## CHAPTER FOUR

## The Effectiveness of a Marketing Decision Support System

## 4.1 INTRODUCTION

In this chapter we shall investigate whether and how the availability of a marketing decision support system (HQMD) influences the decision-making performance of marketing decision-makers. Therefore, we shall look at the differences between decision-makers with an MDSS at their disposal and marketing decision-makers with no MMSS at all. We shall study (1) whether the availability of an MDSS increases the market share (SHARE), (2) whether the availability of an MDSS costs extra decision-making time (DMTIME), (3) which factors influence the number of simulations made with an MDSS (SIMUL), (4) whether the availability of an MDSS increases the level of decision-confidence (CONFIDENCE), and (5) which factors influence the perceived usefulness of an MDSS (USEFUL).

The effects of the availability of an MDSS are expected to differ for the different values of the intervening variables as described in Chapter Two, i.e. marketing decision-making experience (EXPE), field dependence (FIDE), attitude towards MDSS-in-general (ATTI) and time-pressure (TIPR). Therefore, in our experiment we have investigated the interaction effects between these intervening variables and HQMD. Furthermore, to study whether the effects of the MDSS changed over the four periods of time, the effect of the number of periods played (PERI) has been analysed.

It was not possible to analyse the data of the experiment by means of (a single) MANCOVA. A separate analysis had to be performed for each dependent variable because the number of times the five dependent variables were measured differed, as did the specific intervening variables which were expected to influence the dependent variables. Therefore, the data for each of the five dependent variables were analysed per variable by means of ANCOVA<sup>8</sup>.

The independent variable was defined as the availability rather than the use of a marketing decision support system. This was done because subjects with an MDSS at their disposal were free to decide whether they would actually use the system or not. It appeared that all subjects, with an MDSS at their disposal also used it.

To carry out the ANCOVA, SPSS-X (4.0) was used. The dependent variables were measured twice (CONFIDENCE and USEFUL) or four times (SHARE, DMTIME, and SIMUL). The values of the dependent variables, in the different periods, were treated as repeated measures. The MANOVA routine in SPSS-X was used to analyse the repeated measures design.

The organization of this chapter is as follows. In § 4.2, the market share effects as a result of the availability of an MDSS are analysed. In § 4.3, decision-making time effects of the availability of an MDSS are analysed. In § 4.4, we study the factors which influence the number of simulations made with an MDSS. In § 4.5, the decision-confidence effects resulting from the availability of an MDSS, and the factors that influence the perceived usefulness of an MDSS are studied. In the four sections, mentioned above, partial analyses are performed on the different dependent variables. In these analyses we study the *factors* that influence the various dependent variables. Finally, in § 4.6, we analyse the *process* that appears between the various dependent variables over the four periods of time.

## 4.2 EFFECTS ON MARKET SHARE

In this section we shall study whether the availability of an MDSS increases the market share (SHARE) and if so under which conditions. We shall consider whether the magnitude of the effects of the availability of an MDSS on SHARE is dependent on the values of marketing decision-making experience (EXPE), field dependence (FIDE) and time-pressure (TIPR). In Table 4-1 the mean market shares of the eight experimental groups are presented. In Table 4-2 the results of the ANCOVA are presented.

The results in Table 4-1 (see also Figure 4-1) show that marketing decision-makers, who use the MDSS, on average, obtain a higher market share (F=18.02, p=0.000)<sup>9</sup> than their non-MDSS counterparts in all of the four periods<sup>10</sup>. The average difference in market share over the four periods is 5.36 percentage-points<sup>11</sup>. The finding of an increase in the performance is in conformity with the results of the studies of Fudge and Lodish (1977), McIntyre (1982) and Lodish et al. (1988) who also showed an increase in the performance of marketing decision-makers due to the use of a decision-aid.

The presented significance levels are two-tailed.

The correlation between the values of market share and profit obtained in the MARK-STRAT-world was very high (r=0.89, p<0.000). Therefore, the results we found for market share most of time could also be found for profit.

It should be noted that the magnitude of the effects will be dependent on the specific environment the sytem is used in.

Table 4-1 Mean Market Shares (in percentages) for the eight experimental groups in the four periods (each group: n=20), standard deviations in parentheses

		Marketing Decision-Making Experience				
		Inexperienced  Time-Pressure		Experienced  Time-Pressure		
		Low	High	Low	High	
	NO MMSS	GROUP 1	GROUP 2	GROUP 5	GROUP 6	
		1. 17.42 (2.28)	1. 17.15 (1.99)	1. 16.17 (3.16)	1. 16.90 (1.18)	
		2. 17.49 (3.76)	2. 16.54 (3.07)	2. 15.68 (3.47)	2. 15.09 (2.62)	
Marketing Management		3. 19.30 (5.61)	3. 17.65 (4.48)	3. 16.75 (4.80)	3. 14.40 (3.37)	
		4. 21.70 (6.83)	4. 20.30 (4.84)	4. 19.62 (5.55)	4. 15.34 (4.71)	
Support System	MDSS	GROUP 3	GROUP 4	GROUP 7	GROUP 8	
		1. 24.69 (3.29)	1. 21.42 (3.90)	1. 23.38 (5.25)	1. 23.68 (3.78)	
	(high-	2. 25.40 (5.60)	2. 19.35 (5.36)	2. 19.09 (3.82)	2. 20.37 (3.94)	
	quality)	3. 25.62 (6.93)	3. 21.10 (6.31)	3. 19.45 (5.15)	3. 20.76 (6.82)	
		4. 28.13 (7.45)	4. 24.56 (7.81)	4. 22.06 (6.96)	4. 24.20 (9.22)	

Table 4-2 ANCOVA-statistics for the analysis of Market Share (F-statistic, significance of F-statistic)<sup>12</sup> (n=160, four periods)

	Main Effect	First Order Interaction of Factors with:	Second Order Interaction of Factors with:		
FACTOR		HQMD	HQMD*EXPE	HQMD*FIDE	HQMD*TIPR
HQMD	18.02 (0.000)	1.30 (0.256) 0.16 (0.687)			
EXPE	7.77 (0.006)	1.30 (0.256)			
FIDE	5.17 (0.024)	0.16 (0.687)	1.60 (0.208)		
TIPR	5.19 (0.024)	0.06 (0.808)	4.63 (0.033)	0.05 (0.817)	
PERI	17.16 (0.000)	3.52 (0.034)	2.61 (0.079)	2.43 (0.094)	2.28 (0.108)

In Table 4-2, main effects, first order interaction effects and second order interaction effects are presented. Since this study focuses on the conditions under which the MDSS shows effects, only the interaction effects of the independent variables with the availability of the high-quality MDSS (HQDM) are analysed. Since no significant third and higher order interaction effects showed up, these higher order interaction effects have been left out of the table. From here onwards, higher order interaction effects are presented, only when they are significant.

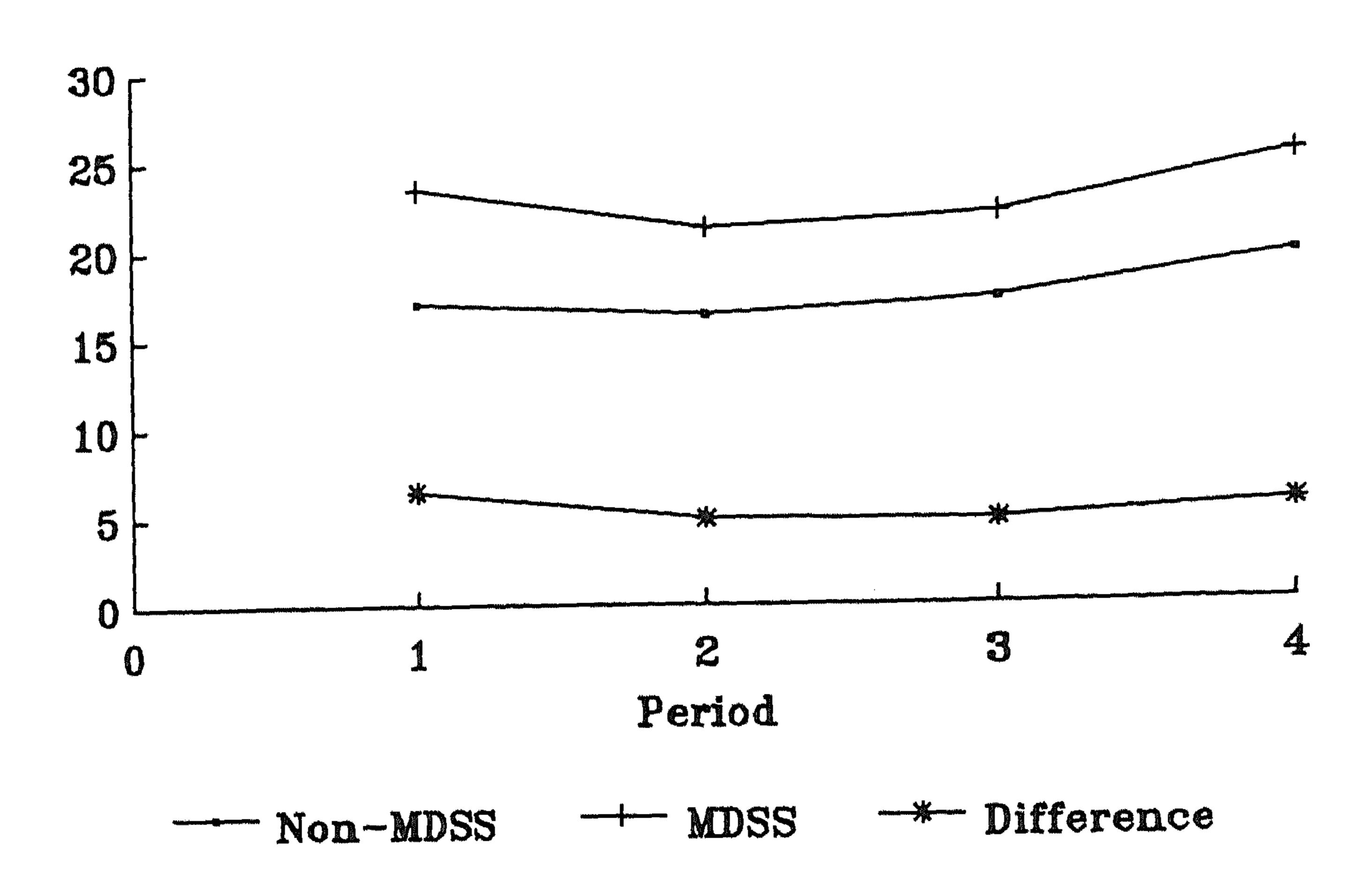


Figure 4-1 SHARE of subjects not using an MDSS (n=80) and subjects using an MDSS (n=80)

The magnitude of the SHARE-difference varies over the four periods  $(F=3.52, p=0.034)^{13}$ , however no clear direction shows up in this variation (see Figure 4-1). The difference decreases between period 1 and period 3 while, between period 3 and period 4, the difference increases a little. The SHARE-effect of the MDSS is present from the start and no learning effect seems to take place: MDSS-users do not benefit more from using the system, the more periods of time they have used it.

Overall, the mean value of the market share changes over the four periods (F=17.16, p=0.000). A general tendency exists in the mean value of the overall market share: a decrease between period 1 and period 2 and an increase between period 2 and period 4. This tendency is caused by the model underlying the MARKSTRAT program. In our specific experimental setting (e.g. the behaviour of the MARKSTRAT market, the starting position of the subjects' company and the starting position and the strategies of the phantom competitors), the overall position of company 2 (the company of the subjects) in the MARKSTRAT environment is weaker in period two, when compared with the other three periods.

Next, we look at the effect of marketing decision-making experience on SHARE. It is surprising to see that, overall, experienced marketing decision-makers perform worse than inexperienced marketing decision-makers (F=7.77, p=0.006) and, the more periods played, the larger the difference

All levels of significance of within-subject effects were corrected when the assumption of homogeneity of variance for within-subjects was violated. The Huynh-Feldt correction (Tabachnick and Fidell, 1989) was used for this purpose.

between the two groups becomes (F=6.72, p=0.002). The SHARE-difference between the inexperienced and the experienced marketing decision-makers is 0.14 percentage-points in period 1 and 3.36 percentage-points in period 4. The availability of an MDSS increases the performance of both experienced and inexperienced marketing decision-makers by the same amount (see Figure 4-2) (F=1.30, p=0.256). Experienced and inexperienced marketing decision-makers thus benefit equally from the availability of an MDSS.

The finding that the poorer performance was that of experienced marketing decision-makers confirms the findings of Johnson (1988). He reports that the behaviourial-decision literature does not present a flattering view of expert judgment. The superiority of experts over novices is often surprisingly small, or, in some cases, nonexistent. By this measure the results reported above, are even stronger than the findings of Johnson.

The poorer performance of the experienced decision-makers might be explained by their experience making them more cautious when making decisions in MARKSTRAT and less willing to make relatively large shifts in their marketing expenditures and production planning. One of the subjects, for example, after participating in the experiment stated that he "was afraid to build up a large stock and was therefore careful in planning the quantity of products he produced". In his real-life decision-environment large stocks were very expensive, while in the MARKSTRAT environment they were not. In this way experience probably influenced the performance of the marketing decision-makers negatively because, the experienced decision-makers could not throw off their real-life decision-environment.

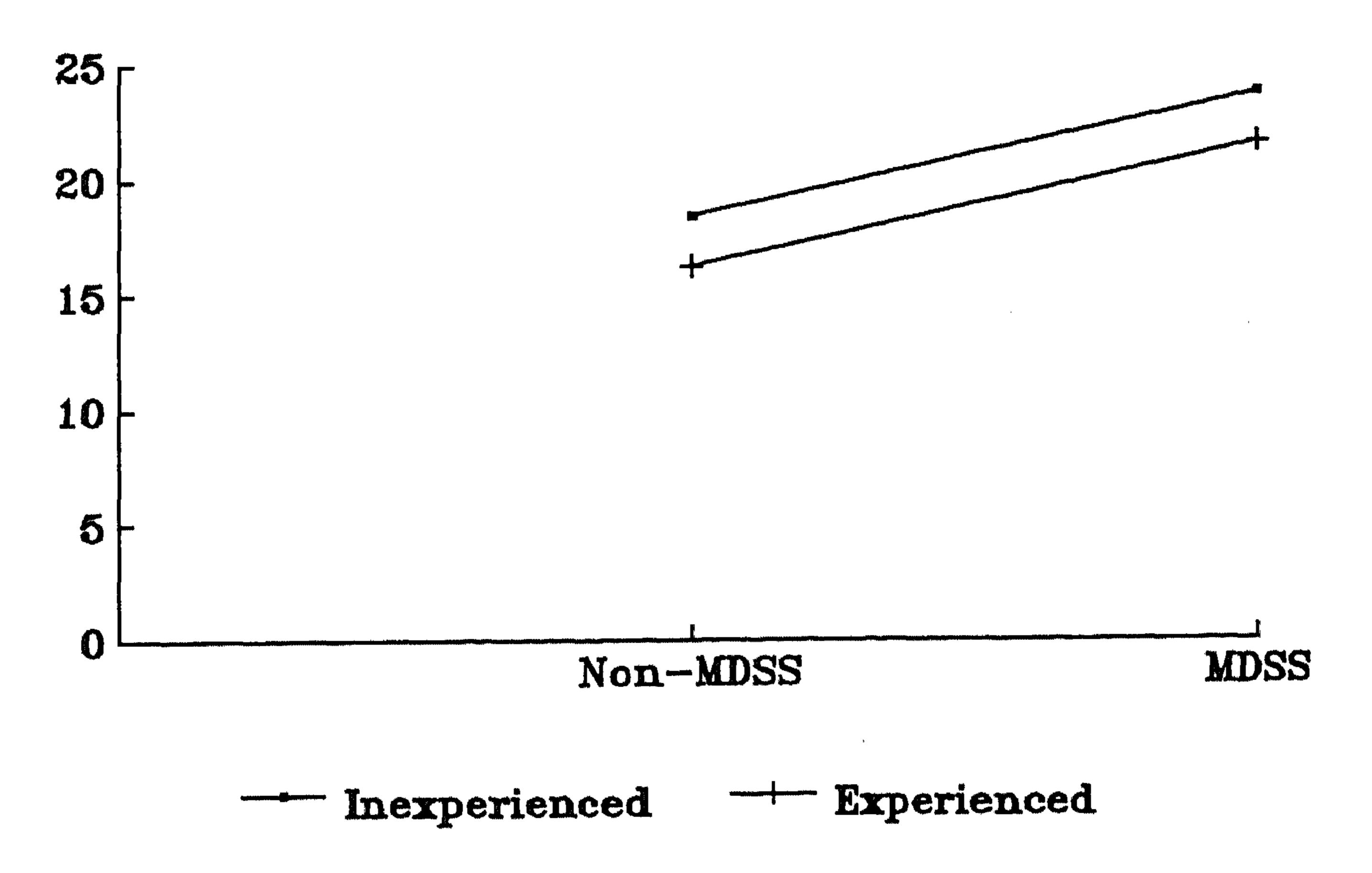


Figure 4-2 SHARE-effect of an MDSS for inexperienced subjects (n=80) and experienced subjects (n=80). The value of SHARE is averaged over the four periods

The inexperienced subjects (the students) were less pre-programmed by reallife experience, and therefore they were probably prepared to make larger shifts in their marketing expenditures and in their production planning. Since the market in the MARKSTRAT environment used in this study was growing very fast, a less cautious way of making decisions was advantageous.

When we examine whether the SHARE-difference, as a result of the availability of the MDSS, differs for experienced vs. inexperienced marketing decision-makers, we do not find an effect (F=1.30, p=0.256) (see Figure 4-2). Experienced and inexperienced marketing decision-makers benefit equally from the availability of the MDSS. However, we may expect that the actual use of the MDSS does differ for decision-makers with different amounts of experience. This issue is studied in Section 4.4.

Next, we examine whether the SHARE-effect due to the availability of an MDSS differs for marketing decision-makers with different analytical  $^{14}$  capabilities. Overall, non-analytical marketing decision-makers perform worse than analytical marketing decision-makers (F=5.17, p=0.024). This finding confirms the results of research by Benbasat and Dexter (1982) who also found analytical decision-makers performing better.

With respect to the interaction effect between FIDE and the availability of the MDSS, the results are interesting. No significant first order interaction effect between FIDE and HQMD shows up (F=0.16, p=0.687), but a higher order interaction effect between FIDE, EXPE, PERI and HQMD (F=2.91, p=0.061) does appear.

In the case of inexperienced marketing decision-makers the MDSS seems to play a compensatory role. The difference between non-analytical and analytical decision-makers *increases* without the use of an MDSS (see Figure 4-3a) while the difference *decreases* over the four periods with the use of an MDSS (see Figure 4-3b).

From here onwards, field independent subjects will be classified as analytical subjects, while field dependent subjects will be classified as non-analytical subjects.

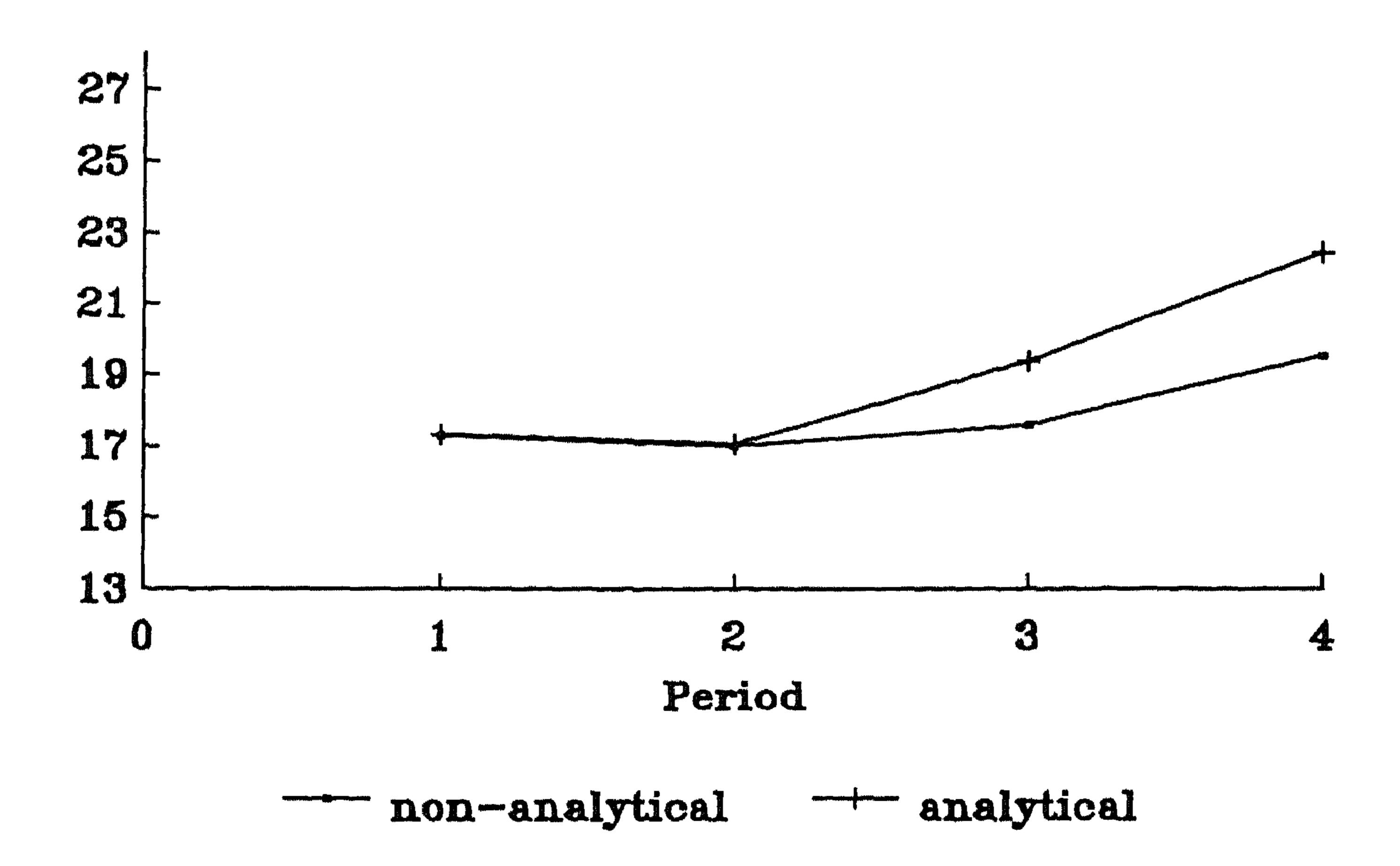


Figure 4-3a SHARE for analytical (n=20) and non-analytical (n=20) subjects without an MDSS at their disposal, all subjects inexperienced

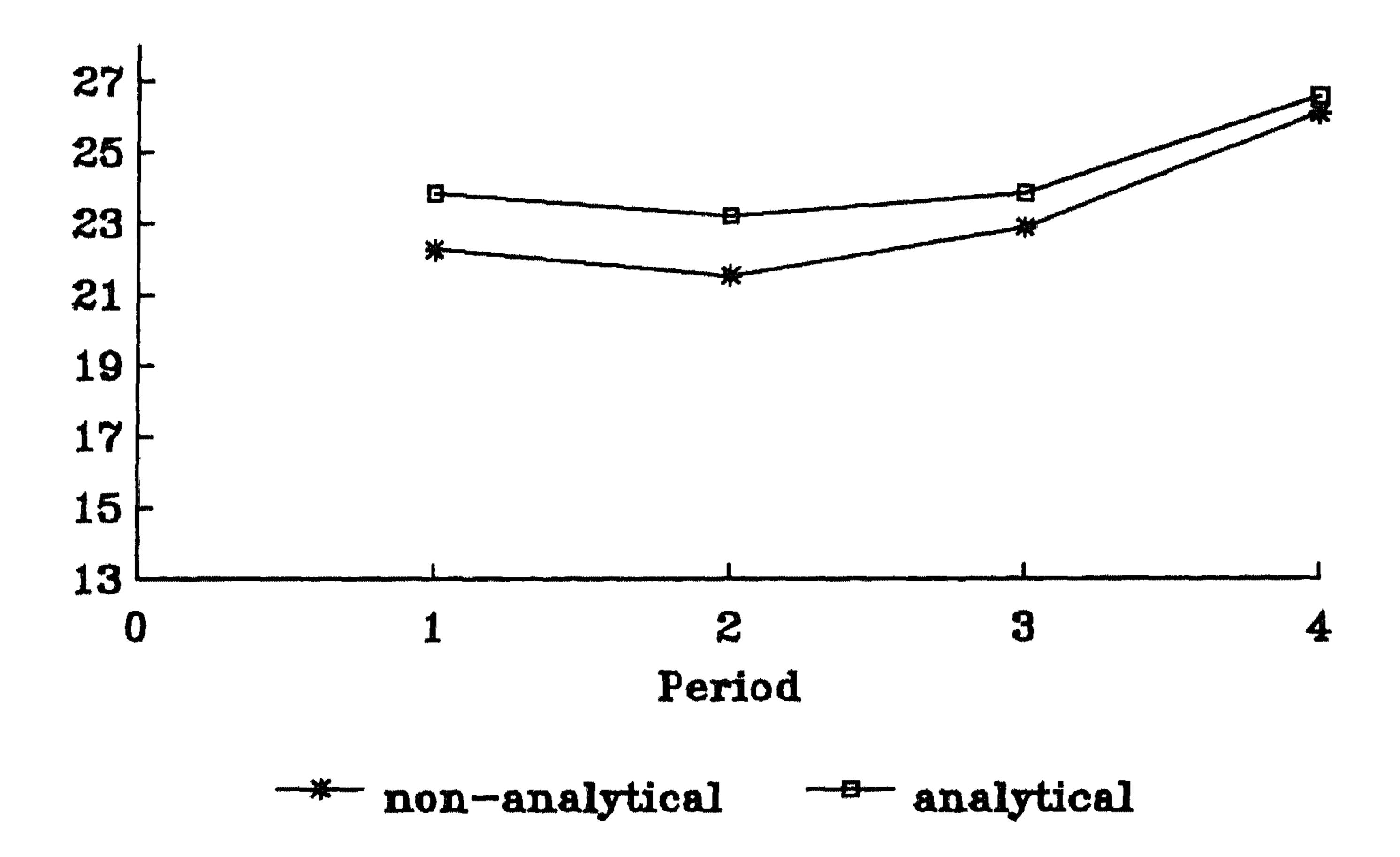


Figure 4-3b SHARE for analytical (n=20) and non-analytical (n=20) subjects with an MDSS at their disposal, all subjects inexperienced

In the case of experienced marketing decision-makers the opposite effect shows up. There is little difference between the SHARE of non-analytical and analytical decision-makers when not using the MDSS (see Figure 4-3c). However, analytical decision-makers outperform non-analytical decision-makers when they use an MDSS (see Figure 4-3d).

Two groups (analytical versus non-analytical decision makers) were created by performing a median-split on the FIDE scores.

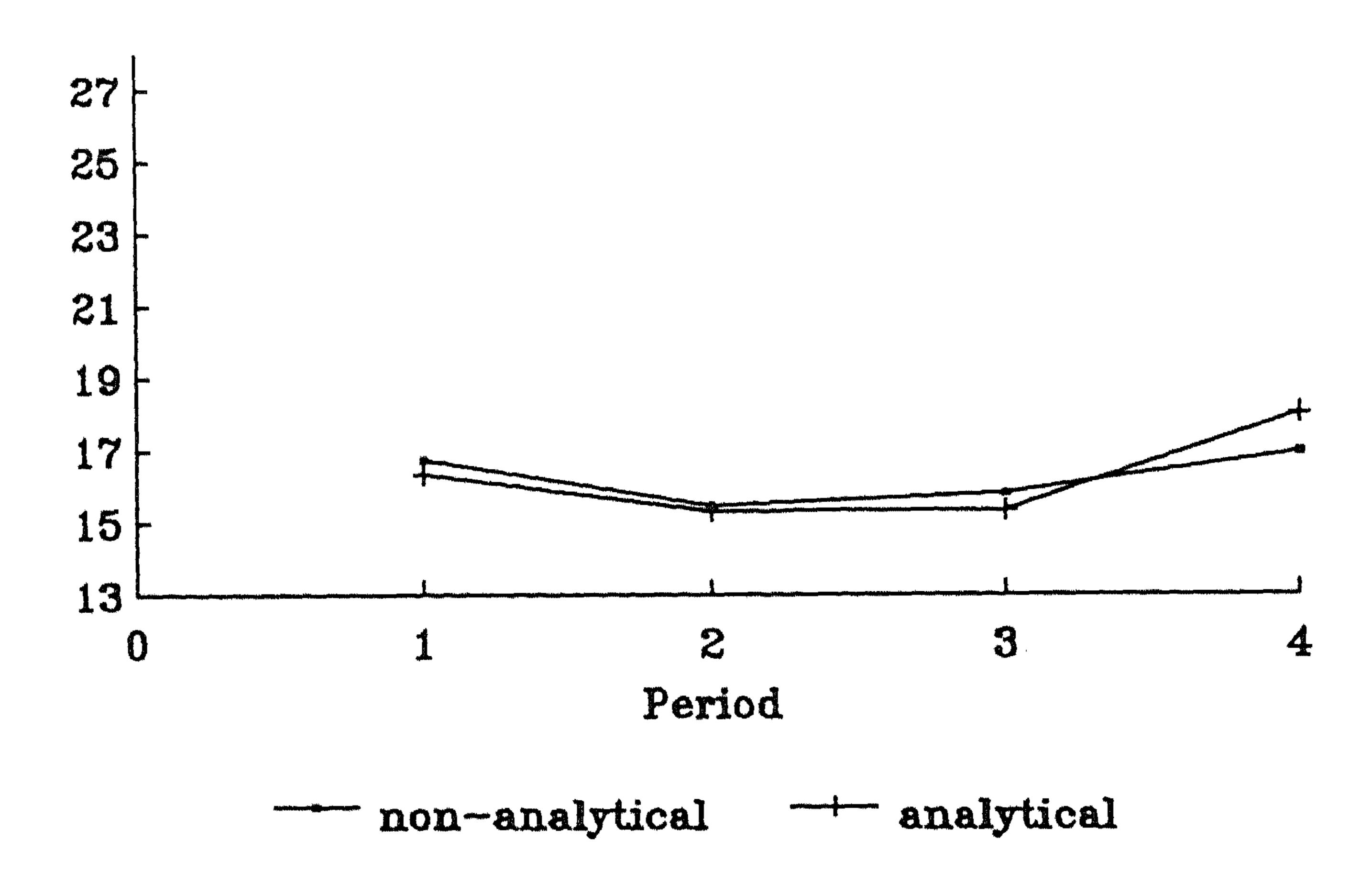


Figure 4-3c SHARE for analytical (n=20) and non-analytical (n=20) subjects without an MDSS at their disposal, all subjects experienced

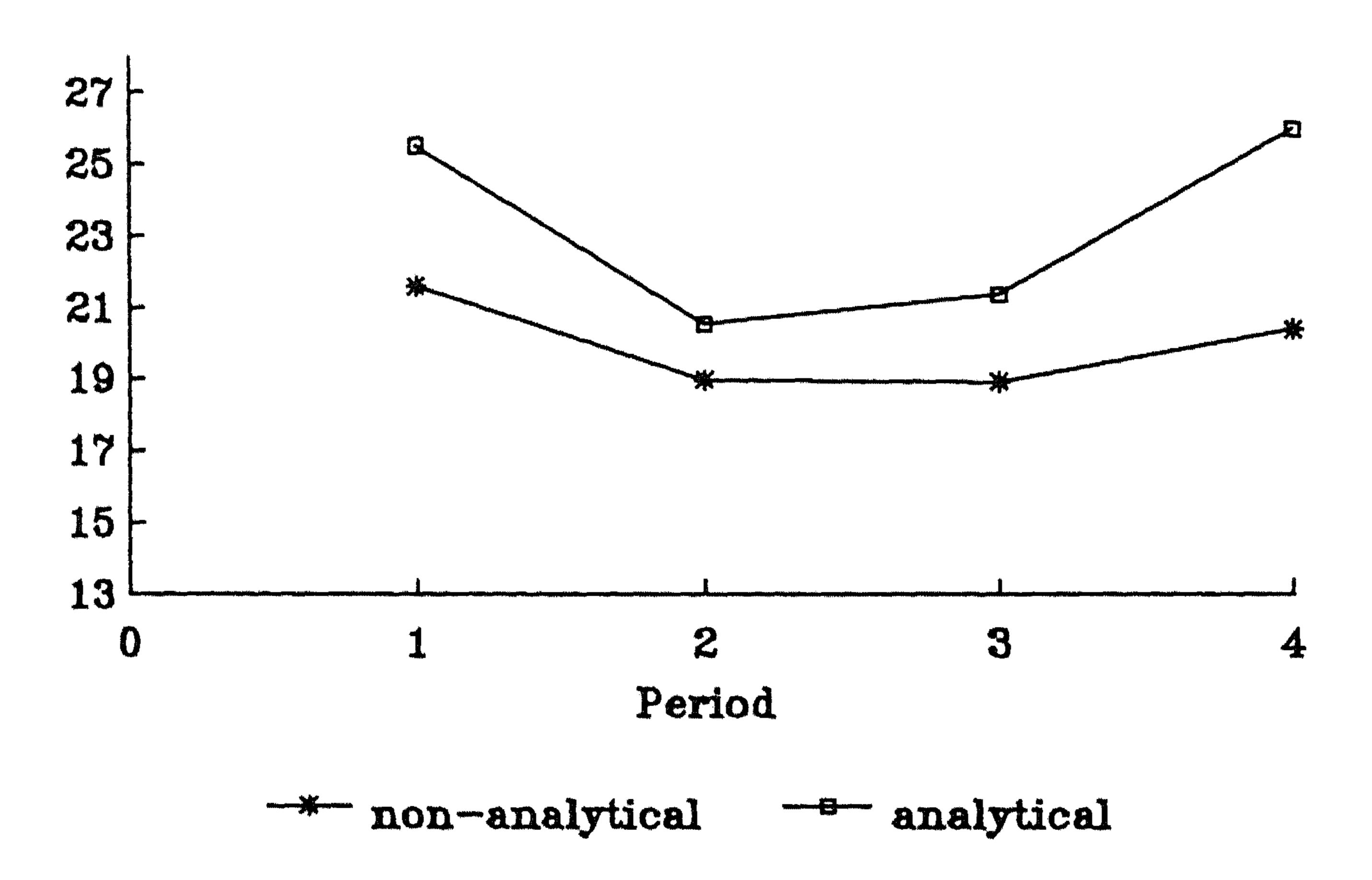


Figure 4-3d SHARE for analytical (n=20) and non-analytical (n=20) subjects with an MDSS at their disposal, all subjects experienced

In the case of inexperienced marketing decision-makers, an MDSS thus functions as *compensatory* to the analytical capabilities of the decision-makers (it helps especially the non-analytics to perform better), while for the experienced marketing decision-makers, an MDSS *reinforces* the analytical capabilities (it especially helps the analytical decision-makers to perform better).

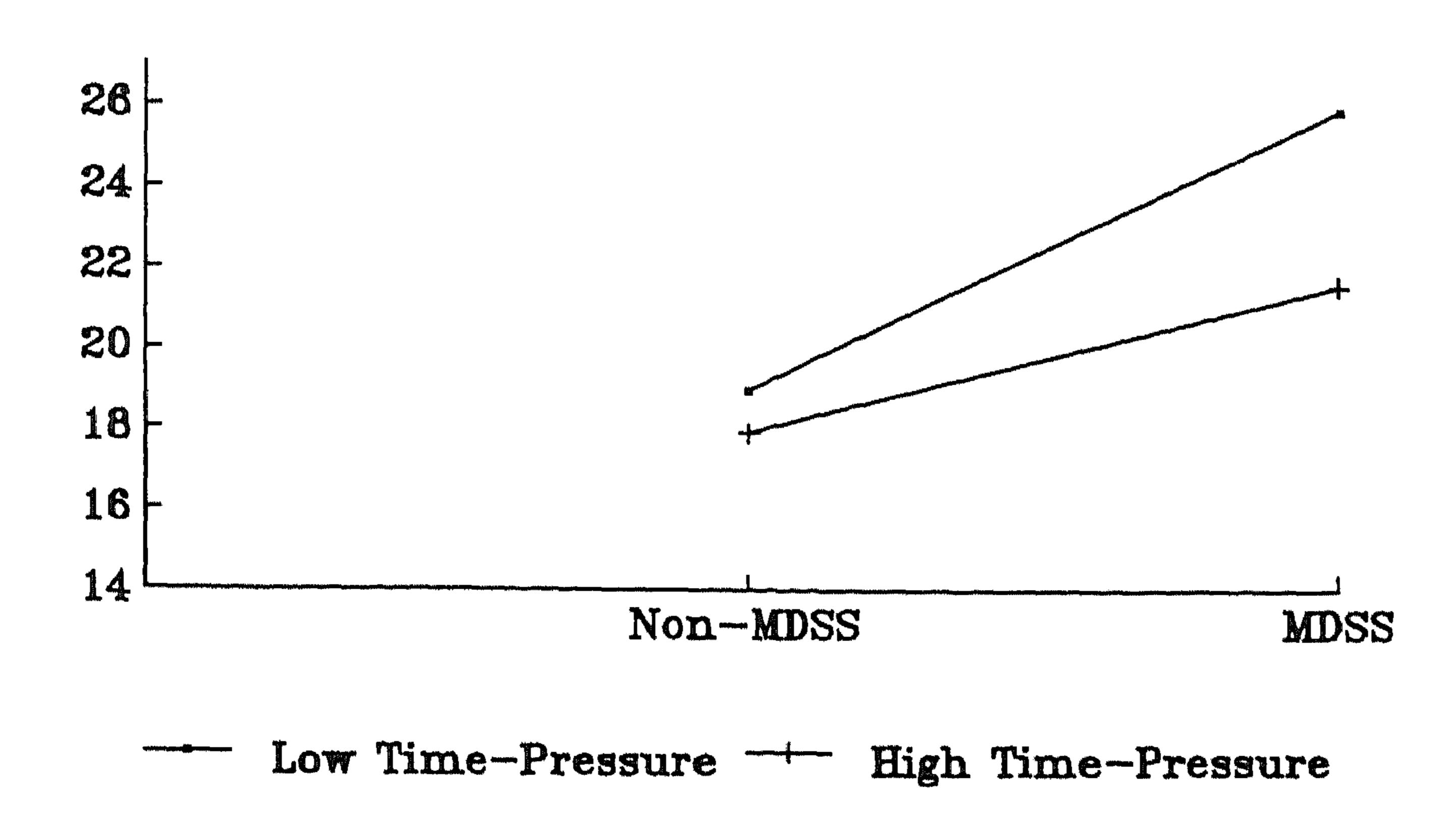


Figure 4-4a SHARE-effect of an MDSS for low time-pressured (n=40) and high time-pressured (n=40) subjects, both groups <u>inexperienced</u>. The value of SHARE is averaged over the four periods

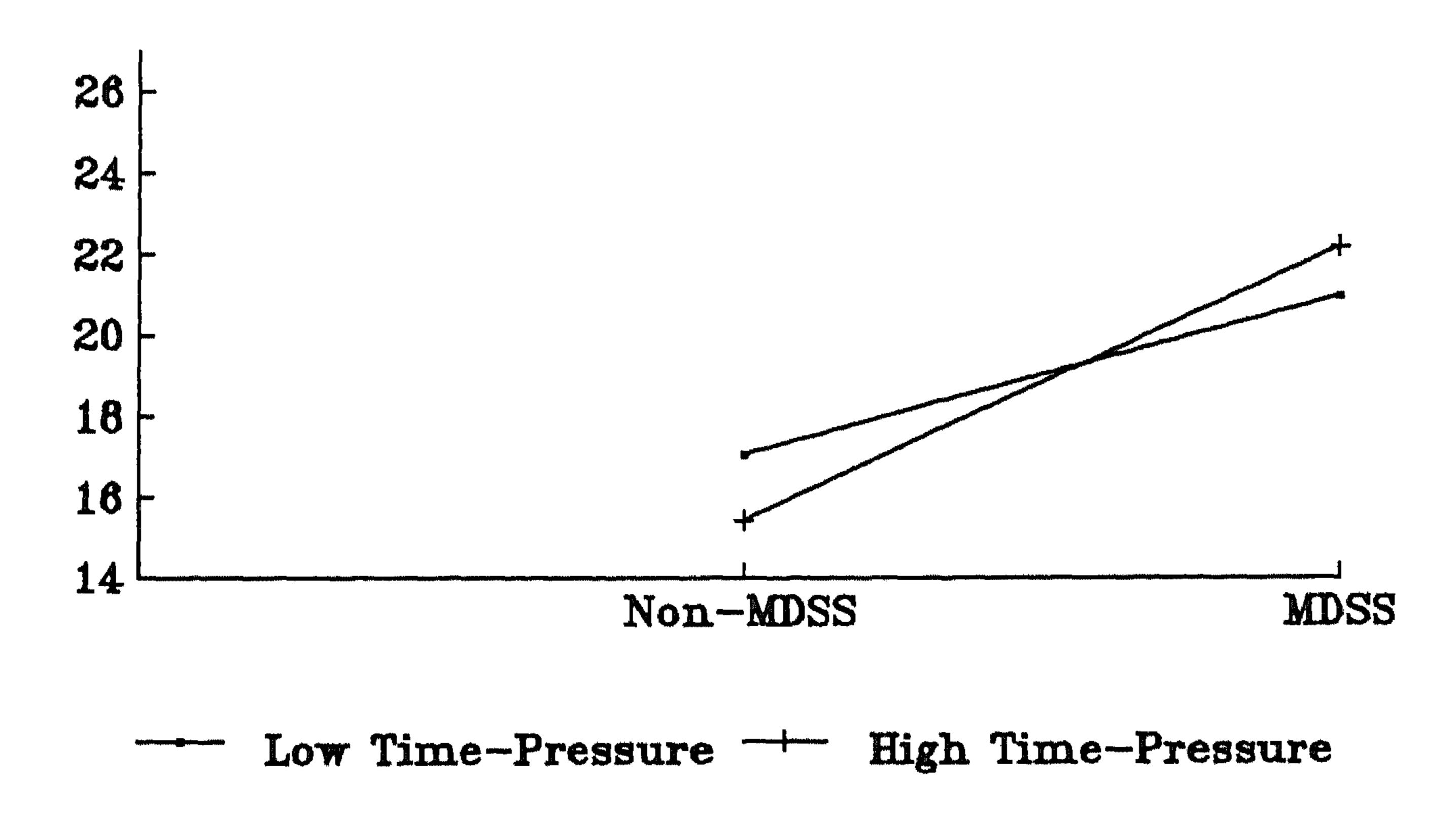


Figure 4-4b SHARE-effect of an MDSS for low time-pressured (n=40) and high time-pressured (n=40) subjects, both groups experienced. The value of SHARE is averaged over the four periods

Thus the experienced non-analytical marketing decision-makers were not able to use an MDSS to as much advantage as their analytical counterparts. A possible explanation for this might be that their analytical capabilities were too poor. Overall (see Chapter Three), experienced marketing decision-makers had poorer analytical capabilities than inexperienced marketing decision-makers. It might be that when analytical abilities drop below a certain threshold level, decision-makers can no longer benefit from the availability of an MDSS. The level of this threshold probably is between a