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Determinants of Susceptibility to Sunk-Cost Fallacy: A Nigerian Case Study

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Abstract:

A general economic principle is that when evaluating the costs of a decision, sunk costs should not be considered and that the decision-maker should consider only those costs that are incurred as a result of making that decision. However, both anecdotal and empirical evidence has shown that when making decisions, people are influenced by sunk costs, thereby committing the sunk-cost fallacy. A corpus of research has established that this fallacy occurs among different nations and cultures to differing extents or degrees. However, none of the previous research was conducted on Nigerians. This study, therefore, investigates whether Nigerians, too, commit this fallacy and then identifies factors that affect Nigerians' susceptibility to the fallacy. Employing a binary logit model, it was found that about 49 per cent of the respondents to questions based on a decision-making vignette committed the sunk-cost fallacy. The results also showed that locus of cost

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responsibility (whether the cost was borne by the decision maker or another person on behalf of the decision maker) and ethnicity (whether the decision maker is Yoruba or not) were significant determinants of susceptibility to sunk-cost fallacy. This suggests that in Nigeria sunk-cost fallacy is intrapersonal and more prevalent among the Yorubas than among the Hausas or the Igbos. Therefore, the sunk-cost fallacy is ubiquitous and more likely in personal decisions than decisions made on behalf of others.
Keywords: Nigeria, Self-justification Theory, Sunk Cost, Sunk-cost Effect, Sunk-cost Fallacy.
JEL Codes: D91, C83, C90.

1. Introduction

There exist inevitable circumstances in which it makes economic sense for a decision maker to jettison a prior decision and let the decision stay in the past or bring it to a halt, even though the decision maker has already incurred irrecoverable costs. Giving up the initial cost of a failing activity is more rational than throwing good money after it (Falchetta, 2015), especially when the benefits of further commitment to the activity are not worth additional costs.

Based on rational choice theory, a cost that is already borne and, therefore, cannot be avoided should be ignored when making a current decision. This is tantamount to such maxims as "it is no use crying over spilt milk", "let bygones be bygones", and "avoid throwing good money after bad". This theory argues that what is already spent (the sunk cost) is irrelevant to any further decisions you make and that any decisions should be made based on the comparison of future benefits and costs. This theory—known as the *cost-benefit principle*—states that a decision should be made if its benefit exceeds its cost or its level be increased if its marginal benefit exceeds its marginal cost[1]. The principle describes the idea that rational people compare the marginal benefits of a choice against its marginal costs in deciding whether or not to undertake the activity, without considering related benefits and costs of past choices: People choose to undertake any activity as long as its marginal benefit outweighs its marginal cost.

However, anecdotal as well as empirical evidence has established that in reality, people do not follow this normative principle in their individual and business decision-making and thus fall victim to the *sunk-cost fallacy*—

[1] Marginal benefit (or cost) refers to the benefit (or cost) derived from undertaking one more unit of an activity.

mistaken reasoning that sunk costs should be considered in the current decision (e.g., Thaler, 1980; Arkes and Blummer, 1985; Olivola, 2018). The sunk-cost fallacy is a ubiquitous and costly mental error that people are inclined to make when making decisions. It is a reasoning pitfall that can dissuade one from choosing optimum when it is an option and can lead to poor and suboptimal decisions, such as

- Escalating financial commitment to a failed project just because a huge amount of financial resources has been expended on the project;
- Sitting through an uninteresting movie just because the price paid was very expensive (Arkes & Blumer, 1985; Strough et al., 2008);
- Letting unworn clothes fill up your closet or wearing an uncomfortable piece of clothing just because they were expensive (Zeng, et al., 2013);
- Keeping an underperforming employee just because you have already spent so much on him or her (Bazerman et al., 1982);
- Staying too long at a terrible job, or a faltering career, just because you have spent years in training to get this job (Staw & Ross, 1989; Arkes and Blumer, 1985);
- Refusing to drop out of a hopeless political campaign;
- Waiting more minutes for a bus to come after a long wait (Falchetta, 2015);
- Finishing an expensive meal you paid for when you are already full, eating an expensive but disliked food;
- Filling your home with objects you no longer use; and
- Continuing gambling, after losing, to recover losses (Maréchal, 2010); and
- Continuing an unhappy relationship or a troubled marriage (Arkes and Blumer, 1985; Staw & Ross, 1989).

All these diverse situations are characterized by sunk-cost effects—the influence on decision-makers to continue a failed or an unpleasant activity just because of the resources already expended on it (Thaler, 1980; Arkes & Blumer, 1985). The last situation above illustrates the fact that the longer you have been together with your spouse, the harder it is to break up because of the time, money and effort already expended on the relationship. In deciding whether or not to seek a divorce, you should not consider the past time, money and other resources expended on the relationship.

As portrayed in the sunk-cost scenarios itemized above, sunk-cost fallacy features in both business (investment) decisions and personal (consumption) decisions and thus has two respective effects: (1) consumption of goods and services that are less enjoyable and (2) continued investments

in failing activities (Olivola, 2018; Arkes & Blumer, 1985; Thaler, 1980). These effects, named *sunk-cost effects* by Thaler (1980), have been variously termed *escalation of commitment* (Staw, 1976), *investment trap*, *escalation bias* or *effect* (Bornstein and Chapman, 1995), *irrational escalation*, *too-much-invested-to-quit syndrome*, and *throwing good money after bad* (Garland, 1990).

These effects are deemed irrational because current decisions consider the past costs, instead of the future costs. Consequently, several researchers have investigated why people commit the sunk-cost fallacy. One of the factors found culpable is culture (Chow et al., 1997; Geiger et al., 1998; Yoder, 2014). For example, Chow et al. found that Chinese participants were more likely to honour sunk costs than American participants. However, Yoder et al. found that Americans committed more sunk-cost fallacy than Indians. Meanwhile, the literature search conducted for this study revealed that all of this research was carried out on Western cultures in comparison with Eastern cultures, and that little or no attention has been focused on Nigerian and/or African cultures. The only related study conducted on Nigerians is that of Akinbobola and Ehigie (2012). Yet Akinbobola and Ehigie's study is on the escalation of commitment, not on sunk cost. Therefore, to my knowledge, this current study is the first sunk-cost study conducted on Nigerians.

Furthermore, one of the problems plaguing research on sunk cost and escalation behaviour is the reliance on laboratory settings with their attendant problem of external validity. There exist only a few fields and archival studies on the topic (e.g., Astebro et al., 2007). Most studies on sunk costs (e.g., Brockner et al., 1982) relied totally on laboratory research with students as the participants. This probably accounts for why contradictory results have been so prevalent in previous studies (Staw, 2016). For example, Peterson (2001) found that effect sizes from studies that used student samples differed in magnitude and direction from effect sizes from studies conducted on non-students. Given this methodological gap, Roth et al. (2015) have called for further studies that would focus on older, well-educated, professional samples. Therefore, by employing and carrying out a survey, this study is partly a response to the call by Roth et al. and partly a response to the need to increase the external validity of the studies conducted in the laboratory.

It is against this background that this study sought to examine whether Nigerians, too, are prone to sunk-cost fallacy and to identify factors that influence susceptibility to the fallacy. This objective is necessary given the distinctiveness of Nigeria's population, especially in terms of the demographics and personality of Nigerians. Specifically, this paper builds on the previous studies in two ways. First, it examines the extent to which Hausa,

Yoruba and Igbo people in Nigeria commit the fallacy. Second, it employs a binary logit model.

The present study is necessary to test a richer theoretical model than has been previously examined. With a wider setting than prior studies, this study would go a long way in assisting decision-makers in taking cognizance and being wary of the pitfalls that are likely to affect their decision-making process.

2. Conceptual and theoretical review

A *sunk cost* is an expenditure that has been made and cannot be recovered no matter what decision is made, and thus does not vary according to different decisions. Once a sunk cost is incurred, it cannot be recouped if you walk away from a prior decision. It is thus an expenditure on a fait accompli. Hence, the expression *sunk costs are sunk*, meaning they are gone, ignore them. Whether a cost is considered sunk or not depends on the decision being made. Any costs that would change as a result of making a decision are the non-sunk costs while those costs that do not change no matter what decision is made are the sunk costs (Besanko and Braeutigam, 2014).

A sunk cost can be pecuniary or non-pecuniary. It could be time, money, mental or physical effort as well as emotional energy (Arkes & Blumer, 1985). These are all resources that might be "sunk" into an activity. Therefore, taking a holistic view, sunk costs can be an unrecoverable past investment of money, time or effort. Sunk costs can also be absolute or relative (Garland & Newport, 1991). Garland and Newport pointed out that the relative size of a sunk cost is more important than its absolute size, and that a higher relative sunk cost results in a greater desire to persist with a failed activity than the absolute sunk cost. The influence of relative costs is also consistent with prospect theory, reviewed in the next section.

Because a sunk cost cannot be recovered, it should not influence the current decisions, but it can. Sunk costs are excluded from economic and financial consideration because they are past costs that nothing we do now or in the future can affect. It is important to ignore sunk costs since they cannot be avoided even if the action is not taken. For instance, even if a flight ticket costs a sum of money, if you have already bought it and cannot sell it to anyone else, the cost of the ticket is sunk and, thus, should not influence your decisions about whether to embark on the trip.

The tendency to consider sunk costs in making a new decision is called the *sunk-cost fallacy*. The sunk cost fallacy is committed when sunk costs influence present decisions, thereby causing an escalation of commitment to a failed activity—that is, expending more resources on a

failed venture to recover the sunk losses or costs. The sunk-cost fallacy is an erroneous, mistaken or faulty reasoning in which the sunk costs (past expenditures) of an activity are considered when deciding whether to continue with the activity. This reasoning leads to the *sunk-cost effect*—the influence on decision-makers to continue with a failing or an unpleasant activity (and expending more resources on it) just because significant irrecoverable resources have already been invested in it (Thaler, 1980). In his words, "paying for the right to use a good or service will increase the rate at which the good will be utilized, *ceteris paribus"* (Thaler, 1980: 47), meaning past spending influences the current consumption decision. It refers to the desire to persevere, or the will to stay the course, because money, time, and/or effort has been invested, even when its marginal costs exceed marginal benefits (Arkes & Blumer, 1985).

Dawkins and Carlisle (1976) labelled this fallacy the *Concorde effect*, after the first supersonic passenger jet, *Concorde*, was produced by the British and French governments. The two governments continued funding the Concorde project, even though they both knew, after a period of significant investment, that it was likely to be a bad investment. Because a lot had already been invested in the project, they thought that stopping would mean a waste of resources.

The *Concorde effect* is used to refer to the situation in which both humans and animals defend an initial investment (a project or nest) and defence costs more than abandonment (Dawkins and Carlisle, 1976; Pattison et al., 2012; Sweis et al., 2018). It is used in evolutionary biology to explain the escalation behaviour of insects and animals in which they try to protect their young from predators in relation to how much energy they have expanded upon their young up to the time of an attack—relatively less developed offspring are more likely to be abandoned (Dawkins & Carlisle, 1976; Navarro & Fantino, 2008; Sweis et al., 2018; Olivola, 2018).

The sunk-cost effect or fallacy has also been investigated by researchers in economics (e.g., Biala, 2022), psychology (e.g., Klaczynski, 2001; Zhang & Baumeister, 2006), accounting (e.g., Jeffrey, 1992), finance (e.g., Schulz & Cheng, 2002), marketing (e.g., Soman, 2001; Schmidt & Calantone, 2002) as well as information systems (e.g., Heng et al., 2003).

Research on why people might commit the sunk-cost fallacy often rests on four theories: self-justification theory, expectancy theory, agency theory, and prospect theory.

Self-justification theory—attributed to Aronson (1968) and inspired by Festinger's (1957) theory of cognitive dissonance—was proposed by Staw (1976) as a theory explaining the sunk-cost fallacy. Self-justification posits

that the sunk-cost effects occur when a decision-maker is in charge of both the initial decision and the current decision concerning the stoppage of the initial decision because decision-makers would desire to justify their previous decisions and would not want to admit to themselves or others that their previous decisions were incorrect or undertaken in vain (Staw, 1976). Therefore, decision-makers would commit to the sunk-cost fallacy.

Agency theory is concerned with the relationship between a principal (one who delegates a task) and an agent (one who performs the task). With respect to the sunk-cost fallacy, agency theory assumes that the agent knows more about the performance of a failing activity than the principal. Because of this, when the agent is responsible for the failing activity, he or she has incentives to devote more resources to it (against the interest of the principal) to safeguard his or her reputation and career prospects (Forrest & Hasseldine, 2016). Since discontinuing the activity may damage the reputation of the agent, he or she would prefer to continue the failing project in his or her interest but against the principal's interest. Thus, agency theory postulates that self-interests influence decision-making and that the agent will purposely fall prey to the sunk-cost effect because doing so is in tandem with his or her self-interests, though against the interest of the principal (Sleesman et al., 2018). So, according to agency theory, agents are susceptible to sunk-cost effects because their interests differ from those of their principals. For example, incentives for the agent might be organised in such a manner that the sunk-cost effect has only a positive effect, with no associated negative effect, for the agent (Sleesman et al. 2012).

Another explanation for the sunk-cost fallacy is *prospect theory* (Kahnemann & Tversky, 1979). Prospect theory attributes the sunk-cost fallacy to the framing of decisions—the way the decision is presented or perceived. It posits that the framing of decision situations affects decision-making behaviour and that people evaluate decisions in terms of losses and gains. It explains that people tend to be more averse to risk when the outcome of a decision is a gain but more risk-seeking when the outcome is a loss (Whyte, 1986). When a decision (e.g., disregarding a sunk cost) is presented as a loss, people would be more inclined to take a risk (investing more) to recover the loss, thereby committing the sunk-cost fallacy. In other words, people tend to be more risk-loving if the situation (e.g., discontinuing a failed activity in which previous investments are involved) is framed or posed as a loss.

Prospect theory assumes that individuals in the context of sunk costs feel like being in the domain of losses. Considering loss aversion and the convex value function in the domain of losses, they will be risk-seeking and,

hence, be willing to continue a failing activity and turn it around, instead of accepting the certain loss if the activity is stopped (Brockner, 1992). They would prefer to continue a failing activity to recover the past investment rather than accepting the past spending as a sure loss (Whyte, 1986; Brockner, 1992). People perceive sunk cost as an option between discontinuing an activity already invested in (accepting a sure loss) and continuing to invest in it (accepting an unsure loss) hoping that persistence might help recover the sunk cost (Kahneman & Tversky, 1979; Garland & Newport, 1991; Soman, 2001). Accordingly, people would become risk-loving when they are faced with the chance of a sure loss but risk averse when they are faced with (the prospect of) a sure gain (Kahnemann & Tversky, 1979). When people invest in an activity and it is obvious that there is a need to continue or halt the activity, they would compare the benefits (or gains) with the costs (losses) in each alternative. If a vast amount of resources has been expended, the decision to stop the activity would constitute a sure loss of resources initially invested, and since individuals have aversion to sure losses, they would continue investing, hoping for a favourable or profitable outcome (Nash, 2017). Hence, susceptibility to sunk-cost fallacy depends on the way the decision problem is framed. It is this "wrong" information processing and unbalanced perception that leads to sunk costs being considered in decisions as against the rational choice theory (Falchetta, 2015).

Furthermore, prospect theory postulates that the higher the size of a sunk cost of an activity, the higher the sure loss associated with the activity and thus the higher the tendency to consider or honour the sunk cost in the decision. The withdrawal from an activity may result in sunk costs being seen as a sure loss. Therefore, people become more unwilling to stop the activity as the sunk cost rises. In other words, large amounts of sunk spending increase the likelihood of committing the sunk-cost fallacy. The likelihood that a decision maker will fall victim to the sunk-cost fallacy increases with the level of sunk cost.

The tendency to commit the sunk-cost fallacy may also be partly explained by *expectancy theory*, according to which the higher the people's expectations that further investment of resources would achieve the desired goal, the more likely they would commit the sunk-cost fallacy (Brockner, 1992). Expectancy theory postulates that the proclivity to honour sunk costs is positively related to the attainment of one's own desired goals. Therefore, a decision maker might be irrational in fostering his or her own aims, even though the means to foster them were rationally chosen (Parfit, 1984).

3. Empirical Studies

Being an interdisciplinary topic, several factors from the many disciplines have been attributed to why an individual, a business firm, an organization or a government may commit the sunk-cost fallacy and thus engage in escalation behaviour. These factors are as follows:

3.1. The size of sunk cost

The size of the sunk cost associated with activity was found to be responsible for the sunk-cost fallacy: the greater the sunk cost, the greater the likelihood of committing the sunk-cost fallacy. Arkes and Blumer (1985), Garland (1990), and Garland and Newport (1991) have shown that the likelihood that a decision maker will fall victim to the sunk-cost fallacy increases as the level of sunk cost increases. That sunk-cost effect is influenced by the size of the past sunk expenditures is consistent with prospect theory. However, Navarro and Fantino (2008) examined whether differences in the level of investment efforts mattered but found no differences in the outcomes

3.2. Cost responsibility

Following the self-justification theory, most prior research considered the sunk-cost fallacy an intrapersonal phenomenon: it results from one's own investments (Staw, 1976; Whyte, 1993). Staw (1976) and Whyte (1993) argued that the sunk-cost fallacy is more common when a decision maker feels personally responsible for the negative consequences of the decision. In support of this argument, Wong (2005) found that personally bearing the cost of a decision increased the chance of committing the sunk-cost fallacy. Yoder et al. (2014) found that personal decisions were more prone to sunk-cost fallacy than decisions made on behalf of others. However, some researchers have considered the sunk-cost fallacy as interpersonal, driven by other people's investments (Arkes and Blumer, 1985; Olivola, 2018). Yet, Arkes and Blumer found no correlation between sunk cost behaviour and whether a third party or oneself is responsible for the decision. Olivola (2018) found that people feel the need to honour other people's sunk costs in the same way that they feel the need to honour their own, even if the person who paid the cost is not a relative or close friend. The author argued that people still escalate commitments to a failing activity even when the sunk cost was incurred by other people, including relatives.

However, several other studies have shown that personal responsibility, or responsibility effect, for initial investment is more likely to make the decision maker prone to sunk-cost fallacy than when the decision maker is not personally responsible for the initial decision (Davis & Bobko, 1986).

3.3 The desire to avoid wastefulness

Another factor identified as influencing the sunk-cost fallacy is the desire to avoid being wasteful. Arkes and Blumer (1985) identified the desire not to appear wasteful as a factor causing decision-makers to commit the sunk-cost fallacy. This was supported by a number of experiments conducted by the authors. According to them, jettisoning a failed project or activity is a waste of the resources already invested. In fact, the use of the "waste-not" rule to resist the abandonment of a failing project is an inappropriate overgeneralization of the rule, which is responsible for the sunk-cost fallacy (Larrick et al., 1990, p. 363). Rather than adhere strictly to the cost-benefit principle of making a rational decision, people are likely to apply the waste-not rule where or when it is not appropriate (Arkes and Ayton, 1999).

The avoidance of waste is consistent with both the prospect theory and the self-justification theory. While self-justification theory suggests that decision-makers commit the sunk-cost fallacy because they would want to justify that their initial decision was not wasteful, prospect theory posits that people generally are averse to waste of resources and, hence, discontinuing spending more resources on the activity is tantamount to an admission of waste of the resources that have been invested (Arkes and Blumer,1985; Nash, 2017).

3.4. Culture

Researchers have also suggested that people from different cultures might engage in different risk behaviour when exposed to the same decision situation (Chow et al., 1997; Keil, 2000). In Yoder et al.'s (2014) study, Americans were found to commit more sunk-cost fallacies than Indians. However, in Chow et al.'s (1997) study, Chinese subjects were found to have a greater tendency to engage in escalated behaviour than U.S. subjects.

3.5 Desire to learn a lesson

The opportunity to learn a lesson was suggested by Bornstein and Chapman (1995) as a reason why decision-makers might commit the sunk-

cost fallacy. The authors argued that decision-makers might continue with a failing project so as to educate themselves that some other time they should reason carefully before making a decision. This argument implies "that the decision maker has two 'selves' one a teacher and the other a learner" (Bornstein and Chapman, 1995, p. 252). This is more reasonable, especially when the teacher and the learner are actually two different persons.

3.6 Penance for bad decision

Another reason suggested by Bornstein and Chapman (1995) for honouring sunk costs is to consider the outcome of the failing activity as penance for making a bad decision. Likewise, punishment suggests an individual with the learner as well as the teacher-punisher components. However, contrary to the learn-a-lesson argument, the punishment could deliver retribution without a direct explanation for why the punishment is required. Hence, punishment is a reason for honouring sunk costs provided it serves as deterrence against future bad decisions, but it is not if it exerts mere revenge.

3.7 Perceived importance of the decision

Susceptibility to sunk-cost effects is found to be linked with the importance of a decision, the level of disappointment with the sunk losses, as well as the interconnectedness of the initial and current decisions (Bazerman et al., 1982).

3.8 Gender and age

It has been established in the literature on gender differences in risk perception that males are more likely to make risk decisions than females, hence more likely to honour sunk costs (Byrnes et al., 1999).

In relation to age, some previous research has indicated that older adults are less susceptible to the sunk-cost fallacy than younger adults (de Bruin et al., 2014; Strough et al., 2016). However, others have found the opposite (Rego et al., 2016). Baron et al. (1993) found that younger people were likely to commit the sunk-cost fallacy but that the likelihood of committing the fallacy did not differ across ages. Yet, Webley and Plaisier (1998) found that younger people were less prone than older people.

4. Method

4.1. Theoretical Framework

The theoretical perspective underlying this study is the self-justification theory. Considering this study, this theory is the most relevant among the four theories reviewed in the preceding section.

Self-justification attributes the sunk-cost fallacy to intrapersonal decisions. If a decision-maker is responsible for making the initial decision and the current decision concerning the stoppage of the initial decision (i.e., if the decision is intrapersonal), decision-makers would desire to justify that their initial or previous decisions were not wasteful or undertaken in vain (Staw, 1976). Thus, susceptibility to the sunk-cost fallacy is a function of whether the initial decision and current decisions are made by the same decision maker; that is, whether the decision scenario is intrapersonal or interpersonal. In other words, susceptibility to the fallacy depends on who bears the sunk cost (cost responsibility), among other factors. This relationship is represented by the conceptual framework in Figure 1.

Figure 1 exhibits the conceptual framework describing the self-justification theory. It incorporates cost responsibility and other factors as explanatory variables. Other variables include demographic and socio-economic variables such as age, income, gender, education, and ethnicity.

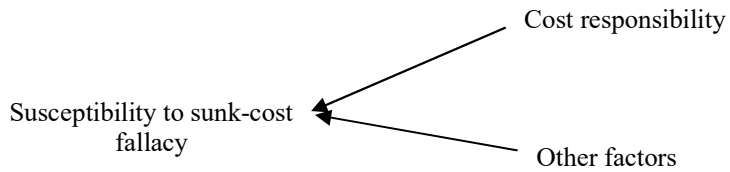


Figure 1. A Conceptual Framework for Self-Justification Theory

4.2. The model

Since the response variable is dichotomous—committing or not committing the sunk-cost fallacy—a binary logit model was employed. The theoretical binary logistic distribution function is given by:

$$P_i = E\left(Y = \frac{1}{X_i}\right) = \frac{1}{1+e^{-(\beta_0+\beta_1 X_{1i}+\beta_2 X_{2i}+\ \ldots\ +\beta_k X_{ki})}} \quad (1)$$

By logit transformation, Equation (1) becomes:

$$L_i = \log(odds) = \log(\frac{P_i}{1-P_i}) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \ ... + \beta_k X_{ki} + \mu_i \quad (2)$$

Where $P_i = E(Y=1/X_i)$ gives the probability that a respondent would commit sunk-cost fallacy given the explanatory variables (X), $\frac{P_i}{1-P_i}$ is the odds ratio in favour of committing a sunk-cost fallacy, L_i represents the natural log of the odds ratios, and μ is an identically and independently distributed error term with mean 0 and variance 1.

To arrive at the empirical model for this study, relevant factors identified in the previous studies were integrated with control variables that were considered to be possible influences on the likelihood of committing the fallacy. Following Biala (2022), the model was specified as:

$$SCF_i = \beta_0 + \beta_1 INCOMH_i + \beta_2 GENDM_i + \beta_3 AGEO_i + \beta_4 EDUC_i + \beta_5 ETHY_i + \beta_6 ETHH_i + \beta_7 LDRESP_i + +\mu_i$$

The definitions and measurements of the response and explanatory variables are contained in Table 1.

Table 1. Definition and measurement of variables

Variable	Definition/Measurement
SCF_i	Dummy variable for sunk-cost fallacy = 1 if the respondent selected "₦*20,000* trip", indicating the fallacy occurred; 0 if otherwise.
$EDUCY_i$ (–)[2]	Respondent's level of education is measured by years of schooling.
$INCOMH_i$ (–)	Dummy variable income = 1 if the respondent earned a high income (income equal to or greater than ₦100,000); 0 if otherwise.
$GENDM_i$ (±)	Dummy variable for gender = 1 if a respondent was male, 0 if otherwise
$AGEO_i$ (–)	Dummy variable for age = 1 if the respondent is 25 years or older (OLD); 0 if otherwise (i.e., less than 25 years).
$ETHYi$(±)	Dummy variable for ethnic group of the respondent = 1 if the respondent was Yoruba; 0 if otherwise.
$ETHH_i$(±)	Dummy variable for ethnic group of the respondent = 1 if the respondent was Hausa; 0 if otherwise
$LDRES_i$ (+)	Dummy variable for the locus of cost responsibility = 1 if committing the fallacy was intrapersonal; 0 if it was interpersonal. The intrapersonal sunk-cost fallacy is indicated ($LDRES_i = 1$) if the respondent selected ₦*20,000* trip when the ticket was purchased by him/her and ₦*5,000* trip when someone else bought the ticket for him/her, and 0 if otherwise.

The reference groups for the dummy variables *INCOM*, *GENDM*, *AGEO*, *ETHNY* and *ETHNH* are low income (income less than ₦100,000), female, young (less than 25 years), and Igbo, respectively. It is pointed out in the literature that whether one commits the sunk-cost fallacy depends on whether the decision made is the one responsible for the sunk cost. Therefore,

[2]Expected signs in parentheses.

the locus of cost responsibility (LDRES) is included as an explanatory variable. The variable *INCOMH* (income of the respondent) is introduced into the model to postulate that low-income people are more likely to honour sunk costs than high-income people. This is because the affluence of the latter group would cushion or neutralise the impact of the size of the sunk cost on them, resulting in their lower tendency to fall victim to the sunk-cost fallacy.

The vignette that generated the response variable, sunk-cost fallacy, was adapted from Arkes and Blumer (1985) and Biala (2022). In the decision scenario, the respondents were presented with a vignette in which they were asked to select a trip between two trips as contained below:

Suppose that you have spent ₦20,000 on a ticket for a weekend trip to a state in Nigeria. A week later, you buy a ₦5,000 ticket for a weekend trip to another state in the country. You think you will enjoy the ₦5,000 trip more than the ₦20,000 trip. As you are keeping the ₦5,000 trip ticket in your pocket, you observe that the ₦20,000 trip clashes with the ₦5,000 trip. It is too late to sell either ticket, and you cannot get a refund for either one. You must use one ticket and not the other.

- *Which trip would you go on? ₦20,000 trip or ₦5,000 trip. Why?*
- *If the ticket for the first trip is ₦20,000 while that for the second trip is ₦5,000 and the two tickets were purchased for you by someone, which trip would you go on? ₦20,000 trip or ₦5,000 trip.*

The sunk-cost fallacy, *SCF*, was committed if the respondent selected ₦*20,000* trip and a value of 1 is recorded.

4.3. Estimation techniques

Due to the dichotomous and nonlinear nature of the response variable (*SCF*), the method of maximum likelihood was employed to estimate the parameters of the logit model. Because heteroscedasticity in var(y/x) is automatically accounted for by the method of maximum likelihood, it is a robust technique commonly used for estimating discrete response models (Wooldridge, 2006).

The statistical significance of each coefficient of the explanatory variable was assessed using the p-values of the Wald test (Z^2 test) and the overall significance of the model was evaluated by the p-values of likelihood ratio (LR) statistic χ^2 and Wald χ^2. Stata was used to estimate the logit coefficients, and log-odds and marginal effects were estimated and interpreted.

4.4. Data and data sources

This study relied on primary data collected from an intercept interview survey conducted in May 2022 and administered to a cross-section of Nigerian residents in Ilorin, Kwara State. The interview schedule was administered by the researcher and three research assistants. The interview schedule was pretested with ten respondents after which minor changes were made.

The sample for the study consisted of 148 Nigerians. Since the sampled respondents could not be drawn with a probability sampling technique, quota sampling was employed to ensure that the respondents belonged to different ethnic groups, education levels, ages, and sexes so that the sample drawn could be as heterogeneous and hence representative as possible. Quota sampling was employed because it often approximates the results of probability sampling at less cost and less hassle (Bernard, 2006). Individual respondents constituted the unit of analysis.

The data collected for analysis were respondents' self-reported decisions on the decision-making vignette presented to them on the interview schedule and their socio-economic characteristics: sex, age, ethnicity, educational background, occupation, and income.

5. Results and discussion

5.1. Descriptive statistics

The survey was carried out across Ilorin among a heterogeneous sample of 148 Nigerians who were composed of the major three ethnic groups in the country: 55 Yorubas, 54 Igbos, and 39 Hausas. Nineteen of these respondents had postgraduate education, 39 had a Bachelor's degree, 41 had an Ordinary National Diploma/Nigerian Certificate of Education, 38 had secondary education, 8 had primary education, and 3 had no formal education. The sample is characterized by average years of education of about 14 years. Forty-eight of the respondents were young (aged below 25 years), while 100 were old, aged above 25 years. About 51% of the sampled respondents were men. Moreover, 121 (about 82%) of the respondents earned low income (income < N100,000) whereas 18 per cent of them earned high income (income ≥ N100,000). Table 2 contains further information on the characteristics of the sample.

Table 2. Descriptive statistics of the respondents

Variable	Freq	Mean	Std. Dev	Min.	Max.
Respondents who committed the Sunk-cost fallacy	73	0.4932	0.5017	0	1
Male	75	0.5068	0.5017	0	1
High Income	27	0.1824	0.3875	0	1
Education	NA[a]	13.9392	3.5785	0	19
Aged above 25 years	100	0.6757	0.4697	0	1
Yoruba	55	0.3716	0.4848	0	1
Hausa	39	0.2635	0.4429	0	1
Locus of cost responsibility	33	0.2230	0.4177	0	1

[a]Not Applicable

Overall, 73 of the respondents committed the sunk-cost fallacy (those who selected ₦20,000 trip), representing almost half of the respondents. They selected the more expensive but less enjoyable ₦20,000 trip, instead of the cheaper and more enjoyable trip. It seems that the higher sunk cost represented by the ₦20,000 payment was more important to them than getting greater enjoyment from the less expensive ₦5,000 trip that they had paid for. This shows that the fallacy is at work because the money is already spent and hence gone. No matter what, it cannot be recovered.

5.2. Diagnostic test results

The logit model does not require many of the assumptions of linear regression. However, it requires the assumptions of multicollinearity and large sample size (Schreiber-Gregory & Bader, 2018). Two diagnostic tests for these requirements were, therefore, conducted.

The logit model requires a large sample size. Although there is no universal standard, there are some rules of thumb used to determine the largeness of a sample. One such rule is that for every explanatory variable, there should be at least ten outcomes for each binary category (committing/not committing the fallacy), with the least common outcome (committing the fallacy = 73) determining the maximum number of independent variables. In this study, 73 respondents committed the sunk-cost fallacy and 75 did not, which is consistent with the rule that each category of the response variable is reasonably represented in the sample. Therefore, the logit model estimated in this study could accommodate, at most, seven explanatory variables (since 73 is the smallest outcome). Given that the model for this study contains six independent variables and the expected probability of the least frequent outcome was estimated to be 0.5 and following the general guideline that at least 10 cases with the least frequent outcome for

each independent variable are needed, a minimum sample size of $\frac{(10*6)}{0.5} = 120$ is required. Thus, this requirement is met by selecting a sample size of 148 respondents.

Three tests of multicollinearity of the explanatory variables were carried out: the test of significance of pair-wise correlation coefficients, tolerance test, and variance inflation factor (VIF) test. Using the tolerance test, the hypothesis of multicollinearity among the explanatory variables was rejected, for VIF < 10 and tolerance > 0.1 in all cases. This implies that the model is devoid of severe multicollinearity. Besides, the correlation coefficients between each pair of the explanatory variables are less than 0.5, not so high (Table 3). This implies that multicollinearity was not a problem in estimating the logit model.

Table 3. Correlation matrix

Variable	SCF	EDUC	INCOM	GEND	AGO	ETHNY	ETHNH	LDRES
SCF	1							
EDUC	0.0737	1						
INCOM	-0.1161	0.2926	1					
GEND	0.0002	0.1575	0.1861	1				
AGEO	0.0772	0.1703	0.2152	0.1826	1			
ETHNY	0.2481	0.3620	0.0712	0.1714	0.3536	1		
ETHNH	-0.0993	-0.2607	-0.1634	-0.1155	-0.1426	-0.4600	1	
LDRES	0.2832	-0.0546	-0.1690	-0.0559	0.0937	0.0583	-0.0256	1

5.3. Logit-model estimation results

Results of the binary logit model estimation are contained in Table 4, which presents the logit coefficients, odds ratios, marginal effects as well as standard errors, Wald's Z-statistic and its p-values of the marginal effects. All the figures were obtained from the Stata output of the logit regression of sunk-cost fallacy (SCF) on the set of explanatory variables—*INCOMH*, *GENDM*, *AGEO*, *EDUCY*, *ETHNY*, *ETHNH*, and *LDRES*.

The overall test of significance indicates that all the regressors together had a statistically significant effect on the probability of committing the sunk-cost fallacy (LR statistic = 22.74 with a p-value = 0.0019). This suggests that at least one of the coefficients differs significantly from zero, and hence an important determinant of susceptibility to sunk-cost fallacy.

Next is the analysis of the performance of the explanatory variables in the model. Table 4 shows that two of the explanatory variables—ETHNY and

LDRES—were highly statistically significant with the expected signs while other variables were not. The coefficients of the two variables were positive and significantly related to the probability of committing the sunk-cost fallacy at the 1% level of significance. The marginal effect of ETHNY of 0.2668 indicates that the Yoruba respondents were about 27 per cent more likely to commit the sunk cost fallacy than the Hausa or Igbo respondents. Being a Yoruba decision maker increases the odds of committing the fallacy by 0.03 (odds ratio being 3.0274) and the probability that the decision-maker would honour the sunk cost by about 27 per cent. This result is consistent with the findings by Chow et al. (1997) and Keil (2000).

The marginal effect of LDRES of 0.3335 suggests that the sunk-cost fallacy was 33 per cent more likely when the sunk cost was borne by the respondents than when it was borne by someone else on their behalf. This result corroborates that of Davis and Bobko (1986), Wong (2005) and Yoder et al. (2014) who have found that personal responsibility for sunk costs is more likely to make the decision maker susceptible to the sunk-cot fallacy. However, the result is not in line with the findings of some studies such as Arkes and Blumer (1985), and Olivola (2018).

Table 4. Logit model estimation results

Sunk-cost fallacy	Coef.	Odds Ratio	Marg. Effects	Std. Error	Z	p-val
EDUCY	0.0260	1.0263	0.0065	0.0138	0.4700	0.6380
INCOMH	-0.5804	0.5597	-0.1429	0.1202	-1.1900	0.2340
GENDM	-0.0643	0.9378	-0.0161	0.0927	-0.1700	0.8630
AGEO	-0.0506	0.9506	-0.0127	0.1032	-0.1200	0.9020
ETHNY	1.1077	3.0274	0.2688*	0.1048	2.5600	0.0100
ETHNH	0.0416	1.0425	0.0104	0.1136	0.0900	0.9270
LDRES	1.4410	4.2250	0.3335*	0.0929	3.5900	0.0000
Constant	-0.9318	0.3939	–	–	–	–
No. of Observation	148					
LR $chi^2(7)$	22.740					
prob> chi^2	0.0019					
Pseudo R^2	0.1109					
Log-likelihood	-91.201					

Note. Reference categories: Low income for INCOMH; females for GENDM; Igbo for ETHN; interpersonal decision for LDRES. * represents statistical significance at 1%.

From Table 4, variables such as EDUCY, INCOMH, GENDM, AGEO, and ETHNH were not statistically significant, for their p-values were greater than 0.05. This seems to suggest that these variables did not exert a significant influence on the probability of committing the sunk-cost fallacy. It thus suggests that susceptibility to the sunk-cost fallacy does not depend on the decision maker's level of education, income, gender, age, and the ethnic group to which he or she belongs. However, Yoruba decision makers have

about 27 per cent higher than Hausa or Igbo decision makers. These results are not consistent with the findings of previous studies, such as Byrnes et al. (1999) who have found that male decision-makers are more susceptible to sunk-cost fallacy than females; de Bruin et al. (2014) and Strough et al. (2016) who have found that older adults are less susceptible to sunk-cost fallacy than younger adults.

6. Conclusion

This study has investigated whether Nigerians, too, commit the sunk-cost fallacy and then identified factors that affect Nigerians' susceptibility to the fallacy. By estimating a binary logit model, it was found that about 49 per cent of the respondents to questions based on a decision-making vignette committed the sunk-cost fallacy and that ethnicity and locus of cost responsibility are significant determinants of susceptibility to sunk-cost fallacy.

These results suggest that locus of cost responsibility (whether the cost was borne by the decision maker or another person on behalf of the decision maker) and ethnicity (whether the decision maker is Yoruba or not) are significant determinants of susceptibility to sunk-cost fallacy. Furthermore, the results suggest that in Nigeria sunk-cost fallacy is intrapersonal and more prevalent among the Yorubas than among the Hausas or Igbos. Thus, the sunk-cost fallacy is ubiquitous and more likely in personal decisions than decisions made on behalf of others.

Because the sample of people interviewed was drawn with quota sampling—a nonprobability sampling technique—and the sample size was not sufficiently large, the results of this study cannot be taken as general. These results are simply meant to build a case study and check the consistency of the logistic regression results with the results of experimental studies obtained by the previous studies. Given this limitation, it is suggested that future research with a larger sample size selected by a probability sampling technique be carried out in Nigeria or another country so as to generalize the findings and hence increase the validity of the self-justification theory which forms the theoretical framework of this study.

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