Review of Recent Literature on Sunk-Cost Effects of Prices

Bachelor's Thesis

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Abstract

Sunk costs are past investments, mainly in money, in certain projects. Such investments can have an influence on an individual’s current behavior and decision making. This relationship is called sunk-cost effect of prices. The effect can manifest in a greater willingness to continue and invest further in a failing project. Another common effect is that the higher past investments have been the more use people want to make out of the investment. This was repeatedly shown in scenarios where people bought season tickets for theaters or memberships for health facilities. In the case of a sure loss people become riskier and are more likely to invest even more money than to ensure no loss. The reason for this behavior is that people do not want to appear wasteful and therefore justify past investments through higher usage. It has been proven that sunk-cost effects of prices decrease over time, which is the case if payment and consumption take place with a delay in time.
1. Introduction

Over the past forty years there has been lots of research which focused on sunk costs and their effects on human behavior. It is a topic every individual is confronted with in their daily lives as well as decision makers in small and large companies. The most common definition of the sunk cost effects is “a greater tendency to continue an endeavor once an investment in money, effort, or time has been made” (Arkes and Blumer 1985, p. 124). This definition was adopted by most of the researchers on that topic. The definition implies that first an investment is made which then, afterwards, can have an influence on the individual’s behavior. This relationship contradicts traditional economic theory which states that only incremental costs should influence future decisions (Arkes and Blumer 1985). Some of the researchers tested whether knowledge about sunk costs and their possible impact could avoid such behavior.

This thesis will mainly deal with investments in money, as can be seen in the title, although the other two types of investments, effort and time, will be touched in some of the experiments. Those investments can have significant impacts on the behavior and decisions of individuals in any area of life. Business project management is the most popular example to show that sunk costs can lead to momentous decisions.

As mentioned above, research on sunk-cost effects of prices already started many decades ago. This thesis will be focused on recent literature and the latest findings on sunk-cost effects. However some papers of the early years of the research on sunk-cost effects will also be considered. The reason for this is that on the one hand the theory and main aspects of sunk costs and their effects do not fundamentally change over the years, which is the reason why those older papers are frequently cited by authors of recent papers. On the other hand many recent experiments are based on one of the first experiments conducted by Thaler
(1980) or Arkes and Blumer (1985) and are just further developed to detect more specific behavioral implications of sunk costs.

Beside a discussion of general and well-known characteristics of the sunk-cost effect, a broad range of further aspects and side effects, which may occur in certain scenarios, will be covered. To show how research on sunk-cost effects is implemented, some of the experiments conducted by authors on that topic will be explained in detail. Partially mathematical models are used to survey potential sunk-cost effects instead of, or additionally to, experiments. Both methods are in some way limited, however as experiments are more comprehensible and conducted with people the review will be focused on those. The general aim is to place the experiments in scenarios as realistic as possible to get the best and most valid results. To approach this aim some authors even use existing economic data which does not derive from experiments.

The first part of the thesis will deal with general sunk-cost effects embedded in basic theory. As sunk-cost effects of prices might change if payment and consumption take place with a delay in time, one chapter will focus on effects when the two actions take place simultaneously, whereas effects which occur if there is a separation of time will be discussed in another chapter. Most of the authors emphasize negative effects caused by sunk costs; therefore one chapter will be dedicated to potential positive effects resulting from sunk costs. After a short summary of the most important aspects of sunk-costs and their effects, the research findings will be critically evaluated and implications for managers based on the sunk-cost effects will be given. Some limitations on research will be presented before the thesis will conclude giving an outlook on future research.
2. Literature Review On Sunk-Cost Effects Of Prices

2.1 General Effects

The sources which will contribute to the literature review are from the late 1970s up to the beginning of the current year. Nearly all of the research was conducted in the United States, only few authors evaluated data from Europe, Africa or Asia. One of the first papers about sunk-cost effects was written by Arkes and Blumer (1985). They focused their research on reasons why people do not behave according to traditional economic theory if they already have occurred costs. They conducted several experiments and questionnaires to show different sunk-cost effects. One of their main findings was that if an investment has already been made, people were more likely to finish a project as they don’t want to appear wasteful. This effect is well known as to “throw good money after bad” (Arkes and Blumer 1985, p. 124), which is rooted in prospect theory (Kahneman and Tversky 1979).

Kahneman and Tversky (1979) used a value function (Insert Figure 1 about here) to show why people take more risks when the losses are higher, which is another effect of sunk costs. If great losses have already occurred, people are likely to spend even more, as long as this could result in gains because it does not change their perceived value very much. The situation is different if people have neither gains nor losses or only minimal losses. In this case they would weigh up the possibility of making a gain or a loss. This leads directly to another effect described by prospect theory. The authors could also prove an impact called certainty effect, which suggests that certain losses – in other words sunk costs - are greatly undervalued. Both of the effects can be seen in an experiment conducted by Arkes and Blumer (1985). Participants were asked, if, as the president of an airline company, they would invest further in a 90% finished project even if the probability of success is close to zero. The amount already spent on the project was $10 million. Most of the respondents (41 out of 48)
would continue investing in that project. The same question was given to another group of participants with the difference that in this case no prior investments had been made and that the amount to invest in the project was $1 million. In this case most of the respondents (50 out of 60) would not spent the $1 million on that project. In these experiments it is quite obvious how people’s behavior changed from rational to irrational and riskier decision making due to the existence of sunk costs. In a variation of the first question of the survey Arkes and Blumer (1985) found that the sunk-cost effect is slightly less powerful (37 out of 58) if the students are not perceived to be responsible for the company, but are an outsider looking on the situation.

The authors also surveyed the way in which the amount of sunk costs influences the consumption experience. In one of their questionnaires, students were asked which of two tickets for ski trips they would use. They had already bought both of them, one for $50 and one for $100, but could only use one of them as they had not realized that the ski trips take place the same weekend. Additional information is given in that the $50 ski trip would be more enjoyable. Despite this information about enjoyment, approximately half of the students (33 out of 61) would attend the $100 ski trip. This behavior contradicts traditional economic theory which states that “decisions should be based on the costs and benefits that are expected to arise from the choice of each option” (Arkes and Blumer 1985, p. 127). A similar behavior was found if the person had paid two different prices for the same product but could only consume one. The largest group of participants recognized no difference between the consumption of the goods, but 21 out of 89 prefer the consumption of the more expensive good which makes little sense from an economic point of view.

Arkes and Blumer (1985) also focused their research on usage, in particular if higher prices lead to higher usage of a product or ticket. In the corresponding experiment the researchers observed the usage behavior of 54 buyers of theater tickets for the following 9
months. One third of them paid the regular price of $15 per ticket; one third received a discount of $2 and the last third paid $7 less than the regular price. The authors found that those who paid the regular price for the ticket used the tickets more often during the first half of the season than the two discount groups. This behavior confirmed the suggestion that price is positively correlated with usage.

Moon (2001) discovered that there was no clear differentiation between sunk-cost effects and completion effects in former studies. In fact, authors found both of the effects in their experiments but they could not be clearly allocated to their roots. Moon (2001) in summary stated five hypotheses which he tested by analyzing questionnaires and a study in which 340 students participated. He found significant results for both sunk-cost effects and completion effects in his study. The hypothesis which stated that the higher the sunk costs the greater the willingness of the decision maker to invest further in the project was supported. The corresponding hypothesis for completion, that with an increased level of completion the willingness to invest further in the project also increases, is supported too. In figure 2 (Insert Figure 2 about here) the third hypothesis, which was supported, was shown graphically. It is based on a proposed moderation model and states that sunk costs are not related to commitment under low-completion conditions, but had an influence in high-completion conditions. Besides finding evidence for both sunk costs and completion, the author proved an interaction between the two effects. This takes place in a way that if both effects appear, the willingness to invest further is even higher. This is in contrast to earlier research, which stated that sunk costs are most important during the early stages of a project, Moon (2001) showed that “sunk costs have their greatest impact as level of completion increases” (Moon 2001, p. 111).

A few years ago, Ashraf, Berry and Shapiro (2010) realized an experiment in Zambia, Africa, to gather information about whether higher prices can lead to higher product usage. In
their experiment they sold Clorin in door-to-door sales to about 1,000 households. Clorin is a chlorine bleach solution which is meant to be added to water before it is consumed as it kills pathogens. The bottles of Clorin were offered at different prices and the households which decided to buy it received an additional coupon offering a special discount. This method was used to test for screening effects and sunk-cost effects separately. Approximately two weeks after the marketing experiment the teams visited the households again. Using a survey and test strips the teams tried to find out if the household used the Clorin, if it was the correct usage and if not, what the Clorin was used for.

Ashraf, Berry and Shapiro (2010) firstly tested for screening effects. Evidence for this effect would be if the households with a willingness to pay higher prices were also more likely to use the product. This is exactly what the researchers found in their project. Sunk-cost effects would be manifested if people who paid a higher transaction price (price after using the discount coupon) for Clorin were more likely to use it. Advocates of the public health often use the sunk-cost effect in their reasoning for higher prices of health products. Surprisingly the researchers could not find any sunk-cost effects in their experiment, as there were no significant differences in product use found dependent on the price paid.

Sleesman et al. (2012) systemized in their article past research results on escalating commitment. They divided the factors which could have an influence on commitment to an already started project into four sub-categories, whereof one was psychological determinants, including sunk costs. Using a meta-analysis the authors evaluated existing data. They realized that, with regard to the study of sunk-cost effects, there had been some confusion in the past. Whereas some researches like Arkes and Blumer (1985) found strong sunk-cost effects, others like Ashraf, Berry and Shapiro (2010) did not find any of them. According to Sleesman et al. (2012) the reason for this is that most of the surveys about sunk-cost effects mixed them up with effects of project completion, similar to the findings of Moon (2001). They suggested
that higher project completion leads to higher sunk-cost effects and thus end up in escalating commitment. As only five of the past surveys included this exact relationship in their analysis, they only cautiously confirmed this connection. Beside the suggestion that future studies should be conducted more carefully, the authors indicated that sunk-cost effects on escalating commitment might not be as notable as supposed.

Staw and Hoang (1995) examined sunk-cost effects in a completely different area – professional sports, more precisely in the NBA (National Basketball Association). The starting point was the assumption that the decision, which players should play in a certain game, was made according to the economic principle. This would mean that the players with the best performance would be allowed to play the highest amount of minutes in the games. And those players should also be the ones who stayed in the NBA for the longest time. Finally, players who do not meet the expectations should be traded from the team. As people frequently behave in a way which is not economically the best way, the authors made a hypothesis: the decision making of the responsible people in the NBA is influenced by sunk costs. They used existing data about playing times, goals, shots blocked and some other key figures about performance to evaluate if sunk-cost effects caused by the prices paid for the players in the draft order exist. The data was recorded from the 1980 – 1986 drafts of the NBA and included all players selected in the first two rounds. The study was split into three parts as described above. In the first part Staw and Hoang analyzed the playing time players got in connection to the amount the club had spent on the players. The second part was to find out if the amount paid had an influence on the survival time in the NBA. In the final observation the authors observed whether draft order had an influence on the team’s decision to trade players.

Staw and Hoang (1995) found significant sunk-cost effects of prices in each of the areas surveyed. They explained these results by the fact that people hate to admit that they
made a mistake. The teams wanted to show off with the signings they made and want to make the greatest use of the players to justify their choice. The effect can be seen especially if a certain person was responsible for the decision.

Máñez et al. (2009) focused their research on the effects of sunk costs on R&D (research and development) decisions. In fact, most of the investments in R&D are sunk costs because in general the first step is to gather information which already costs money and time. For their survey the authors used firm-level data of Spanish manufacturing for the years 1990–2000. They found that large firms had significantly higher sunk costs than smaller firms and that experience was quite important when considering current investment decisions in R&D, which means that decision makers are biased toward sunk costs. Additionally they suggested investing continuously in R&D even if that implied to take the risk of causing sunk costs. Ceasing investments in R&D could lead to a rapid depreciation of knowledge and the loss of a firm’s competitiveness.

Schmalensee (2004) surveyed whether sunk costs create entry barriers in the context of antitrust policies. He noted that “in practice, costs are rarely completely fixed or sunk forever” (Schmalensee 2004, p. 471). Using his model he came to the conclusion that the greater the importance of sunk costs, the lower the attractiveness of market entry and the higher the equilibrium price. Even if he found no antitrust barrier to entry caused by sunk costs, he stated that sunk costs may create an entry barrier in other policies because of the fact that “sunk costs may discourage entry by lowering expected profits” (Schmalensee 2004, p. 475).

Åstebro (2004) focused his research on sunk costs in relationship to the adoption of CAD (computer-aided design) and CNC (computerized numerical control) machine tools. Sunk costs in this case were the costs to learn how to use new technology. The study consisted of two parts, a questionnaire and a telephone survey, both targeted at plant
managers in metal working industries. The sample which the author finally evaluated consisted of 270 observations. The results were the same for CAD and CNC machine tools. Åstebro (2004) found significant negative effects of sunk costs of learning on the depth and probability of adoption. He also found that “the output to which these costs are applied will determine adoption behavior” (Åstebro 2004, p. 395). Further he discovered that adoption influenced by sunk costs was independent of other factors such as the age of machines or the risk attitudes of managers.

Gschwandtner and Lambson (2012) investigated special characteristics of high sunk cost industries in particular in connection with depreciation. The paper is based on theory as well as on empirical analysis. The authors found significant evidence for a higher variability of firm value in high sunk cost industries. Using employment variability and the number of firms as an indicator for industry size, they also proved that changes of industry size are significantly lower in high sunk cost industries. There was no significant evidence using the capital stock as an indicator of industry size. The choice of depreciation method is relevant in a way that depreciation can partially remove existing sunk-cost effects. These findings help to understand dynamics of industrial organizations.

In one of their former papers Gschwandtner and Lambson (2006) focused their research on profits and turnover in high sunk-cost industries. They based their analysis on data from the U.S. Census Bureau. As predicted before they found evidence for positive correlation between intertemporal variability of firm-level profit and sunk costs and negative correlation between the rate of turnover and sunk costs. This led to the conclusion that “equilibrium solves a social planner's problem of maximizing the expected present value of the sum of producer and consumer surplus, including the entry costs and scrap values” (Gschwandtner and Lambson 2006, p. 372).
The research area of Cabral and Ross (2008) was, as well as that of Gschwandtner and Lambson (2006, 2012), sunk-cost effects on the industry level. In particular they surveyed the influence of sunk costs on entry barriers. Using game theory and the Stackelberg assumption the authors disproved the common assumption that high sunk costs only created higher entry barriers. This might be true for some industries, because higher entry costs make the entry more risky and incumbents have the advantages of well-established conditions in the industry. These could also organize predatory actions to scare potential new entrants. What Cabral and Ross (2008) found was that sunk costs can also have a positive effect for new entrants of an industry. The message sent when a new firm enters an industry is commitment and especially if exit costs are high, predatory actions of incumbents are useless. This means that industries with high sunk costs might bare a greater potential to success than low sunk-cost industries. The airline industry, commonly known as an industry with low sunk costs, records many failed entry attempts. The incentive of the entrance to defend themselves depends on the degree of sunk investments.

Malhotra and Gino (2011) investigated possible influences of outside sunk investments on exchange relationships in their paper. One possible option to increase one’s power is to make investments in outside options. This allows for more alternatives, shows commitment and makes the person more independent from others. Malhotra and Gino (2011) conducted three experiments to gather knowledge about the consequence of such investments on behavior towards exchange partners. Students as well as non-students participated in the experiments in which they had to negotiate with other people. In all of the experiments the authors found evidence that opportunistic behavior increased significantly after investments in time or money were made. These results broaden the existing knowledge about effects of sunk strategic investments. Sunk costs are often closely connected to escalation of commitment but even if the behavior does not reach this level, the willingness to recover the
investment is existent. The papers further support the understanding of power mechanisms and impacts on exchange relationships.

In their recent article Steinkühler, Mahlendorf and Brettel (2014) surveyed the impact of self-justification on escalation of commitment. They proposed that the need for self-justification had an influence on “the decision maker’s selective perception, sunk-cost effect, and overoptimism” (Steinkühler, Mahlendorf and Brettel 2014, p. 192), which in turn led to the continuation of a failing project and thus escalation of commitment. This relationship can be seen in figure 3 (Insert Figure 3 about here). The authors suggested several hypotheses and tested them using an online survey in which 177 people participated, 130 key-decision makers and 47 non-decision makers from venture capital firms. This mixture was created to counteract common method biases.

In the evaluation Steinkühler, Mahlendorf and Brettel (2014) found significant evidence of the influence of the three cognitive escalation drivers, selective perception, sunk-cost effect, and overoptimism, on project escalation. This result confirmed the fact that the sunk-cost effect often leads to “protective investments” (Steinkühler, Mahlendorf and Brettel 2014, p. 198). Those are investments made by managers to recover past investments. This behavior shows that managers are still not able to ignore past investments in their present decision-making process.

2.2 Effects When Payment And Consumption Take Place Simultaneously

Gourville and Soman (2001) focused their research on sunk-cost effects if prices are bundled. Many studies have been conducted in order to gather information about the impact of price bundles on buying behavior. The aim of Gourville and Soman was to survey if price bundles have an effect on sunk-costs and therefore influence consumption probability. They conducted four experiments, three lab studies and one field study, to find out more about
potential relationships. The first two studies were conducted using the scenario of a ski-trip and different bundles of lift tickets, e.g. one ticket bought for each of the four days and one ticket valid for the whole four days. For the two last experiments the authors used the scenario of theater tickets to observe different effects. The sale of the theatre tickets was linked to special offers such as ‘buy two get one free’. The authors predicted that if prices are bundled the motivation to consume every part of the bundle is lower than if the products are purchased separately, but for the same price in total. In each of the four experiments evidence for the hypothesized effect was found. In the scenario of the ski-trips, the students participating in the study who were confronted with the bundled price version were less likely to make full use of the lift-ticket on a bad day than those who paid separately for the daily tickets. In the theatre scenario people were more likely to attend the play if they explicitly paid for it than if they paid a bundled price or got one certain play for free.

Gourville and Soman (2001) concluded that the effects observed are caused by transaction decoupling. In the case of price bundling the consumer does not consider each product separately but the bundle in total. Expectations decrease in this context as well as typical sunk-cost effects such is the need to justify past behavior, the wish not to appear wasteful or increased readiness to assume risk. These effects are even more prominent if it is not only transaction decoupling but if payment and consumption are not simultaneous, as it will be seen in the following section.

Heinz (2006) verified in her book the ecological validity of economic-psychological research using the example of the sunk-cost effect. She conducted several experiments to investigate the research results on sunk-cost effects undertaken in the US. The aim was to find out in which context sunk-cost effects occur. First she conducted an experiment at the University of Hamburg asking 130 mostly economic students to fill out a questionnaire using a 7-step Likert-scale. The situation described in the questionnaire was the one of a manager,
not one in which students typically find themselves. The experiment was tied up with the one of Arkes and Blumer (1985) in which a manager had to decide whether to continue a project he or she had already invested a great deal of time and money in. Caused by the unusual situation, there were no significant differences found in the decisions of the students, depending on time or money invested or stage of completion.

The next scenario presented by Heinz (2006) was adapted to the university context. In this experiment 60 students of the University of Hamburg decided whether to hold the seminar they had already invested big / small amounts of time in or to hold again the exercise they had the required knowledge for. In this study significant sunk-cost effects were found. The students could easily imagine the dilemma. Only 8 of the 30 students working on the low-sunk-cost scenario decided to continue preparing the seminar instead of ignoring the time already invested and take over the exercise session again. In contrast 29 of the 30 students confronted with the high-sunk-cost scenario decided to continue preparing for the seminar even if that meant there was still work to do.

In a third study Heinz (2006) conducted interviews with 30 managers of big companies as well as small and medium sized companies. All of those managers had experienced sunk-cost decisions themselves in the past and were asked to explain these situations. The aim was to find out, which factors influenced these decisions in reality, how many people were involved, how often these managers were confronted with such decisions and similar questions. This was to verify statements made in the literature. The author categorized the aspects mentioned by the managers to find the most powerful ones. What was surprising was that completion effects were not identified as a powerful justification for the continuation of an unsuccessful project as well as self-justification. One possible explanation for the non-occurrence of self-justification might be that the managers would not like to admit that this was the real reason. In fact the actual sunk costs were the reason most often
mentioned in connection to project completion. Other reasons were the costs caused by the termination of the project, personal reasons such as pride or interest and other reasons as the complexity of the project or the pressure of stakeholders or competitors.

Just and Wansink (2011) conducted a survey to find out whether consumption behavior is independent of prices in a flat-rate price setting. 66 guests of an all-you-can-eat (AYCE) restaurant were asked to fill out two short surveys, one before their lunch and one after. Additionally their eating behavior was observed by staff, which in this special case meant counting the pizza slices eaten. About half of the guests (control group) surveyed paid the regular price for the pizza buffet; the others (treatment group) received a 50%-off coupon. Ordering à-la-carte was not possible.

The authors found that consumption and also wasted food (food left on the table) in an AYCE setting is positively influenced by the price. This is explained by the fact that individuals try to maximize their utility of consumption. With every slice of pizza consumed the average price per slide decreased, which is true for both, the control group and the treatment group. Thus, it can be concluded that “individuals consider price in evaluating their marginal utility of consumption, even when there is no marginal cost for additional consumption” (Just and Wansink 2011, p. 199).

2.3 Effects When Payment And Consumption Take Place With A Delay In Time

The theater experiment conducted by Arkes and Blumer (1985) demonstrated that sunk cost effects change and in particular decrease over time. As mentioned above the usage of the theater tickets differed significantly between the three groups during the first half of the season. The usage of the different groups did not differ in the second half as much as it had in the first half of the season. Furthermore the usage of the tickets of all groups was less in the
second half than in the first half. This indicates that people forget about the prices they paid over time.

Thaler (1985, 1999) introduced a completely new concept to explain why sunk-cost effects decline over time. The concept is called ‘mental accounting’ and is a set of cognitive operations. It is called accounting because individuals and also households open different accounts for expenditures in different categories, mostly in their head, to keep an eye on their financial situation. Small investments might be bundled or not seen as significant, but especially for unusual or big investments people often open an account and check the balance regularly. Thaler used an example he experienced himself to explain what he actually meant by mental accounting. Some years ago he gave a talk in Switzerland, after which he and his wife spent their holidays in Switzerland. Even though the prices were horrendous, they partially adapted to them because they opened a mental account for their time in Switzerland which consisted of the fee Thaler received for his talk. They mentally allocated this fee to the following holidays so that the pain which is normally felt by spending so much money was non-existent. One effect of mental accounting is that accounts lose importance over time. Directly after spending money for a ticket, the consumer has a strong wish to attend, for example the game, to close the account afterwards. The greater the time between payment and consumption, the lower the need to justify the investment. By the time, the costs are seen as sunk and sunk-cost effects are no longer observable. The higher the investment, the longer it takes to depreciate the amount spent.

Gourville and Soman (1998) conducted several experiments to identify whether sunk-cost effects are influenced in the case of temporally separated payment and consumption. In their first survey they found that people were more likely to lend other people their electronic devices if they paid for it some time ago than if they owned it for exactly the same time but just finished paying for it. To explain this phenomenon which contradicts traditional
economic theory the authors used a payment-depreciation perspective, meaning that people experience depreciation of products. In this study the payment which took place some time ago is already depreciated at a greater part, the subject therefore perceived lower sunk-costs and is thus more willing to lend the e.g. desktop computer or television set to a colleague.

The second experiment was focused on differences in the likelihood to risk earnings the subjects just received for an effort it just did or which it did some time ago. It was found that people who invested their time earlier were likely to invest a higher part of their earnings playing a risky game than people who just had the effort. This shows that people who experienced the delay already adapted to the effort and therefore regard the earnings like ‘free money’ whereas people who just finished their effort consider the money as earnings to compensate effort. A direct influence on sunk-cost effects would have been that subjects differ in whether they invest or not, but what was found, was a difference in the amount invested. Thus the first two studies demonstrated that a temporal separation between payment and consumption causes lower sunk-cost effects which results in “a greater willingness to forgo a benefit that is scheduled to expire and a greater willingness to consume a benefit that can be inventoried” (Gourville and Soman 1998, p. 172).

The next study was focused on differences in motivation based on whether the subject had to pay for the ticket or if it was given for free. Other factors included in the study were when the tickets were paid or given for free respectively and how much the tickets were worth. There was no difference in the likelihood of attending the game based on when the subjects were given the tickets for free. What was found is that subjects who paid for the tickets six months prior to the game behaved as if the tickets were given to them for free. The reason for this is that subjects have fully adapted to the payment after six months and thus any sunk-cost effects which normally influence the decision whether to attend the game or not are negligible. The good is then perceived as free.
The purpose of the last experiment was to find evidence of how subjects depreciate payments. The authors evaluated data on the attendance of 33 members of an athletic facility. Starting with the month in which one of the semiannual payments took place Gourville and Soman (1998) observed that the number of attendances decreased each month until the month before the next payment. This confirmed what they suggested in advance, that “the process of payment depreciation is continuous in nature at the level of the individual” (Gourville and Soman 1998, p. 172). This depreciation leads to a steady decrease of sunk-cost effects, similar to what Thaler (1985) explained using his concept of mental accounting.

Eyster (2002) focused his research on the effects of people’s taste for consistency, which means that people take present actions such that their past decision seems to have been optimal. The settings of his experiments are mostly characterized by two or more periods where the state of nature in the following period(s) is not known in the first period. People are confronted with decisions such as if they want to continue an action, if they want to spend money and how much they want to spend. Economic rational behavior would mean that if the person realizes that the decision in period one was not optimal given the state of nature in period two would be that the invested money is dealt like “water under a bridge” (Eyster 2002, p. 1).

Eyster (2002) conducted an experiment in which participants had the opportunity to buy a membership which allowed them to shop in a store where they would have higher utility than if they do their shopping in another store. After a period of time they received the information that due to an economic development, the utility of the shop they bought the membership for has now decreased to the level of another shop. It was found that participants who invested the membership continued to buy at that store in order to rationalize their past decision. The author also found that if the participants received the information concerning
the changed state of nature in a later period they did not stick as much to the shop they bought the membership for as if they received the information in an earlier period.

In his model, Eyster (2002) defined certain characteristics which influence the behavior of an individual in the second period given a certain behavior in the first period. The first factor is defined as the “p-rationalizer” (Eyster, 2002 p. 14), which means how much the person aims at rationalizing past decisions and therefore minimize regret. If p = 0, the decision maker has nothing to regret because the past decision was optimal given the present state of nature and thus, the decision maker just maximizes the overall payoff. The other factor is defined as “v-naive” (Eyster 2002, p. 15). A v-naive p-rationalizer takes the decision in the first period with the belief that she will maximize her payoff in the second period, “but underestimates the extent to which she cares about regret” (Eyster 2002, p. 15).

Another topic Eyster (2002) looked at is the reaction to wrongly chosen contracts, especially in telecommunication. Mostly the contracts include features the consumer does not need or not the amount she is paying for. In order to reduce regret the consumer consumes more than she normally would.

To discover if the perceived price of an activity changes over time, Shafir and Thaler (2006) have undertaken an experiment with subscribers to a wine newsletter. The participants were asked the following question. “Suppose you bought a case of good 1982 Bordeaux in the future market for $20 a bottle. The wine now sells at auction for about $75 a bottle. You have decided to drink a bottle of this wine this dinner. Which of the following best captures your feeling of the cost to you of drinking the bottle?” (Shafir and Thaler 2006, p. 697). Most of the respondents (30%) picked the answer that it felt like it does not cost them anything or that they even saved money (25% of the respondents). Only 20% chose the answer that it felt like consuming $75, which would be the amount necessary to replace it and therefore the answer which economically makes the most sense.
This experiment shows perfectly one effect of sunk costs: if they are separated in time from consumption, people forget about the money they had spent. The same effect can be seen observing flat-rate tariffs in telecommunications (Thaler 1999). People don’t like knowing that they are paying for each minute of the telephone call and therefore prefer to pay a fixed price even if it is higher than paying by the call.

Shafir and Thaler (2006) mention another very common example which shows the zero marginal cost perceived as an effect of sunk cost. Many families living in urban regions own their own car even if, summing up all costs, it would be much cheaper to use cabs or rented cars. The difference is that paying all costs for the car at the beginning of the year makes it impossible to assign them to the activities the car was actually used for. Using a cab to go shopping would make it possible to assign the costs for the cab to the shopping trip and thus make it more expensive whereas a self-owned car is seen as sunk costs and does not produce any additional costs when using it (beside petrol costs obviously).

Lee and Tsai (2014) conducted four different experiments to find out if price promotions have an influence on consumption experience if this takes place with a delay. They found that if consumption takes place immediately after payment discounts, this lead to a higher consumption enjoyment rating as the price paid was lower than normally. But if consumption takes place after a delay, which in some experiments was only some minutes whereas in one of them it was a delay of one week, the consumption enjoyment rating was higher for no-discount products. These findings can be explained by lower sunk-cost considerations. Consumption enjoyment is highly correlated with the attention paid to the consumption. This means that the higher the prices, the higher the attention paid to the consumption and the higher the consumption enjoyment. In the cases when consumption takes place after some delay, the sunk-cost considerations are higher for regular-priced products because of the higher prices. This sunk-cost effect cannot be seen when consumption
takes place at the same time as payment is in this case the sunk-cost effect is overweight of the emotional effect of having made a good deal.

2.4 Positive Sunk-Cost Effects

According to Arkes and Blumer (1985) it was no less than the famous Thomas A. Edison, inventor of the electric bulb, who made some use of existing sunk costs. After not making profits with his invention he decided to increase production to full capacity as he realized that most of the production costs were sunk costs which existed anyway. He accomplished this idea against his associates and ended up making huge profits because he was not only able to sell the additional produced electric bulbs but also sell them for higher prices in Europe. This example shows that the procedure of identifying costs as sunk costs could lead to an increased understanding of processes and change the behavior in a way that sunk costs can result in positive effects.

Depending on the point of view, most sunk-cost effects are positive for at least one of the parties involved. Looking at the study about the attendance in health facilities conducted by Gourville and Soman (1998) the resulting effects can be divided in two parts. The first part is observed in the months directly following the half yearly payment. In this time slot a relatively high attendance per month can be observed. The reason is that the member still has the payment in mind and wants to make the most possible use of it. This has a positive effect on the member as continuous training is a good way to maintain health, staying free from illness. For the provider of the health facility, the months preceding the payment might be more profitable as the usage of his workout devices is lower and therefore he has lower maintenance costs which in turn results in higher profits.
3. Discussion

3.1 Summary Of The Main Findings

On the basis of the literature review, several sunk-cost effects could be found and were proved by different researchers. The continuing investment in failing projects and the increased readiness to assume risk are the main consequences of sunk costs. Higher entry barriers to high sunk-cost industries and the greater probability of success once entered can be derived from these findings. Especially in experiments with individuals, a willingness to higher usage could be observed and the preference of the more expensive product if two different or similar products are available (paid or for free) for consumption. It has also been proven that if payment and consumption are separated by a delay in time, sunk-cost effects decrease over time. Finally in certain situations it is possible to make use of past investments as they are not always lost, but can also be seen as a chance.

3.2 Critical Evaluation

Some results are based on the analysis of existing data, whereas most of the effects were observed during experiments which take place in an artificial scenario or are proven using mathematical methods. One weak aspect of the research is that variables to be observed cannot be isolated which means that effects which are witnessed can also be influenced by other issues beside sunk costs. According to Sleesman et al. (2012), who analyzed past research on escalation of commitment, it was concluded that effects were often mixed up and that sunk-cost effects might not be as notable as expected. Heinz (2006) stated that the result of an experiment is different, whether the participants are familiar with the experimental scenario because of own experience or not. Analysis based upon mathematical formulas might be easily replicable but it is not proven that people in a real situation would behave like
this. Personal feelings as well as external factors and pressure might in fact influence a decision maker. Additionally some aspects cannot be considered in experiment and furthermore some aspects have to be chosen to make the experiment realistic.

3.3 Managerial Implications

As frequently surveyed and described, one effect of sunk costs can be exaggerated commitment to a certain project. Managers do not want to appear wasteful, they feel responsible for their project or they just want to complete it. These are several well-known reasons why firms result in investing in unsuccessful projects – because of the existence of sunk costs. To discover methods to prevent such behavior, Behrens and Ernst (2014) conducted an experiment with 137 R&D managers. During the project, they tested which of the following methods was the most efficient one to reduce escalation of commitment: the advice of a consultant, visual decision aids or a combination of both. Beside the advice that the probability of commitment is reduced by shifting the decision process to someone without personal involvement in the project they found that especially the visual decoding of information, in our case the highlighting of sunk costs, might help.

Gourville and Soman (1998) concluded that giving some advice to make use of the sunk-cost effect described above that for example the usage of health facilities is highest in the month of the payment. This is especially relevant for managers of seasonal businesses, such as a golf course. To scatter the usage of the golf course it could be helpful to schedule the yearly membership fee some time away from the peak season of golf. By the time the peak season is coming, people already depreciated parts of the membership fee and therefore the motivation to make use of it is no longer as high as it would have been directly after the payment.
Soman and Gourville (2001) suggest that consumption can be regulated by price bundling. Offering products in bulk, e.g. one case of wine, can accelerate consumption. The method of price bundling of different products should be used carefully as this can lead to decreased demand.

Steinkühler, Mahlendorf and Brettel (2014) carved out some managerial implications which could help to lower the need for self-justification which itself has a negative impact on sunk-cost effects. One possible method would be to implement leadership rotation. This could lead to improved present decision-making processes as a new leader has neither responsibility nor reasons for self-justification of projects started in the past and could thus judge more neutrally. However firms have to be careful using this method as it can also have negative effects if nobody feels responsible for anything and thus the decisions become worse or riskier. To focus on the reduction of sunk-cost effects it might be helpful to highlight alternative investments.

As mentioned above Lee, Keil and Kasi (2012) found methods to lower the risk of escalation of commitment and unlimited investments in failing projects as a consequence of high sunk costs. These methods include the setting of difficult and also specific goals affecting the budget and the schedule at the beginning of the project. This can help to work more efficiently and to make better decisions on whether to continue a project or not.

In a laboratory experiment with 349 information technology professionals Lee, Keil and Kasi (2012) gathered information about the impact of budgeting and scheduling on escalation of commitment in software projects. Analyzing the collected data the authors found that several procedures can lower the probability of escalation of commitment influenced by sunk costs, among others. They found that the communication of difficult goals concerning budget and schedule as well as the determination of specific goals have negative effects on the risk of escalation of commitment. Also the willingness to complete the project is lower in this
context. These findings can help to avoid unlimited investments in failing projects caused by high sunk costs.

3.4 Limitations And Future Research

Heinz (2006) criticized two main limitations of current research. Firstly, nearly all of the studies are conducted for one person, deciding themselves, which in reality is hardly ever the case. There is no further contact to the people initializing the study or deep relationship with other team members who the person will have to work with for a longer time. Heinz realized this difference during the interviews with 30 managers of firms with different sizes, when “we” was the word fourth-often spoken. Secondly Heinz (2006) found that many aspects which influence decisions on project continuation are not considered in laboratory experiments. In most studies only two aspects are surveyed, sunk costs and completion effects, which by far do not cover a realistic decision scenario.

One aspect which should be improved in future research on sunk-cost effects is that exactly this effect is measured and that it is not mixed up with any other figure. This specification was claimed by many authors, just to name Moon (2001) and Sleesman (2012) as two of them.

Steinkühler, Mahlendorf and Brettel (2014) state that “laboratory research might have failed to capture the complexity of real-world escalation” (p. 211). They suggest focusing future research on a possible relationship between preferences and escalation.

Another topic which could lead to further managerial implication would be to survey the influence of payment depreciation on the willingness to repurchase a product. This focus was suggested by Gourville and Soman (1998) who also propose to investigate scenarios in which benefits take place before actions.
Figures

Figure 1: A Hypothetical Value Function to Explain Prospect Theory

Source: Kahneman and Tversky 1979, p. 279
Figure 2: Demonstration of Relationship between Sunk Costs and Completion Effect

Source: Moon 2001, p. 108
Figure 3: Graphical Description of the Relationships in the Research Model

Source: Steinkühler, Mahlendorf and Brettel 2014, p. 198
References


### Literature Review Tables

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<th>Author/s (Year) [Journal]</th>
<th>Research Focus</th>
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</table>
| Arkes and Blumer (1985) [Organizational Behavior and human decision processes] | psychological effects of sunk costs | robust judgement error | 10 experiments | - people tend to continue an endeavour in order not to appear wasteful  
- estimates of how likely a project is to succeed are influenced by the level of sunk costs  
- it is not possible to avoid sunk-cost effects even if people have taken prior courses in economics  
- Thomas A. Edison is named as an example for positive sunk-cost effects  
- people become riskier having increased sunk costs |

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</table>
| Ashraf, Berry and Shapiro (2010) [American Economic Review] | effect of prices on product use | sunk-cost effects and screening effects | 1,260 households in Lusaka, Zambia participated in the experiment | - no evidence was found that households paying a higher transaction price are more likely to use Clorin in their drinking water (and some of their point estimates even suggest the opposite)  
- instead of sunk-cost effects, screening effects were found |
### Main Findings

- sunk costs, in this case learning costs, have a significant influence on depth and adoption of CAD/CNC machine tools
- the output to which the sunk costs are applied will determine adoption behavior

### Method / Analysis

- analysis of 270 questionnaires filled out by plant managers in metalworking industries

### Theoretical Background

- influence on adoption of CAD/CNC machine tools

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<th>Author/s (Year) [Journal]</th>
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</table>
| Åstebro (2004) [The Journal of Industrial Economics] | influence of sunk costs on probability and adoption of CAD/CNC machine tools | influence on adoption of CAD/CNC machine tools | analysis of 270 questionnaires filled out by plant managers in metalworking industries | sunk costs, in this case learning costs, have a significant influence on depth and adoption of CAD/CNC machine tools  
the output to which the sunk costs are applied will determine adoption behavior |

### Research Focus

- influence of sunk costs on probability and adoption of CAD/CNC machine tools

### Theoretical Background

- escalation of commitment

### Method / Analysis

- experiment with 137 R&D managers

### Main Findings

- escalation of commitment as a result of sunk costs can be reduced using visualization of the information, especially highlighting sunk costs

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<tr>
<td>Behrens and Ernst (2014) [Journal of Product Innovation Management]</td>
<td>managerial implications to prevent escalation of commitment</td>
<td>escalation of commitment</td>
<td>experiment with 137 R&amp;D managers</td>
<td>escalation of commitment as a result of sunk costs can be reduced using visualization of the information, especially highlighting sunk costs</td>
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| Cabral and Ross (2008) [Journal of Economics & Management Strategy] | effect of sunk costs on entry barriers | structural approach and behavioral approach toward the effect of sunk costs, game theory | mathematical analysis | - sunk costs create barriers to entry for new firms into profitable industries  
- possibility for entrants to use sunk investments to commit to entry and thereby influence the behavior of their incumbent rivals |

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| Eyster (2002) [Job-Market Paper] | a taste for consistency as one sunk-cost effect | sunk-cost effect in one and more periods of time | logical reasoning using Thaler's (1980) example, mathematical reasoning | - people dislike regretting past choices, they therefore take current choices designed to improve past choices: they have a taste for current actions for which their past actions were optimal  
- regret dominates rejoicing |
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| Gourville and Soman (1998) [Journal of Consumer Research] | sunk-cost effects when payment and consumption are separated by a delay in time | payment depreciation and mental accounting | surveys and experiments | - sunk-cost effect is attenuated by a separation in time between an upstream cost and a downstream benefit, resulting in a greater willingness to forgo a benefit that is scheduled to expire and a greater willingness to consume a benefit that can be inventoried  
- with a sufficient temporal delay, an upstream payment will be fully discounted and the pending benefit will take on the characteristics of a free good  
- payment depreciation is a continuous process |
| Gschwandtner and Lambson (2006) [Economic Inquiry] | turnover and profits in high sunk-cost industries | sunk-cost effects in industries | theory and empirical analysis | - positive correlation between sunk costs and variability of firm-level profit  
- negative correlation between sunk costs and rate of turnover |
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<tr>
<td>Gschwandtner and Lam bson (2012) [The Review of Economics and Statistics]</td>
<td>sunk costs and depreciation in the context of industry dynamics</td>
<td>impact of depreciation on sunk-cost effects</td>
<td>theory and empirical analysis</td>
<td>▪ in high sunk-cost industries the range of firm value is intertemporally more variable and the size of the industry is less variable than normally ▪ sunk cost effects can be partially removed by depreciation</td>
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<tr>
<td>Heinz (2006) [Book: &quot;Too much invested to quit?&quot;]</td>
<td>validity of sunk-cost experiments compared to practice</td>
<td>sunk-cost effects</td>
<td>theory and three experiments</td>
<td>▪ lab studies only lead to valid results if the participants are in scenarios with which they are familiar ▪ research is mostly limited to very few parameters which leads to missing aspects compared to practice</td>
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- Individuals consider price when evaluating their marginal utility of consumption, even when there is no marginal cost for additional consumption. |
| Theoretical analysis | Prospect theory | Decision making under risk in contrast to expected utility theory | Kahneman and Tversky (1979) [Econometrica] | - Prospect theory as a description model of decision making under risk is introduced.
- Decisions become riskier if sure losses exist. |
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| Lee and Tsai (2014) [Journal of Consumer Research] | effect of price promotions on consumption experience | sunk-cost account | experiments with chocolate truffles (82 undergraduate students), music (155 students) and orange juice (293/193 students) | ▪ when product consumption occurs immediately after purchase, price discounts enhance consumers' enjoyment of the product  
▪ when consumption is decoupled from the transaction by a time delay, price discounts reduce consumption enjoyment because lower prices lower sunk-cost considerations |

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| Lee, Keil and Kasi (2012) [Journal of Management Information Systems] | sunk-cost effects in the context of software project escalation | goal setting theory, sunk costs and mental budgeting perspectives | laboratory experiment with 349 information technology professionals | ▪ high sunk costs increase the probability of escalation of commitment  
▪ specific and difficult goals concerning budget and schedule lower the likelihood of project commitment in comparison to vague goals  
▪ the effects described are highest when sunk costs are high and the effects are only low assuming low sunk costs |
### Main Findings

- sunk investments is one method to increase power and to show commitment
- outside options increase opportunistic behavior in current exchange relationships
- the effects can be seen even if the investment was long time ago or is no longer valid

### Method / Analysis

- experiments and analysis

### Theoretical Background

- increase of power and behavioral implications

### Research Focus

- psychological and behavioral consequences of the pursuit of power using sunk investments

### Author(s) (Year)

- Malhotra and Gino (2011) [Administrative Science Quarterly]
- Máñez, Rochina-Barrachina, Sanchis and Sanchis (2009) [The Journal of Industrial Economics]

### Main Findings

- most of the costs in R&D are sunk
- large firms have higher sunk costs than small firms
- it is important to take the risk of causing more sunk costs to remain competitive
### Main Findings

- as the level of sunk costs increases, a decision maker will be significantly more willing to invest further into a progress-related project
- as the level of completion increases, a decision maker will be significantly more willing to invest further into a progress-related project
- sunk costs will not be related to commitment under low completion conditions, but sunk costs will be related to commitment under high-completion conditions

### Theoretical Background

- many studies found no sunk-cost effects in relation to completion effects
- sunk costs do not create entry barriers in antitrust policies
- they may have an influence in other settings, because of lower expected profits

### Research Focus

- relevance of sunk costs in relation to completion effects in an escalation of commitment scenario
- sunk costs in the context of antitrust policy

### Method / Analysis

- study with 340 students and a questionnaire
- mathematical model

### Author/s (Year) [Journal]

- Moon (2001) [Journal of Applied Psychology]
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<tr>
<td>Shafir and Thaler (2006) [Journal of Economic Psychology]</td>
<td>importance and influence of advanced purchases</td>
<td>mental accounting rules</td>
<td>experiment with 76 subscribers to a wine newsletter</td>
<td>▪ long time distance between payment and consumption lead to zero marginal cost of consumption instead of the feeling of consuming the actual value of the product (which would be due if the product e.g. wine would have been bought today)</td>
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<td>Slesesman, Conlon, McNamara and Miles (2012) [Academy of Management Journal]</td>
<td>factors which influence escalation of commitment</td>
<td>sunk-cost effects and project completion</td>
<td>analysis and summary of past research on the topic</td>
<td>▪ the prominence of sunk costs is lower than expected because the effects are often mixed up with project completion</td>
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<td>Soman and Gourville (2001) [Journal of Marketing Research]</td>
<td>impact of price bundling on sunk-cost effects</td>
<td>consumer behavior</td>
<td>lab studies and field studies</td>
<td>▪ typical sunk-cost effects such as increased willingness of consumption as a consequence of high prices are significantly lower in price bundling scenarios&lt;br&gt;▪ the effects are lower because of transaction decoupling</td>
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<td>Staw and Hoang (1995) [Administrative Science Quarterly]</td>
<td>sunk-cost effects in the NBA</td>
<td>sunk-cost effects of prices for trading and behavioral implications</td>
<td>analysis of existing data of the NBA (draft orders 1980 - 1986)</td>
<td>▪ the higher the amount paid for a player the more playing time he is allowed to play&lt;br&gt;▪ the higher the amount paid the longer the player survives in the NBA&lt;br&gt;▪ the higher the price the lower the probability to be traded</td>
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</table>
| Steinkühler, Mahlendorf and Brettel (2014) [Schmalenbach Business Review] | sunk-cost effects on self-justification (explanation of escalation of commitment) | motivated reasoning theory, cognitive dissonance theory | line of argument, literature review | - sunk costs often give rise to "protective investments" (are made by investors to recover their initial investments and to demonstrate an inability to disregard sunk investment)
- alternative investment possibilities should be highlighted and managers should implement practices to reduce the need for self-justification to reduce sunk costs |

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| Thaler (1980) [Journal of Economic Behavior and Organization] | failure to ignore sunk costs and prospect theory | prospect theory and traditional economic theory | analysis of data gathered through experiments | - gains are treated differently than losses
- people are not able to ignore sunk costs and thus often behave contradictory to economic theory |
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</table>
| Thaler (1985) [Marketing Science] | introduction of the concept of mental accounting | household budgeting processes, transaction utility theory | experiments, theory and mathematical analysis | - people mentally code gains and losses according to prospect theory value function  
- prior gains and losses influence subsequent choices  
- experiments with real money are harder than created scenarios |

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</table>
| Thaler (1999) [Journal of Behavioral Decision Making] | why people pay attention to sunk costs | mental accounting | literature review | - although sunk costs influence decisions, they do not linger indefinitely  
- separation of prepayment from consumption reduces the perceived cost of the activity |