling the change in market value, entry and exit. Historical data on the mutual funds from 2001 to 2013 have been used to support the regression analysis, where the market concentration indexes Herfindahl-Hirschman Index (HHI) and Concentration Ratio (CR) are introduced.

The findings indicates that there is competition in the Swedish premium pension system. Changes in CR_4 affects the market value of the mutual funds negatively, as the market becomes more concentrated the market value of the mutual funds decreases. The market value of mutual funds are negatively correlated with the number of mutual funds in the premium pension system. We find a higher probability of smaller mutual fund managers to enter and exit the mutual fund market. The probability of mutual funds' entry in the market is negatively correlated with the total number of mutual funds and the probability of entry increases when the total market value of the premium pension system increases. Mutual funds are more likely to exit the market as the total market value of the premium pension system decreases. The current level of the market concentration indexes CR_4 is at 37 and HHI is at 963. Together, these findings support the idea of a competitive premium pension system.

Further research may expand the regressions to involve more mutual fund specific parameters or by taking different perspectives of competition. Since this thesis has focused on relating industrial dynamics to competition of the overall market, further research may also relate competition to the conduct and performance of mutual fund managers on a company level.

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Appendices

A Results market value regression

Table 11: Results of the market value regression

Explanatory variable	Estimate	Std. Error	t value	Pr(>|t|)
Log_e Total market value$_{t-1}$	0.8000	0.1048	7.64	0.0000
Log_e Number of mutual funds$_{t-1}$	-4.1769	0.3352	-12.46	0.0000
Log_e $CR_{4,t-1}$	-1.3871	0.5944	-2.33	0.0196
C_{equity}	21.4131	3.0405	7.04	0.0000
C_{mixed}	27.7316	3.1815	8.72	0.0000
C_{fixed}	29.7959	3.0140	9.89	0.0000
C_{equity} $\log_e$ $CR_{4,t-1,equity}$	1.8408	0.1857	9.91	0.0000
C_{mixed} $\log_e$ $CR_{4,t-1,mixed}$	0.1210	0.2873	0.42	0.6737
C_{fixed} $\log_e$ $CR_{4,t-1,fixed}$	-0.8637	0.1884	-4.58	0.0000
February	0.0117	0.0384	0.31	0.7597
Mars	0.0207	0.0389	0.53	0.5957
April	0.0559	0.0392	1.42	0.1543
May	0.0525	0.0401	1.31	0.1900
June	0.0362	0.0415	0.87	0.3835
July	0.0758	0.0416	1.82	0.0687
August	0.0621	0.0407	1.53	0.1268
September	0.0532	0.0412	1.29	0.1964
October	0.0894	0.0411	2.18	0.0296
November	0.0849	0.0413	2.06	0.0398
December	0.1215	0.0417	2.91	0.0036
2002	0.2847	0.0662	4.30	0.0000
2003	0.5278	0.0773	6.83	0.0000
2004	0.7007	0.0985	7.11	0.0000
2005	1.0402	0.1287	8.08	0.0000
2006	1.2947	0.1700	7.61	0.0000
2007	1.5026	0.2035	7.38	0.0000
2008	1.6400	0.2079	7.89	0.0000
2009	1.7997	0.2267	7.94	0.0000
2010	1.9947	0.2510	7.95	0.0000
2011	2.0828	0.2579	8.08	0.0000
2012	2.0370	0.2651	7.68	0.0000
2013	2.0923	0.2723	7.68	0.0000
Adj. R^2	0.9781			
No. of observations	110 225			

B Result exit regression

Table 12: Exit regression

Explanatory variable	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-6.3752	0.3463	-18.41	0.0000
Total market value$_{t-1}$	-3.257e-12	0.0000	-1.42	0.1563
Market value of manager$_{i,t-1}$	-2.109e-11	0.0000	-5.26	0.0000
February	0.0373	0.2336	0.16	0.8730
Mars	0.5686	0.2099	2.71	0.0067
April	0.8249	0.2021	4.08	0.0000
May	0.1795	0.2312	0.78	0.4375
June	0.8605	0.2062	4.17	0.0000
July	-0.2625	0.2601	-1.01	0.3129
August	0.4695	0.2161	2.17	0.0298
September	1.0180	0.1962	5.19	0.0000
October	0.9417	0.1975	4.77	0.0000
November	0.3298	0.2201	1.50	0.1340
December	-0.6975	0.2898	-2.41	0.0161
2002	0.8429	0.3249	2.59	0.0095
2003	1.8629	0.3005	6.20	0.0000
2004	0.9632	0.3522	2.73	0.0062
2005	0.9611	0.4068	2.36	0.0181
2006	1.1918	0.5069	2.35	0.0187
2007	1.9410	0.6044	3.21	0.0013
2008	2.1705	0.5470	3.97	0.0001
2009	1.4846	0.5562	2.67	0.0076
2010	2.0439	0.7273	2.81	0.0050
2011	2.8341	0.7960	3.56	0.0004
2012	2.3445	0.8879	2.64	0.0083
2013	2.2883	1.0938	2.09	0.0364
AIC	8 059.3			
No. of observations	110 225			

C Result extended exit

Table 13: Extended exit regression

Explanatory variable	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	21.9622	12.5499	1.75	0.0801
Log_e Market value$_{i,t-1}$	-0.1492	0.0180	-8.31	0.0000
Log_e Number of mutual funds$_{t-1}$	-3.9195	2.0103	-1.95	0.0512
Log_e Market value of manager$_{i,t-1}$	-0.0972	0.0199	-4.88	0.0000
February	0.0794	0.2353	0.34	0.7359
Mars	0.6337	0.2127	2.98	0.0029
April	0.8980	0.2059	4.36	0.0000
May	0.2420	0.2325	1.04	0.2981
June	0.9354	0.2096	4.46	0.0000
July	-0.1704	0.2636	-0.65	0.5180
August	0.5509	0.2188	2.52	0.0118
September	1.1241	0.2021	5.56	0.0000
October	1.0572	0.2042	5.18	0.0000
November	0.4146	0.2228	1.86	0.0627
December	-0.6195	0.2913	-2.13	0.0334
2002	1.3619	0.4777	2.85	0.0044
2003	2.5467	0.5251	4.85	0.0000
2004	1.7364	0.5897	2.94	0.0032
2005	1.8753	0.6749	2.78	0.0055
2006	2.2068	0.7909	2.79	0.0053
2007	2.9823	0.8651	3.45	0.0006
2008	3.3236	0.8703	3.82	0.0001
2009	2.6477	0.8542	3.10	0.0019
2010	3.0002	0.8653	3.47	0.0005
2011	3.7151	0.8676	4.28	0.0000
2012	3.1315	0.8863	3.53	0.0004
2013	2.9368	0.9794	3.00	0.0027
AIC	7 880.7			
No. of observations	110 225			

D Result entry regression

Table 14: Entry regression

Explanatory variable	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	5.1102	1.2969	3.94	0.0001
Herfindahl-Hirschman Index$_{t-1}$	0.0037	0.0013	2.83	0.0046
Total market value$_{t-1}$	3.02e-12	0.0000	1.50	0.1336
Market value of manager$_{i,t-1}$	-3.24e-11	0.0000	-7.35	0.0000
Number of mutual funds$_{t-1}$	-0.0248	0.0021	-11.55	0.0000
February	-0.4522	0.1394	-3.24	0.0012
Mars	-0.6245	0.1524	-4.10	0.0000
April	-0.5282	0.1524	-3.47	0.0005
May	0.4375	0.1216	3.60	0.0003
June	-0.8727	0.2007	-4.35	0.0000
July	0.2057	0.1392	1.48	0.1396
August	-0.4141	0.1660	-2.49	0.0126
September	-0.2712	0.1666	-1.63	0.1035
October	0.0329	0.1545	0.21	0.8312
November	-0.0626	0.1517	-0.41	0.6798
December	0.0606	0.1481	0.41	0.6825
2002	2.0881	0.2926	7.14	0.0000
2003	2.1104	0.3375	6.25	0.0000
2004	2.7268	0.3730	7.31	0.0000
2005	3.0982	0.4543	6.82	0.0000
2006	4.7461	0.5832	8.14	0.0000
2007	5.2572	0.7594	6.92	0.0000
2008	5.7345	0.7600	7.55	0.0000
2009	5.6345	0.8195	6.88	0.0000
2010	5.7361	0.9304	6.17	0.0000
2011	5.9925	0.9510	6.30	0.0000
2012	5.8490	0.9882	5.92	0.0000
2013	6.2101	1.1140	5.57	0.0000
AIC	11,667			
No. of observations	110,225			

E Result extended entry regression

Table 15: Extended entry regression

Explanatory variable	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-53.9378	12.6455	-4.27	0.0000
Log_e Herfindahl-Hirschman Index_{t-1}	4.3187	1.1867	3.64	0.0003
Log_e Total market value_{t-1}	1.3701	0.3870	3.54	0.0004
Market value of $\text{manager}_{i,t-1}$	-3.26e-11	0.0000	-7.38	0.0000
Number of mutual funds_{t-1}	-0.0263	0.0022	-11.99	0.0000
February	-0.4902	0.1397	-3.51	0.0004
Mars	-0.6821	0.1532	-4.45	0.0000
April	-0.5656	0.1527	-3.70	0.0002
May	0.3160	0.1263	2.50	0.0124
June	-0.9589	0.2017	-4.75	0.0000
July	0.1322	0.1409	0.94	0.3483
August	-0.4821	0.1667	-2.89	0.0038
September	-0.3190	0.1678	-1.90	0.0573
October	0.0121	0.1554	0.08	0.9381
November	-0.1263	0.1529	-0.83	0.4086
December	-0.0052	0.1495	-0.03	0.9723
2002	2.0644	0.2900	7.12	0.0000
2003	1.8325	0.3373	5.43	0.0000
2004	2.1457	0.4155	5.16	0.0000
2005	2.2877	0.5298	4.32	0.0000
2006	3.7817	0.6616	5.72	0.0000
2007	4.2782	0.8091	5.29	0.0000
2008	4.8447	0.8100	5.98	0.0000
2009	4.9040	0.8614	5.69	0.0000
2010	4.9199	0.9408	5.23	0.0000
2011	5.0971	0.9410	5.42	0.0000
2012	4.8987	0.9517	5.15	0.0000
2013	5.2008	1.0074	5.16	0.0000
AIC	11,654			
No. of observations	110,225			