Competition as a Driving Force among Institutional Investors: The Case of Swedish Pension Funds

Naufal Alimov

Abstract

This paper studies whether competition between pension funds enhances fund performance. Sweden conducted a large-scale experiment in the pension system reform finalised at the turn of the millennium. A central feature of the Swedish pension system is to encourage competition among pension funds (AP 1-4 buffer funds). An essential question is to what extent there is actual competition for performance between these funds. Instead of competing, they may simply be following each other into and out of the same securities. This paper documents a portfolio overlap of 60-85 percent in Swedish pension funds' domestic equity portfolios during the period 2001-2012. The results also indicate significant co-movements in pension funds' equity portfolios.

JEL Classification: G11, G23, G28, G30, G38, M21

Key words:

Institutional investors, pension funds, competition, portfolio choice, investment decisions

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1. Introduction

It has been argued that competition between institutional investors is a driving force for their better performance because asset managers compete to achieve higher remuneration (Brown et al., 1996; Agarwal, et al. 2004) or better career prospects (Chevalier & Elison, 1999). Competitive pressure may also encourage institutional investors to improve the quality of the corporate governance of firms in their portfolios (Black, 1992). On the other hand, competitive pressure reinforced by the fact that asset managers are subject to agency problems, excessive regulation, and evaluation on an annual basis against predetermined benchmarks (Black, 1992; Lakonishok, 1992), and the constant performance judgement by public scrutiny may result in fund managers following each other into and out of the same securities at the same time (Lakonishok et al., 1992; Nofsinger & Sias , 1999; Bushee, 2001; Sias, 2004; Fong et al., 2011; Jame, 2011).

Sweden has an interesting example of establishing a framework with a number of public pension funds (AP buffer funds) that have similar mandates and the same history. One of the main reasons for creating more than one buffer fund was to stimulate competition among them alongside other reasons, such as reducing their market impact, diversifying managerial risk, and diminishing political influence (Björkmo & Lundbergh 2010).

In this study, I investigate whether the Swedish pension system has indeed been successful in encouraging competition between buffer funds in contrast to their moving into and out of the same securities. I focus the analysis on AP funds' domestic equities because they manage these portfolios actively and internally, whereas their foreign securities are mostly indexed or managed externally[1].

During the sample period 2001-2012, the AP 1-4 funds demonstrated similar patterns of performance change in terms of returns generated both in general and in Swedish equity portfolios. There is therefore a good reason to compare their portfolios' composition to test whether there has been a tendency for them to have similar portfolios over time (Björkmo & Lundbergh 2010). In using the measure suggested by Cremers & Petajisto (2009), and Petajisto (2013), I find a 60-85% portfolio overlap between Swedish AP 1-4 equities. Their portfolio overlap appears to have increased somewhat during the later sample period, and especially after the financial crisis.

On further analysis, I find co-movements within the Swedish equity portfolios of the AP 1-4 funds. Co-movements in AP funds' share trades are observed both in purchases and sales. One of the funds was followed more intensively by other AP funds. I find evidence that AP funds execute their strategic investment policy during more than one quarter, which could partly explain the co-movements.

I go a step further and test whether the co-movements are also the result of their selling stocks with a low return and buying ones with a high return at intensified rate during the last quarter, i.e. "window dressing" (Lakonishok, 1991). Window dressing behaviour designed to avoid questions from the authorities would be a clear evidence of "bad" competition. I do not find clear-cut evidence in my analysis of "window dressing" behaviour by AP funds that would explain the co-movements in their portfolios.

I conclude that the co-movements within AP funds' Swedish equity portfolios could have resulted from a combination of different factors, such as stringent investment rules for AP funds, reputation concerns by fund managers, and AP funds' investment decision policy carried out over more than one quarter. However, the most plausible explanation for the co-movements is that there is a small

[1] At least until the end of the sample period 2001-2012, the in-house management of foreign securities has increased between 2012 and 2015.

market for liquid shares in Sweden, and AP fund base their decisions on the same information sources.

Next, I outline the literature and state my hypotheses. In the analysis that follows I start with a performance comparison of AP funds before measuring their portfolio similarities. In the subsequent sections I outline the results of testing co-movement and window-dressing hypotheses. I conclude with a discussion of perspective changes in the system in the context of my findings.

2. Literature and Hypotheses

Brown et al. (1996) note the importance of competition between asset managers. They compare the mutual fund market to a tournament in which asset managers compete for higher remuneration, the "winning" of which depends on better relative performance. At the same time the authors suggest that such competition has implications for their portfolio management, which is not always desirable, as "losers" take a short-term view and re-focus on projects with a higher risk than "winners" do, even at shareholders' expense.

Chevalier & Ellison (1999) claim that career concerns and competition between asset managers has an impact on their portfolio decisions. They find that managerial turnover is related to past performance. Their findings show that younger asset managers, who are more likely to lose their jobs, tend to be risk-averse. This argument is consistent with the notion that young asset managers act in line with others or index their portfolios.

Bushee (2001) also supports the view that competition between institutional investors may force them to take relatively short-term gains. He argues that competitive pressures and the frequent evaluation of fund managers compel them to invest in firms that demonstrate high near-term earnings at the expense of long-term value. He finds that institutional investors with a high portfolio turnover and diverse portfolios with a near-term investment horizon prefer near-term earnings.

It is documented that institutional investors move in and out of the same securities at the same time for reasons other than competition for better performance. In the literature such behaviour is labelled broadly as herding (Sias, 2004). As the literature explains (Sias, 2004; Choi & Sias, 2009), herding among institutional investors may occur if institutional investors: (1) follow correlated signals –investigative herding, (2) infer information from each other's trades –informational cascades (Bikhchandari et al., 1992; Sias, 2004); (3) have reputational and remuneration penalties for acting differently – reputational herding (Scharfstein & Stein 1990; Chevalier& Ellison, 1999); (4) are attracted to stocks with specific characteristics – characteristic herding (Sias, 2004); (5) enter the same industries – fads (Choi & Sias, 2009). A stricter definition of herding would encompass reasons 3-5, because the first two reasons fall into the category of informative trading.

Early studies find weak evidence on institutional herding. For example, Lakonishok et al. (1992) claim that US pension funds in the 1980s were more likely to practise positive feedback trading than they were to follow each other into the same securities. Notably, the authors design a herding measure that has been extensively used in subsequent studies of institutional herding.

On the other hand, Sias (2004), who investigates data up to the late 1990s, identifies strong institutional herding. The author finds that institutional investors follow both their own as well as other institutional investors' last quarter trades. The author concludes that institutional investors move in the same direction because they are momentum traders and infer information from each other's trades.

Contrary to the existing literature on herding, Fong et al. (2011) use the leader-follower behaviour argument to explain institutional herding. They claim that leaders with superior market information try to disguise valuable information by executing trade packages through multiple brokers and over several days. In consequence, other institutional investors trade on the same securities and in the same direction as the leaders. The authors support the informational nature of leader-follower behaviour by demonstrating that the number of followers is lower when leaders disguise their trades, and that it is higher when leaders have a strong reputation.

According to Jame (2011) when pension funds are compared to other institutional investors, they are more likely to herd through uninformative trading because they have greater fiduciary responsibilities, less need for performance compensation, and larger reputational costs. Consistent with his argument, he finds that pension fund herding, unlike other institutional herding, is followed by a reversal in stock returns. This effect is stronger in smaller, and hence noisier, stocks, in line with reputational and characteristic herding and in contrast to investigative herding.

Particular attention in the literature has been given to the relationship between institutional investor herding and subsequent stock returns. For example, Nofsinger & Sias (1999) document a positive correlation between annual changes in institutional ownership and contemporaneous returns. They claim that such a relationship arises from institutional investors practising positive feedback trading and also from their being better informed which drives returns. According to Sias (2004) institutional herding has no negative impact on near-term returns–it is weakly positive. More recent studies, however, find a reversal in longer-term stock returns following institutional herding (Gutierrez & Keley, 2009; Dasgupta et al. 2011a; Dasgupta et al. 2011b; Jame, 2011).

As evidenced in the literature, competition has an impact on asset managers' performance. Competitive pressure may also result in institutional investors trading in the same stock and in the same direction. Such behaviour may have both positive and negative features, depending on whether institutions contribute to information revelation and whether prices are driven down from their intrinsic level because of herding.

In line with the previous literature, it is reasonable to test whether there has been a tendency for AP funds to have similar portfolios over time, and whether they have similar buy and sell strategies within their domestic equity portfolios.

Thus, the following two research hypotheses are tested:

Hypothesis – 1:
AP funds have similar equity portfolio compositions.

Hypothesis – 2:
AP funds follow similar buy and sell strategies in their equity portfolios.

Furthermore, correlated trading between AP funds would be undesirable if it resulted primarily from their "window dressing" behaviour at year ends, i.e. the practice of removing stocks that have recently declined sharply in value simply to please public opinion or a controlling agency (Lakonishok, 1991).

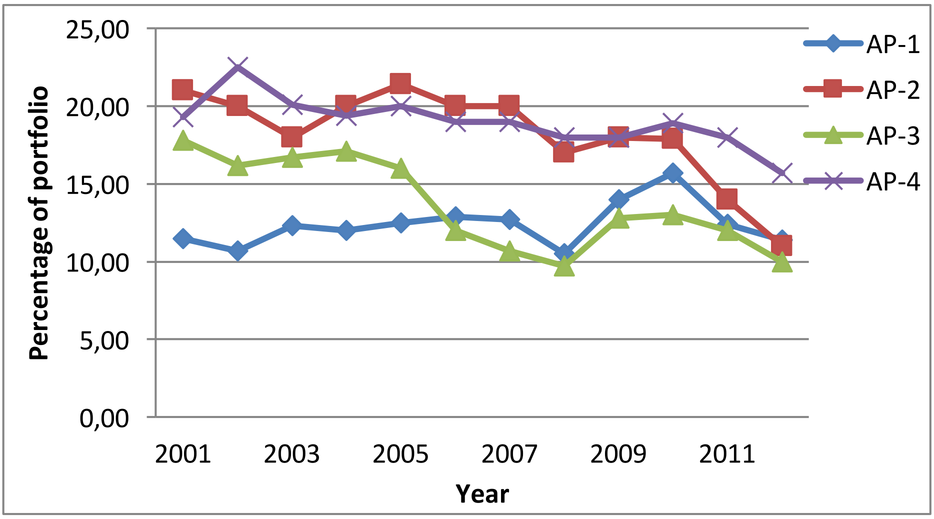
With respect to "window dressing", the following hypothesis is tested:

Hypothesis – 3:
There is a specific pattern in AP funds' ownership changes during the last quarter of the year.

3. Data

I collect data on AP funds' Swedish equity portfolios from their financial reports for the period from the last quarter of 2001 to the last quarter of 2012. As financial reports of AP funds are issued on a semi-annual basis, I

Figure 1 Return on the total portfolio before expenses of AP 1-4 funds



fill the missing quarters with data obtained from SIS Ägarservice AB, which has rich and accurate information on ownership data, especially in Swedish companies[2]. Information collected includes the value of holdings in Swedish kronor, as well as the ownership position in a company, such as the number of shares, percentage of cash flow, and voting rights. From the value of holdings for each AP fund and each quarter in the sample, I compute the Swedish equity portfolio weights assigned to each of the securities.

I obtain stock market returns, and ask-bid spreads for a measure of liquidity from the Thomson Reuters One Banker and FactSet databases. These databases have no information on delisted companies. Therefore, missing information is retrieved from Datastream.

4. AP 1-4 Buffer Fund Performance

4.1. Descriptive Statistics

AP buffer funds identified their strategic benchmarks - portfolio weights allocated to equity, and debt instruments. During 2001-2012, AP funds invested about 20% of their funds in Swedish equity, except AP-1, which allocated about 11-12% of its assets into this category. During later periods, especially after 2010, AP 1-4 funds reduced their ownership of Swedish equity to 11-12%, except AP-4 that had around 16% of its funds in Swedish equity at the end of the period. See Figure-1.

The largest holding in terms of cash flow rights in Swedish companies is observed in AP-4 and is close to 2% (Table 1). Other AP funds have smaller holdings in companies - around 1% by AP-1, and under 1% by AP-3 and AP-2. The holdings of AP-2 are the mostly dispersed.

AP funds' portfolio turnover in terms of sales (Column2 of Table 1) is larger than portfolio turnover in terms of purchases (Column3 of Table 1). This arises from the fact that in the later periods AP funds reduced their Swedish equity holdings, and more data is therefore available from these periods. The largest changes within the Swedish equity portfolios are observed in AP-4.

4.2 Portfolio Management and Performance

AP 1-4 buffer funds all claim to have actively managed their Swedish equity portfolios.

[2] Note that AP fund portfolios include equity of both financial and non-financial companies.

Table 1 Ownership and portfolio turnover of AP funds

	CASH FLOW RIGHTS[1]	ANNUAL PORTFOLIO TURNOVER (SALES)	ANNUAL PORTFOLIO TURNOVER (PURCHASES)	ANNUAL PORTFOLIO TURNOVER (MIN)
AP-1	1.054 *** (0.003)	13.081*** (2.790)	8.103*** (2.102)	5.589*** (1.108)
AP-2	0.664*** (0.0130)	22.81*** (5.662)	7.972 *** (2.252)	6.521 *** (1.489)
AP-3	0.867*** (0.022)	25.128** (9.212)	10.259*** (2.947)	6.185*** (1.857)
AP-4	1.771*** (0.029)	27.918*** (7.784)	18.647* (10.026)	13.428* (6.706)

AP funds' annual portfolio turnover is computed as a weighted average of changes in cash flow rights in companies; Weighting is based on portfolio weights given by funds to specific securities;
Annual portfolio turnover (min) is calculated from a minimum of increase or decrease of cash flow rights in companies. Standard errors are in brackets. Significance level: * p<.10, ** p<.05, *** p<.01

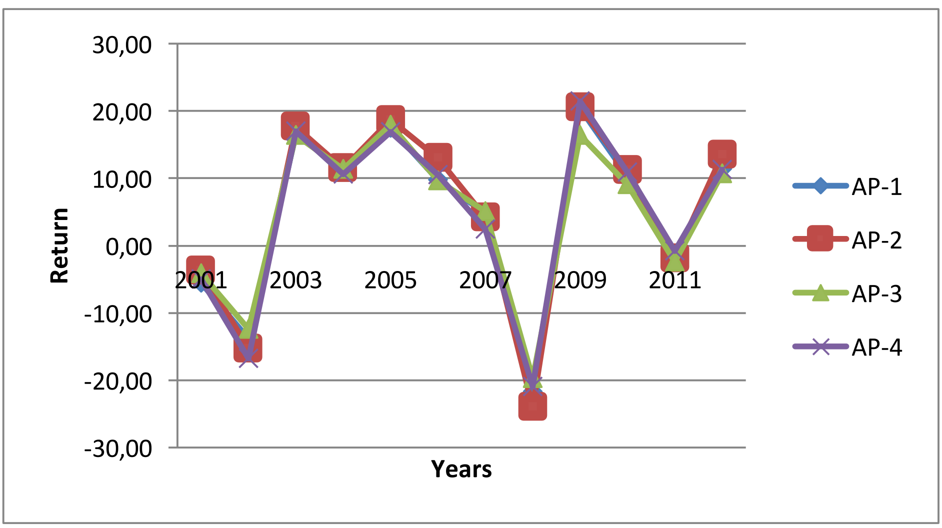
[1]If cash flow rights of the fund >0

Their foreign equity is mostly indexed or managed externally. In the later periods AP funds have also increased their in-house management of foreign equity.

AP 1-4 funds targeted a long-term annual inflation-adjusted real return of 4%. This target is required to maintain the balance between pension contributions and liabilities that are annually adjusted upwards with income growth in Sweden. Note that income grew on average by 3.4% annually between 2001 and 2011 in Sweden.

The performance of all the portfolios of AP 1-4 buffer funds during the sample period is presented in Figure 2. AP buffer funds' performance was hit by three crises: (i) the dot-com bubble at the beginning of the 2000s, (ii) the financial crisis that started in 2007-2008, and (iii) the debt crisis in Europe in 2011. In their 10-year summary reports published in 2011 annual reports, they conceded that they had failed to reach the objective of 4%-real return. Nominal annual return during the 10-year period for the AP 1-4 buffer funds was 4.3%, 3.8%,

Figure 2 Return on Swedish Equity portfolios (before expenses) of AP 1-4 funds



3.4%, and 4.1%, while average annual inflation in this period was 1-2%.

Figure 3 depicts the performance of the Swedish equity portfolios held by AP funds. Their performance looks very similar, especially when compared to the MSCI Sweden benchmark, which comprises large and mid-caps. The similarity of the Swedish equity portfolio performance of AP 1-4 funds, as well as their proximity to the MSCI Sweden benchmark, has increased since the financial crisis.

5. The Similarity of AP 1-4 Funds' Swedish Equity Portfolios

In this section, I aim at identifying the similarity of AP 1-4 buffer funds' Swedish equity portfolios (Hypothesis-1). For the purposes of this section I define AP funds' Swedish equity portfolios as consisting of the weights assigned to stocks by each of the funds (the value of holdings in a company against the total value of the Swedish equity portfolio) during each quarter in the period. To compare portfolios, we need an appropriate measure. The Active Share measure proposed by Petajisto (2013) and Cremers & Petajisto (2009) is suitable for our purpose.

$$\textbf{Active Share} = \frac{1}{2}\sum_{i=1}^{N} | w_{fund,i} - w_{benchmark,i} |$$

Here, $w_{fund,i}$ are the portfolio weights of specific equity in the fund, $w_{benchmark,i}$ are the portfolio weights of specific equity in the fund taken as a benchmark, such as other AP funds, average of other AP funds; and N is the quantity of stock. If there is zero portfolio overlap between a fund under consideration and another fund, the Active Share will be equal to 100. I therefore define the portfolio overlap measure as the following:

Portfolio Overlap = 100 - Active Share

The portfolio overlap measure is between "0" and "100", taking the value "0" if there is no overlap and "100" if there is complete overlap between the portfolios of the funds compared.

I calculate portfolio overlap between each fund against other funds, as well as average portfolio of other funds for each quarter and year during the sample period. The results are given in Tables 2, 3, 4, and 5.

Figure 3 Return on Swedish Equity portfolios (before expenses) of AP 1-4 funds

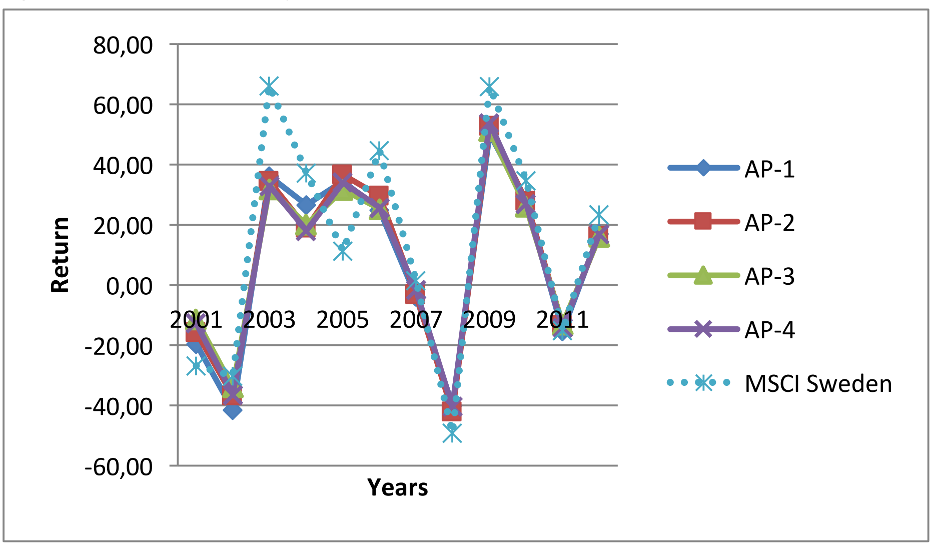


Table 2 Overlap of AP-1's Swedish equity portfolio with other AP funds

	AP1 - AP2		AP1- AP3		AP1-AP4		AP1-Benchmark	
	Quarter	Year	Quarter	Year	Quarter	Year	Quarter	Year
2002		74		67		63		70
	69		60		52		63	
	80		73		73		78	
2003		80		74		71		77
	79		75		70		77	
	80		72		71		77	
2004		76		69		69		74
	80		67		70		75	
	72		70		68		73	
2005		71		73		66		75
	69		67		66		72	
	72		80		66		77	
2006	73	68	82	80	63	56	76	72
	68		79		59		73	
	63		81		52		70	
	69		80		50		69	
2007	65	70	78	77	57	61	70	73
	66		79		56		71	
	73		76		60		72	
	78		73		73		78	
2008	75	71	82	77	76	74	83	78
	71		74		69		74	
	69		74		79		78	
	71		79		74		76	
2009	75	78	78	77	83	79	84	82
	81		81		75		82	
	81		76		82		84	
	74		73		77		78	
2010	76	76	73	73	78	75	78	76
	77		72		71		76	
	74		72		74		76	
	76		74		76		76	
2011	76	74	70	72	75	75	75	75
	73		73		76		75	
	73		74		75		75	
	74		71		75		75	
2012	73	73	77	72	76	77	76	76
	72		56		76		70	
	74		79		79		79	
	74		76		78		79	
Total	**74**		**74**		**70**		**75**	

Portfolio Overlap is computed as following:

$$\text{Portfolio Overlap} = 100 - \frac{1}{2}\sum_{i=1}^{N} | w_{fund,i} - w_{benchmark,i} |$$

here, $w_{fund,i}$ are portfolio weights given by a fund to specific security;
$w_{benchmark,i}$ are portfolio weights given to specific security, by a fund taken as a benchmark;
N is the quantity of stock;
Portfolio Overlap measure is between 0, and 100, with 0 for no overlap, and 100 for complete overlap;
AP-1 benchmark is the average holdings of other AP funds.

Table 3 Overlap of AP-2's Swedish equity portfolio with other AP funds.

	AP2-AP1		AP2-AP3		AP2-AP4		AP2-Benchmark	
	Quarter	Year	Quarter	Year	Quarter	Year	Quarter	Year
2002		74		77		68		79
	69		76		62		75	
	80		78		73		82	
2003		80		80		72		82
	79		81		71		82	
	80		80		73		82	
2004		76		76		70		79
	80		77		73		82	
	72		75		68		76	
2005		71		71		69		76
	69		70		69		75	
	72		73		68		77	
2006	73	68	76	75	64	60	79	75
	68		77		59		74	
	63		70		60		70	
	69		77		58		77	
2007	65	70	77	76	64	67	75	77
	66		78		63		74	
	73		74		67		79	
	78		77		74		80	
2008	75	71	75	73	74	70	79	74
	71		73		68		73	
	69		66		71		72	
	71		76		68		73	
2009	75	78	67	74	73	76	75	80
	81		80		73		80	
	81		75		81		84	
	74		72		76		79	
2010	76	76	80	83	81	74	84	83
	77		84		71		82	
	74		83		68		81	
	76		84		77		83	
2011	76	74	82	83	79	80	84	83
	73		84		77		82	
	73		84		81		83	
	74		83		82		83	
2012	73	73	88	78	84	83	85	82
	72		64		84		79	
	74		81		83		83	
	74		77		83		82	
Total	**74**		**77**		**72**		**79**	

Portfolio Overlap is computed as following:

$$\text{Portfolio Overlap} = 100 - \frac{1}{2}\sum_{i=1}^{N} | w_{fund,i} - w_{benchmark,i} |$$

here, $w_{fund,i}$ are portfolio weights given by a fund to specific security;
$w_{benchmark,i}$ are portfolio weights given to specific security, by a fund taken as a benchmark;
N is the quantity of stock;
Portfolio Overlap measure is between 0, and 100, with 0 for no overlap, and 100 for complete overlap;
AP-2 benchmark is the average holdings of other AP funds.

Table 4 Overlap of AP-3's Swedish equity portfolio with other AP funds.

	AP3-AP1		AP3-AP2		AP3- AP4		AP3-Benchmark	
	Quarter	Year	Quarter	Year	Quarter	Year	Quarter	Year
2002		67		77		62		72
	60		76		55		67	
	73		78		69		77	
2003		74		80		74		80
	75		81		73		80	
	72		80		76		80	
2004		69		76		68		75
	67		77		68		74	
	70		75		68		75	
2005		73		71		72		76
	67		70		73		75	
	80		73		70		77	
2006	82	80	76	75	67	62	80	79
	79		77		64		80	
	81		70		59		78	
	80		77		60		79	
2007	78	77	77	76	66	67	81	79
	79		78		67		81	
	76		74		69		78	
	73		77		67		76	
2008	82	77	75	73	75	75	81	80
	74		73		73		79	
	74		66		70		74	
	79		76		82		84	
2009	78	77	67	74	72	74	75	78
	81		80		81		85	
	76		75		74		76	
	73		72		70		74	
2010	73	73	80	83	76	73	80	81
	72		84		69		81	
	72		83		72		80	
	74		84		76		83	
2011	70	72	82	83	78	78	79	82
	73		84		77		82	
	74		84		80		84	
	71		83		78		82	
2012	77	72	88	78	84	77	87	79
	56		64		64		64	
	79		81		80		84	
	76		77		78		81	
Total	**74**		**77**		**71**		**78**	

Portfolio Overlap is computed as following:

$$\text{Portfolio Overlap} = 100 - \frac{1}{2}\sum_{i=1}^{N} | w_{fund,i} - w_{benchmark,i} |$$

here, $w_{fund,i}$ are portfolio weights given by a fund to specific security;
$w_{benchmark,i}$ are portfolio weights given to specific security, by a fund taken as a benchmark;
N is the quantity of stock;
Portfolio Overlap measure is between 0, and 100, with 0 for no overlap, and 100 for complete overlap;
AP-3 benchmark is the average holdings of other AP funds.

Table 5 Overlap of AP-4's Swedish equity portfolio with other AP funds.

	AP4-AP1		AP4-AP2		AP4-AP3		AP4-Benchmark	
	Quarter	Year	Quarter	Year	Quarter	Year	Quarter	Year
2002		63		68		62		69
	52		62		55		62	
	73		73		69		76	
2003		71		72		74		76
	70		71		73		75	
	71		73		76		78	
2004		69		70		68		73
	70		73		68		74	
	68		68		68		72	
2005		66		69		72		72
	66		69		73		74	
	66		68		70		71	
2006	63	56	64	60	67	62	68	62
	59		59		64		63	
	52		60		59		59	
	50		58		60		58	
2007	57	61	64	67	66	67	64	68
	56		63		67		65	
	60		67		69		69	
	73		74		67		75	
2008	76	74	74	70	75	75	80	79
	69		68		73		77	
	79		71		70		80	
	74		68		82		79	
2009	83	79	73	76	72	74	83	83
	75		73		81		81	
	82		81		74		85	
	77		76		70		83	
2010	78	75	81	74	76	73	83	77
	71		71		69		73	
	74		68		72		74	
	76		77		76		79	
2011	75	75	79	80	78	78	83	82
	76		77		77		81	
	75		81		80		85	
	75		82		78		82	
2012	76	77	84	83	84	77	86	84
	76		84		64		81	
	79		83		80		85	
	78		83		78		85	
Total	**70**		**72**		**71**		**75**	

Portfolio Overlap is computed as following:

$$\text{Portfolio Overlap} = 100 - \frac{1}{2}\sum_{i=1}^{N} | w_{fund,i} - w_{benchmark,i} |$$

here, $w_{fund,i}$ are portfolio weights given by a fund to specific security;
$w_{benchmark,i}$ are portfolio weights given to specific security, by a fund taken as a benchmark;
N is the quantity of stock;
Portfolio Overlap measure is between 0, and 100, with 0 for no overlap, and 100 for complete overlap
AP-4 benchmark is the average holdings of other AP funds.

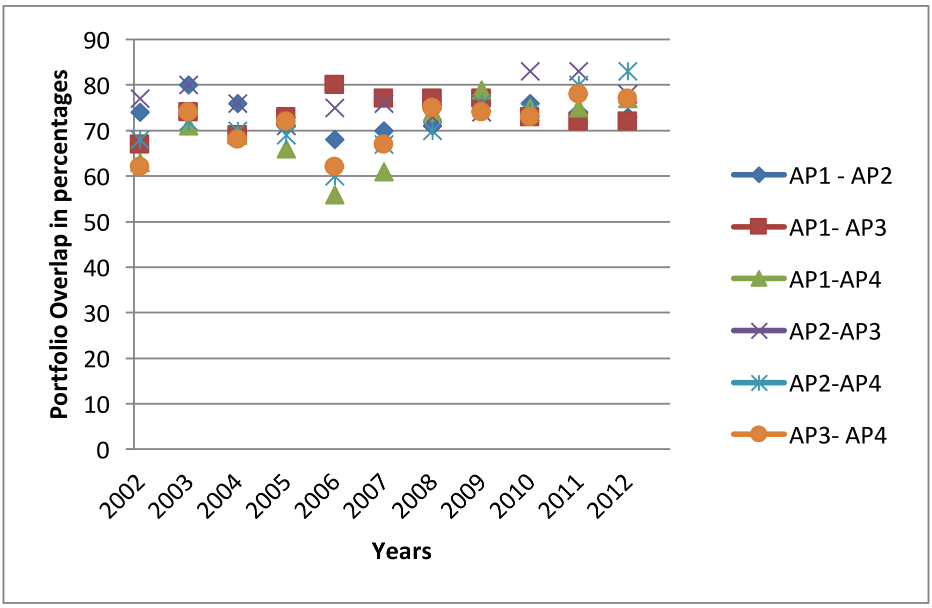
Portfolio overlap measures computed may be better visualized in Figure 4. The portfolio overlap between AP funds' Swedish equity was 60-85% during the different periods. At the beginning of the sample, portfolio overlap between the Swedish equity holdings of AP funds was relatively low and lay between 60-77% in 2002. The highest portfolio overlap during this period was between AP-2 and AP-3 – about 77%, and the lowest between AP-3 and AP-4 – around 62%.

The highest discrepancy in Swedish equity portfolios of AP funds was especially pronounced in 2006, when AP-4's Swedish equity portfolio diverged from other AP funds' portfolios. For example, the portfolio overlaps between AP-4 and AP-1 was only 56%, and with AP-2, 60%.

Since the start of the financial crisis the similarity between AP funds' Swedish equity portfolios has increased slightly. This especially applies to AP-4, which brought its Swedish equity portfolio closer to those of the other AP funds. The highest degree of similarity between AP funds in terms of Swedish equity composition is observed between 2010 and 2012. This is particularly true for AP funds 2-4. For example, portfolio overlap between AP-2 and AP-3 in 2010, and AP-2 and AP-4 in 2012, reached 83%.

Judging the extent of Swedish equity portfolio similarity between the AP 1-4 funds remains a subjective matter. One could also argue that a 20-25% portfolio difference between AP funds has the capacity to generate substantial differences in performance. How-

Figure 4 Annual portfolio overlap of AP 1-4 funds' Swedish Equity portfolios



Portfolio overlap is calculated as follows. For each period, I compute Active Shave measure.

$$\text{Active Share} = \frac{1}{2}\sum_{i=1}^{N} | w_{fund,i} - w_{benchmark,i} |$$

where $w_{fund,i}$ are portfolio weights given by a fund to specific equity; $w_{benchmark,i}$ are portfolio weights given to specific security, by a fund taken as a benchmark; and, N is the quantity of stock.

Finally,

$$\text{Portfolio Overlap} = 100 - \text{Active Share}$$

This measure is between 0, and 100.

Table 6 Co-movements of AP 1-4 funds within their Swedish equity portfolios: purchases

DEPENDENT VARIABLE:	PURCHASE AP1$_{(T+1)}$ (1)	PURCHASE AP2$_{(T+1)}$ (2)	PURCHASE AP3$_{(T+1)}$ (3)	PURCHASE AP4$_{(T+1)}$ (4)
Purchase -AP1$_{(T)}$	0.816***	0.391***	0.591***	0.408***
	(0.093)	(0.077)	(0.136)	(0.130)
Purchase -AP2$_{(T)}$	0.203***	0.258***	0.207***	0.099
	(0.063)	(0.061)	(0.075)	(0.068)
Purchase -AP3$_{(T)}$	0.146***	0.051	-0.047	0.061
	(0.052)	(0.037)	(0.072)	(0.055)
Purchase -AP4$_{(T)}$	0.086	0.072*	0.122**	0.419***
	(0.053)	(0.039)	(0.060)	(0.083)
Illiquidity $_{(T)}$	-0.016	0.001	-0.010	-0.002
	(0.022)	(0.008)	(0.014)	(0.009)
N	5783	5783	5783	5783
pseudo R^2	0.043	0.016	0.010	0.017

The regression model is a left-censored Tobit. Purchase -AP variables are from the increase in the cash flow rights of a particular AP fund in a company. The variables are left-censored.
Illiquidity = (ask price- bid price), which is computed on weekly (end of week) ask and bid prices. Robust standard errors are clustered by firm. Significance level: * p<.10, ** p<.05, *** p<.01

ever, Figure 3 above shows that the returns generated by AP funds' Swedish equity portfolios, especially following the financial crisis, were close to identical.

6. Co-Movements in AP Buffer Fund Portfolios?

In this section, I test the co-movements of AP 1-4 funds into and out of particular stocks within their Swedish equity portfolios (Hypothesis-2). Co-movements are tested through AP funds' ownership changes in terms of cash flow rights in companies.

The AP funds under consideration may react dissimilarly to other AP funds' sales or purchases. I therefore construct two types of variable for each AP fund: "Purchases" characterizing increase in ownership, and "Sales" representing decrease in ownership[3].

Next, I regress future changes in ownership of a particular AP fund on the past changes in ownership of the other AP Funds. In addition, these regressions include AP funds' own past changes of ownership to account for the possibility that their strategic decisions are implemented over more than one calendar quarter. Since purchases and sales variables are left-censored, I employ left-censored Tobit regressions to identify co-movements rather than to find causality. I therefore include no other control variables except the liquidity measure.

Table 6 describes the outcome from regressions of future purchases of each AP funds against its own and other AP funds' past purchases. I include control for stock liquidity measured through ask-bid spread in the regressions.

[3] I multiply the decrease in the ownership variable by "-1".

Table 6's results indicate that AP funds continue to purchase shares in specific companies during more than one quarter. This is evidenced by the positively significant coefficients of own past purchase variables. In addition, each AP fund is likely to increase its ownership in a company when one of the other funds increases its ownership. Purchases of AP1 are followed by all funds.

The co-movement argument is even more valid if we examine the sales of AP funds (see Table 7). Note that the coefficients of the Tobit regression do not show linear impact on the dependent variable. However, we can still discuss their relative economic importance.
Interestingly, the other AP funds' reactions are greater in response to the purchases or sales of AP-1.This finding is perhaps unsurprising when we consider that AP-1 performed slightly better than the other AP funds between 2001 and 2011. Note that annual average nominal return generated by AP-1 during this period was 4.3% , while in AP-2 to AP-4 in was 3.8%, 3.4%, and 4.1% respectively. The difference in performance between funds is economically insignificant, but reputational aspects may have played a role here.

To test the robustness of the results of this section, I construct another set of variables. For each AP 1-4 fund, I construct two sets of dummy variables: (1) a purchase dummy that takes a value of 1 if an AP fund increased its ownership in terms of cash flow rights in a company; (2) a sales dummy that takes a value of 1 if an AP fund decreased its ownership in a company.

I regress the future purchase/sales dummy variable of each AP fund on the last quarter's purchase/sales dummies, together with a control for stock liquidity.
Results of probit regressions are given in Tables 8 and 9. These results confirm the co-movement of AP funds' sales within their

Table 7 Co-movements of AP 1-4 funds within their Swedish equity portfolios: sales

DEPENDENT VARIABLE:	SALES AP1(T+1) (1)	SALES AP2(T+1) (2)	SALES AP3(T+1) (3)	SALES AP4 (T+1) (4)
Sales -AP1$_{(T)}$	0.958***	0.628***	0.779***	0.987***
	(0.089)	(0.102)	(0.146)	(0.201)
Sales -AP$_{2(T)}$	0.203***	0.310***	0.251***	0.256***
	(0.052)	(0.066)	(0.078)	(0.081)
Sales -AP3$_{(T)}$	0.306***	0.310***	0.066	0.427***
	(0.081)	(0.082)	(0.075)	(0.105)
Sales -AP3$_{(T)}$	0.136***	0.185***	0.283***	0.358***
	(0.050)	(0.064)	(0.088)	(0.077)
Illiquidity $_{(T)}$	-0.042	-0.013	-0.011	-0.009
	(0.037)	(0.008)	(0.011)	(0.008)
N	8649	8649	8649	8649
pseudo R^2	0.068	0.030	0.026	0.033

The regression model is a left-censored Tobit. *Sales* -AP variables are from the decrease in cash flow rights of a particular AP fund in a company, multiplied by (-1). The variables are left-censored.
Illiquidity = (ask price- bid price), which is computed on weekly (end of week) ask and bid prices. Robust standard errors are clustered by firm. Significance level: * p<.10, ** p<.05, *** p<.01

Table 8 Co-movements of AP 1-4 funds within their Swedish equity portfolios (purchases- robustness)

DEPENDENT VARIABLE:	P _DUM_ AP1$_{(T+1)}$ (1)	P_DUM_ AP2$_{(T+1)}$ (2)	P_DUM _ AP3$_{(T+1)}$ (3)	P_DUM _ AP4$_{(T+1)}$ (4)
P _Dum -AP1$_{(T)}$	1.583***	0.991***	1.360***	0.929***
	(0.099)	(0.071)	(0.077)	(0.067)
P _Dum -AP2$_{(T)}$	0.713***	0.393***	0.552***	0.274***
	(0.065)	(0.048)	(0.047)	(0.045)
P _Dum -AP3$_{(T)}$	0.804***	0.501***	0.143*	0.550***
	(0.061)	(0.053)	(0.075)	(0.057)
P _Dum -A4$_{(T)}$	0.576***	0.528***	0.622***	0.943***
	(0.065)	(0.045)	(0.057)	(0.049)
Illiquidity$_{(T)}$	0.008*	0.007**	0.006**	0.009*
	(0.004)	(0.003)	(0.003)	(0.005)
N	8649	8649	8649	8649
pseudo R^2	0.663	0.373	0.454	0.449

The regression model is probit. *P _Dum_AP* variables are dummy variables taking a value of 1 if there is an increase in the cash flow rights of a particular AP fund in a company. *Illiquidity* = (ask price- bid price), which is computed on weekly (end of week) ask and bid prices. Robust standard errors are clustered by firm. Significance level: * p<.10, ** p<.05, *** p<.01

Table 9 Co-movements of AP 1-4 funds within their Swedish equity portfolios (sales- robustness)

DEPENDENT VARIABLE:	S _DUM_ AP1(T+1) (1)	S_DUM_ AP2(T+1) (2)	S_DUM _ AP3(T+1) (3)	S_DUM _ AP4(T+1) (4)
S _Dum -AP1$_{(T)}$	1.144***	0.498***	0.798***	0.542***
	(0.098)	(0.060)	(0.077)	(0.076)
S _Dum -AP2$_{(T)}$	0.571***	0.506***	0.607***	0.306***
	(0.065)	(0.051)	(0.047)	(0.049)
S _Dum -AP3$_{(T)}$	0.774***	0.537***	0.194**	0.603***
	(0.076)	(0.053)	(0.076)	(0.057)
S _Dum -AP4(T)	0.176**	0.584***	0.631***	0.895***
	(0.071)	(0.045)	(0.058)	(0.053)
Illiquidity (T)	-0.058	-0.014	-0.007	-0.006
	(0.046)	(0.010)	(0.008)	(0.006)
N	8649	8649	8649	8649
pseudo R2	0.254	0.121	0.136	0.162

The regression model is probit. *S _Dum_AP* variables are dummy valuables taking a value of 1 if there is a decrease in the cash flow rights of a particular AP fund in a company. *Illiquidity* = (ask price- bid price), which is computed on weekly (end of week) ask and bid prices. Robust standard errors are clustered by firm. Significance level: * p<.10, ** p<.05, *** p<.01

Swedish equity portfolios. Here, we may only judge the likelihood of AP funds having similar buy and sell strategies, and not the magnitude of their ownership changes in reaction to the level of change in other AP funds. Whether AP-1 is being followed by a significantly greater degree of ownership change in other AP funds is not verified here.

The findings in this section suggest that there are indeed co-movements in the Swedish equity portfolios held by AP funds 1-4. The co-movements are in line with AP funds' strategic decision-making being executed over more than one quarter. The fact that one of the AP funds is followed more extensively is consistent with Fong et al. (2011), who suggest a rational and intentional following of the leader with superior information by other institutional investors, and the leader getting higher return on investment along the co-movement towards price discovery.

7. Co-Movements Through Window Dressing?

If the co-movement of AP funds were a result of their selling off low-return stock and buying high-return stock more extensively during the last quarter immediately before reporting their holdings in annual reports to please the controller, which is represented by the state, and public opinion, we would consider especially such co-movement to run counter to competition arguments. In this section, I therefore test AP funds' "window dressing" behaviour (Hypothesis-3).

To this end, I split the sample of firms into five quantiles with regard to their per-

Table 10 Test of window dressing by AP-1

AP-1 PURCHASES			
Return (low to high) last quarter	Quarters 1-3	Quarter 4	Difference
1	0.293*** (0.062)	0.357*** (0.080)	0.063 (0.110)
2	0.266*** (0.038)	0.541** (0.192)	0.285** (0.120)
3	0.285*** (0.036)	0.285** (0.087)	0.0008 (0.091)
4	0.261*** (0.043)	0.136*** (0.042)	- 0.125 (0.088)
5	0.353*** (0.055)	0.280*** (0.058)	- 0.074 (0.101)
AP-1 SALES			
Return (low to high) last quarter	Quarters 1-3	Quarter 4	Difference
1	0.310*** (0.063)	0.190*** (0.053)	- 0.124 (0.113)
2	0.263*** (0.037)	0.264*** (0.054)	0.002 (0.081)
3	0.249*** (0.033)	0.204*** (0.046)	-0.045 (0.061)
4	0.261*** (0.034)	0.182*** (0.036)	- 0.079 (0.050)
5	0.360*** (0.069)	0.180*** (0.040)	- 0.18** (0.084)

For each quarter, firms are split into 5 quantiles with regard to stock returns.
Purchases and sales are from the next quarter trades of the AP fund (the changes in cash flow rights in companies). Standard errors (in brackets) and significance in the first two columns show whether the particular number is different from zero. Standard errors (in brackets) and significance in the third column show whether Quarter 4 trades (purchases/sales) are significantly different from those in Quarters 1-3.

formance in terms of the stock returns for each quarter, and then consider the quarterly changes in ownership by AP 1-4 funds for each performance group. Subsequently, I compare Quarter 1-3 trades with those observed in Quarter 4. The results are given in Table 10 for AP-1 portfolio, Table 11 for AP-2 portfolio, Table 12 for AP-3 portfolio, and Table 13 for AP-4 portfolio. Our main interest here is in the significant difference between Quarter 4 and Quarter 1-3 trades in selling losers and buying winners.

Table 10 shows that AP-1 sells winners less intensively during the fourth quarter, as "window dressing" would lead us to expect. At the same time, however, the fund purchases comparatively underperforming stock - the group of shares second from last in terms of last quarter's returns during the fourth quarter. The results for AP-1 are not, therefore, completely in line with the window dressing hypothesis.

Contrary to the window dressing hypothesis, AP-2 purchases losers and sells

Table 11 Test of window dressing by AP-2

AP-2 PURCHASES			
Return (low to high) last quarter	Quarters 1-3	Quarter 4	Difference
1	0.178*** (0.021)	0.258*** (0.036)	0.080** (0.039)
2	0.208*** (.024)	0.156*** (0.022)	-0.051 (0.042)
3	0.198*** (.023)	0.208*** (0.055)	0.010 (0.050)
4	0.205*** (.024)	0.210*** (0.065)	0.004 (0.059)
5	0.304*** (.062)	0.180*** (0.031)	-0.123 (0.085)
AP-2 SALES			
Return (low to high) last quarter	Quarters 1-3	Quarter 4	Difference
1	0.259*** (0.030)	0.493*** (0.177)	0.234** (0.104)
2	0.231*** (0.033)	0.234*** (0.055)	0.003 (0.075)
3	0.230*** (0.040)	0.218*** (0.052)	- 0.013 (0.096)
4	0.175*** (0.021)	0.294*** (0.075)	0.120** (0.055)
5	0.200*** (0.025)	0.227*** (0.056)	0.027 (0.059)

For each quarter, firms are split into 5 quantiles with regard to stock returns.
Purchases and sales are from the next quarter trades of the AP fund (the changes in cash flow rights in companies). Standard errors (in brackets) and significance in the first two columns show whether the particular number is different from zero. Standard errors (in brackets) and significance in the third column show whether Quarter 4 trades (purchases/sales) are significantly different from those in Quarters 1-3.

Table 12 Test of window dressing by AP-3

AP-3 PURCHASES			
Return (low to high) last quarter	Quarters 1-3	Quarter 4	Difference
1	0.442*** (0.064)	0.562*** (0.125)	0.120 (0.127)
2	0.350*** (0.057)	0.314*** (0.045)	-0.037 (0.090)
3	0.251*** (0.030)	0.221*** (0.027)	-0.030 (0.047)
4	0.213*** (0.025)	0.245*** (0.031)	0.033 (0.040)
5	0.298*** (0.042)	0.336*** (0.056)	0.038 (0.069)
AP-3 SALES			
Return (low to high) last quarter	Quarters 1-3	Quarter 4	Difference
1	0.357*** (0.034)	0.521*** (0.119)	0.163* (0.092)
2	0.288*** (0.0255)	0.272*** (0.136)	-0.0161 (0.084)
3	0.259*** (0.023)	0.217*** (0.067)	-0.042 (0.064)
4	0.251*** (0.019)	0.159*** (0.036)	-0.091** (0.042)
5	0.339*** (0.033)	0.315*** (0.145)	-0.025 (0.098)

For each quarter, firms are split into 5 quantiles with regard to stock returns.
Purchases and sales are from the next quarter trades of the AP fund (the changes in cash flow rights in companies). Standard errors (in brackets) and significance in the first two columns show whether the particular number is different from zero. Standard errors (in brackets) and significance in the third column show whether Quarter 4 trades (purchases/sales) are significantly different from those in Quarters 1-3.

both losers and second group winners more intensively during the fourth quarter (Table 11). AP-3 sells losers, and undersells second group winners, more intensively during the last quarter, which is in line with the window dressing hypothesis (Table 12). AP-4 purchases losers at an accelerated rate during the fourth quarter, which is not in line with window dressing behaviour (Table 13). In summary, there is no clear picture for window dressing in AP funds' purchases and sales that would drive the results of co-movements.

To test the robustness of this section, I run Tobit regression of a *Purchases* variable on a *High_return* dummy variable, which takes a value of 1 if the stock belonged to the group with the highest return during the last quarter and its interaction with a Quarter 4 dummy, as well as a control for the previous period's liquidity measured through ask-bid spread. If there were window dressing by AP funds, we would expect a positive significant interaction term of *High_return* with quarter 4. When regarding results from these regressions re-

Table 13 Test of window dressing by AP-4

AP-4 PURCHASES			
Return (low to high) last quarter	Quarters 1-3	Quarter 4	Difference
1	0.504*** (0.059)	0.910*** (0.169)	0.406*** (0.148)
2	0.386*** (0.057)	0.626*** (0.085)	0.240** (0.101)
3	0.391*** (0.043)	0.550*** (0.101)	0.159* (0.093)
4	0.361*** (0.045)	0.408*** (0.046)	0.047 (0.070)
5	0.381*** (0.066)	0.581*** (0.122)	0.200 (0.128)
AP-4 SALES			
Return (low to high) last quarter	Quarters 1-3	Quarter 4	Difference
1	0.558*** (0.080)	0.433*** (0.116)	-0.125 (0.186)
2	0.375*** (0.062)	0.464*** (0.135)	0.089 (0.137)
3	0.364*** (0.047)	0.206*** (0.039)	-0.158* (0.087)
4	0.312*** (0.039)	0.317*** (0.058)	0.005 (0.076)
5	0.478*** (0.074)	0.285*** (0.046)	-0.193 (0.126)

For each quarter, firms are split into 5 quantiles with regard to stock returns.
Purchases and sales are from the next quarter trades of the AP fund (the changes in cash flow rights in companies). Standard errors (in brackets) and significance in the first two columns show whether the particular number is different from zero. Standard errors (in brackets) and significance in the third column show whether Quarter 4 trades (purchases/sales) are significantly different from those in Quarters 1-3.

ported in Table 14, then we can see that the interaction term of *High_return* with quarter 4 is positively significant only true for AP-3.

Next, I re-run the Tobit regression of *Sales* variable against the *Low_return* dummy variable, which takes a value of 1 if the stock belonged to the group that had the lowest return during the last quarter, and its interaction with the Quarter 4 dummy, as well as controlling for last period liquidity. These results are reported in Table 15. Again, a positively significant interaction term is expected for window dressing. It is significant but negative for only one of the funds, namely AP-4.

The results reported in this section show that there is no clear-cut window dressing behaviour by AP funds. It is unlikely that window dressing behaviour by AP 1-4 funds would explain co-movements within their Swedish equity portfolios.

8. Discussion

The rationale for having more than one AP buffer fund in the Swedish pension system

Table 14 Window dressing by AP 1-4 funds. Robustness tests for purchases

DEPENDENT VARIABLE:	PURCHASE-AP1(T)	PURCHASE-AP2(T)	PURCHASE-AP3(T)	PURCHASE-AP4(T)
	(1)	(2)	(3)	(4)
High_return	0.015	0.076*	-0.000	-0.087*
	(0.048)	(0.041)	(0.048)	(0.052)
High_return*Quarter4	0.045	0.053	0.148**	-0.041
	(0.079)	(0.059)	(0.074)	(0.091)
Quarter4	-0.085**	0.110***	0.228***	0.242***
	(0.041)	(0.029)	(0.037)	(0.052)
Illiquidity(T-1)	-0.012	-0.001	-0.008	-0.003
	(0.022)	(0.009)	(0.013)	(0.010)
N	5838	5838	5838	5838
pseudo R2	0.002	0.006	0.012	0.006

The regression model is a left-censored Tobit.

Purchase -AP variables are from the increase in cash flow rights of a particular AP fund in a company. The variables are left-censored. High_return is a dummy variable taking the value of 1 if stock belonged to the group with the highest returns (out of 5 groups) during the previous quarter. Quarter 4 is a dummy variable taking the value of 1 for Quarter 4. Illiquidity= (ask price- bid price), which is computed on weekly (end of week) ask and bid prices. Robust standard errors are clustered by firm. Significance level: * p<.10, ** p<.05, *** p<.01

has been questioned since their establishment. It has been argued that the system is unsuccessful in encouraging competition in performance between buffer funds (Björkmo & Lundbergh, 2010; Buffertkapitalsutredningen, 2012). A team of investigators led by Mats Langensjö (of the Buffer Capital Inquiry - Buffertkapitalsutredningen), which was tasked to evaluate the system by the Finance Ministry Swedish Pension Group, noted the following:

> *"The competition between the four AP-funds has if anything had a negative influence. The management of the funds has become much the same. It has been more important that results do not deviate from the other funds in the short term than to implement a deliberate long-term strategy. Competition among the funds has also contributed to a misdirected focus on their internal costs." (Buffertkapitalsutredningen, 2012)*

In this study, I have found that there is certain similarity in equity portfolios of AP funds. They are also likely to have similar sell and buy strategies in their domestic equity portfolios. However, it is an overstatement to say that competition has been misdirected. These may simply be the result of a small market, low liquidity, and over-regulation of a system that was designed for the realities of 15 years ago – when there were still live discussions about the dot-com bubble.

Indeed, the Buffer Capital Inquiry group suggested that investment rules should be replaced with a less stringent prudent-person rule[4]. Later, a political consensus formed

[4] Prudent-person rule: "A fiduciary must discharge his or her duties with the care, skill, prudence, and diligence that a prudent person acting in a like capacity would use in the conduct of an enterprise of like character and aims." Galer (2002)

Table 15 Window dressing by AP 1-4 funds (Sales: robustness)

DEPENDENT VARIABLE:	SALES-AP1(T)	SALES -AP2(T)	SALES-AP3(T)	SALES-AP4 (T)
	(1)	(2)	(3)	(4)
Low_return	-0.050	0.010	-0.036	-0.028
	(0.046)	(0.040)	(0.047)	(0.056)
Low_return*Quarter4	-0.115	0.014	0.116	-0.266**
	(0.080)	(0.091)	(0.083)	(0.114)
Quarter4	0.087***	-0.155***	-0.258***	-0.013
	(0.027)	(0.034)	(0.033)	(0.033)
Illiquidity(T-1)	-0.059	-0.013	-0.012	-0.011
	(0.052)	(0.010)	(0.012)	(0.010)
N	8449	8449	8449	8449
pseudo R2	0.010	0.006	0.012	0.003

The regression model is a left-censored Tobit.

Sales -AP variables are from the decrease in cash flow rights (multiplied by "-1".) of a particular AP fund in a company. The variables are left-censored. Low_return is a dummy variable taking the value of 1 if stock belonged to the group with lowest returns (out of 5 groups) during the previous quarter. Quarter 4 is a dummy variable taking the value of 1 for Quarter 4. Illiquidity= (ask price- bid price), which is computed on weekly (end of week) ask and bid prices. Robust standard errors are clustered by firm. Significance level: * p<.10, ** p<.05, *** p<.01

around this suggestion, as was reflected in the new AP fund regulation (Finansdepartementet, 2015)[5]. However, this regulation suggests a merger of some AP funds, the creation of a unified supervisory board, and the evaluation of funds' performance against a reference portfolio. These suggestions do not support the fostering of competition, and may result in an even stronger convergence of AP funds.

Such concerns were expressed by Eva Halvarsson, CEO of AP-2, in that fund's Annual Report for 2014:

> *"... It is important that there are several independent funds, pursuing different strategies – which is how things are at present. If implemented, the reforms proposed by the Pensions Group will reduce this spread of risk and the relative independence enjoyed by the AP Funds. ... One proposal is that the funds' administrative functions should be centralized. The Second AP Fund has a successful and complex organisation, in which administration and portfolio management work closely together and have been tailored for each other. ... Extracting a single aspect from this concept poses a significantly increased risk – rather like removing the leg from a stool. It's likely to collapse." (AP-2, Annual Report 2014, pp. 3)*

Furthermore, as Mats Langensjö notes, evaluation by reference portfolio may result in heavy indexation being practised by AP fund managers (in Williams, 2015), which would represent a further step away from competition.

AP funds also states that:

> *"There are a number of unresolved risks in*

[5] In December 2015, deputy finance minister Per Bolund announced that this regulation would be abandoned.

> *the Pension group's proposal, including greater risk of standardization, shortsightedness and political influence of the AP funds. ... With an annual evaluation of the AP funds' performance to that of the reference portfolio, together with that the planning process of the reference portfolio and its asset allocation moves from the AP funds to the Pension Authority which increasingly focuses on the Income Index and constraints in the pension system, increases the risk of shortsightedness and consequently nearly passive index management."* (AP-4, Interim Report 2015, pp. 13)

As we can see, there are lessons to be learned from the Swedish pension reform. It is very difficult to set stringent investment rules and expect that institutional investors will be active in the governance of firms in their portfolios. In the most likely scenario asset managers would be restricted to short-term performance, drive their portfolios in a similar manner, and regard corporate governance involvement as too costly.

9. Conclusions

Sweden has introduced a competitive structure among several public pension funds (AP 1-4 buffer funds) on reforming its pension system. The main question addressed in this paper is whether those funds compete for performance rather than follow each other into and out of the same securities. While investigating Swedish equities of AP 1-4 funds, I find that there is 60-85% overlap between their portfolios during the sample period 2001-2012. Further analysis reveals co-movements in their domestic share trades. There is higher reaction to one of the AP fund's share trades by other AP funds. I do not find evidence for window dressing by AP 1-4 funds that can explain co-movements in their Swedish equity portfolios.

The co-movements within AP funds' Swedish equity portfolios are consistent with strategic investment policy implemented over more than one quarter. The finding that one of AP funds is followed more intensely by the other funds makes the co-movements consistent with the leader-follower behaviour by institutional investors observed by Fong et al. (2011). The co-movements are partly explained by the fact that the funds are subject to identical investment rules, state control, and public scrutiny. Furthermore, it may well be that fund managers, as pointed out in the literature on reputation building, are unwilling to deviate from other funds because of their personal career concerns. However, the most important reason is likely to be that the Swedish market is relatively small (few liquid stocks to choose from) and the AP funds base their investment decisions on the same information sources. As a combination of these factors AP funds tend to hold similar domestic equity portfolios, creating co-movements in ownership changes.

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