Status Quo Bias in Large and Small Choice Sets*

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Abstract

This paper introduces models of status quo bias based on the concept of *decision avoidance,* by which a decision maker may select the status quo in order to avoid a difficult decision. These models capture the experimental finding that the status quo is more frequently chosen in larger choice sets. This phenomenon violates the predictions of current *preference-based* models of status quo bias that assume a decision maker with a fixed status quo will make consistent choices. Using laboratory experiments, I show that subjects in large choice sets do exhibit behavior in line with decision avoidance, while in small choice sets, preference-based models offer a better explanation of behavior. These findings raise questions for advocated policies of "benign paternalism."

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1 Introduction

Status quo bias (SQB) is the increased propensity of a decision maker (DM) to choose an alternative because it is the status quo, or default option. SQB has been shown to affect many important economic decisions, such as the choice of electrical service provider, car insurance, investment portfolio, and 401(k) pension plan.[1] The power of status quos has led governments and firms to begin using defaults as a policy instrument to "improve" the decisions that people make, on the basis that such interventions represent a "benign" form of paternalism.[2] Yet recent behavioral evidence has suggested that people's ability to make good decisions may break down in larger choice sets, leading to an increase in SQB.[3] In large choice sets people may choose a status quo that they would never choose in smaller choice sets. Such behavior violates current models of SQB and throws into question the claim that status quo manipulation is benign.

This paper proposes, axiomatically characterizes and tests a class of models that capture the increasing power of status quo bias as choice set size increases. These models are based on the psychological concept of *decision avoidance*: the selection of a status quo as a way for a DM to avoid a difficult or aversive decision. This concept focusses on the role of the status quo as a default option, or the outcome that occurs if no action is taken. It allows for SQB to be more prevalent in larger choice sets if such sets represent a more difficult choice for the DM. The decision avoidance class of models makes starkly different predictions to existing models of status quo bias, which focus on the role of the status quo in affecting *preferences*.[4] The central difference between the two classes of explanation is that preference-based models assume that DMs will make consistent choices for a fixed status quo, whereas decision avoidance models assume that the only possible effect of making an object a status quo is to cause a DM to switch to choosing that object.

This paper tests the predictions of the decision avoidance and preference-based models of SQB using observations of the choices made by experimental subjects from sets of lotteries. Lotteries were

[1] On portfolio choices see Ameriks and Zeldes [2001] and Agnew, Balduzzi, and Sunden [2003]. On mutual fund investment see Patel, Zeckhauser, and Hendricks [1991; 1994] and Kempf and Ruenzi [2006]. On choice of electrical service provider see Hartman et al. [1991], while Johnson et al. [1993] examine choice of car insurance. For 401(k) pension plans see Madrian and Shea [2001], Choi et al. [2004], Beshears et al. [2006] and Iyengar et al. [2004].

[2] For examples of policies based on status quo manipulation see Halpern et al. [2007] and Benartzi and Thaler [2004]. Advocates of benign, or "light", "asymmetric", or "liberal" paternalism include Thaler and Sunstein [2003], Camerer et al. [2003] and Loewenstein and Haisley [2008].

[3] Samuelson and Zeckhauser [1988]; Tversky and Shafir [1992]; Iyengar and Lepper [2000]; Kempf and Ruenzi [2006].

[4] There are a number of proposed mechanisms by which a status quo could affect preferences, such as some perceived information content in the status quo, or through references point effects such as loss aversion [Tversky and Kahneman, 1991] or asymmetric dominance [Masatlioglu and Ok, 2005; 2007].

used as choice objects specifically because many settings in which the manipulation of status quos has been proposed involve risky choices,[5] yet there exists no experimental evidence on the effect of a stochastic status quo. Status quo bias was generated using a two-stage procedure similar to that used by Samuelson and Zeckhauser [1988] – the choice a subject makes at the first stage becomes the status quo in a second stage choice.

In this experimental setting subjects exhibited decision avoidance-type behavior in large choice sets. As the size of a choice set was increased, subjects switched their choices away from other options and towards the status quo. This behavior is in line with decision avoidance, but violates the predictions of preference-based models. The switch towards the status quo appears to have been driven by the sheer number of alteratives in the choice set, rather than the difficulty in selecting amongst those alternatives. Even when the size of the choice set was increased by adding stochastically dominated lotteries, subjects still switched to selecting the status quo,[6] suggesting that the increase in SQB was not driven by any inherent difficulty in comparing the objects of choice.

Although decision avoidance models capture choice behavior in large choice sets, this paper shows that the preference-based model is needed to understand behavior in small choice sets. The most striking finding is that a stochastic status quo can have an extreme effect on risk preferences. The introduction of a somewhat risky status quo can lead people to choose a much riskier option, even to the extent of exhibiting risk-loving behavior. However, this effect is only apparent in small choice sets. As the size of the choice set increases, subjects switch away from the extremely risky alternative and back to the status quo.[7] These findings suggest that SQB may be driven by different psychological processes in small and large choice sets.

The findings of this paper have implications for the implementation of policies based on the manipulation of status quos. Such schemes have been extremely successful in increasing retirement savings in 401(k) plans [Benartzi and Thaler, 2004] and organ donation [Johnson and Goldstein, 2003]. This approach has been justified as a form of "benign" (or "light", "liberal", or "asymmetric") paternalism,[8] in contrast to "traditional" paternalism, which restricts the options from which an individual

[5] For example the use of defaults to encourage 401(k) fund investment.

[6] I also show in a separate experiment that subjects' choices almost always respect stochastic dominance, regardless of status quo.

[7] While other authors [Hearne, 1998; Masatlioglu and Uler, 2008] have demonstrated a general effect of status quo on choice, they have focussed on the manipulation of dominated status quo options – the asymmetric dominance effect. To my knowledge, this is the first study to show this type of generalized status quo dependance with non-dominated options, and to show the effect of a risky status quo on risk attitudes.

[8] See Thaler and Sunstein [2003], Camerer et al. [2003] and Loewenstein and Haisley [2008].

may choose.[9] In small choice sets, the finding that a somewhat risky status quo can lead people to choose a very risky option may act as a caveat for those proposing that defaults be used to encourage investors in 401(k) plans to move away from low-yield money market funds [Gale et al., 2005]. In large choice sets people may choose an object because it is the status quo over another that they robustly prefer in small choice sets. SQB can override preferences that are "well defined" in the sense that they are status quo independent in smaller choice sets. This draws into question the sense in which such manipulations are benign. However, the finding that this effect is driven by the sheer number of alternatives suggests a potential solution to this problem: presenting large choice sets as a sequence of choices between a smaller numbers of alternatives could mitigate the increased power of the status quo.

Section 2 of this paper outlines the decision avoidance and preference-based models of SQB. Section 3 presents the experimental evidence on the nature of SQB in large and small choice sets. Section 4 traces the implications of these findings for policies based on the manipulation of status quos. Section 5 concludes, and presents possibilities for further research.

2 Models of Status Quo Bias

The term *status quo bias* was first coined by Samuelson and Zeckhauser in 1988 to capture the increased propensity of a DM to choose an option because it is the status quo, or default option. This seminal article contained both laboratory and field experiments which demonstrated such a bias. It also helped to spawn a literature which has shown that status quo effects apply to many important economic decisions such as portfolio choices [Ameriks and Zeldes, 2001; Agnew, Balduzzi, and Sunden, 2003], mutual fund investment [Patel, Zeckhauser, and Hendricks, 1991; 1994; Kempf and Ruenzi, 2006], choice of electrical service provider [Hartman et al., 1991], car insurance [Johnson et al., 1993] and 401(k) pension plans [Madrian and Shea, 2001; Iyengar et al., 2004; Choi et al., 2004; Beshears et al., 2006;]. Further laboratory experiments have confirmed the existence of status quo bias in decision making and have explored the related phenomena of the *endowment effect* (by which people place a

[9] One perceived advantage of the benign paternalism approach is that it manipulates the choice only of those that do not have "well formed" preferences in a particular choice environment. A person that strongly prefers a particular option will always choose it, regardless of the status quo. However, those that do not have a strong preference can be manipulated into choosing a status quo option that has been selected for them.

higher value on objects that they own compared to those that they do not),[10] and *reference dependence* (by which people's choices are modified by the presence of a reference point).[11]

The importance of status quo effects in economic decision making has led to the development of a large number of models that attempt to capture the phenomenon. These models have been largely based on the effect a status quo has in altering people's *preferences.* They tend to focus on the status quo's role as a reference point, in light of which particular objects may become more or less attractive. It is generally assumed that an object will be more attractive when it is the status quo than when it is not, thus capturing a positive status quo *bias.* Models that fall into this category include Tversky and Kahneman [1991], Rubinstein and Zhou [1999], Sagi [2003], Apesteguia and Ballester [2004], Giraud [2004] and Masatlioglu and Ok [2005; 2007]. The defining characteristic of these models is that they assume a DM will make consistent choices for a fixed status quo, because the DM acts to maximize the preferences associated with that status quo.

Recent experiments have pointed to a potentially important new behavioral phenomenon that preference-based models cannot capture. Iyengar and Lepper [2000] provide evidence that people may be more likely to buy jam when they are offered a small selection than when they are offered a larger one. Similarly, Tversky and Shafir [1992] report that subjects are more likely to choose a monetary status quo from a choice set that also contains two types of pen than one containing only a single type of pen. Both papers interpret their findings as evidence that people may be more likely to choose the default option in large choice sets than in small ones. This behavior violates the independence of irrelevant alternatives even with a *fixed* status quo, and so violates the predictions of preference-based models of SQB.

This section of the paper proposes and axiomatizes a class of models of SQB that allows for an increased propensity to choose the status quo in larger choice sets. These models are based on the psychological concept of *decision avoidance.*[12] This concept explains the selection of a status quo as a way for a DM to avoid a difficult or aversive decision, and so focusses on the role of the status quo as a default option (or the outcome that occurs if no action is taken).[13] This paper discusses two variants

[10] For example Knetsch and Sinden [1984], Coursey et al. [1987], Knetsch [1989], Kahneman, Knetsch and Thaler [1990], List [2003] and Plott and Zeiler [2005].

[11] For example Bateman et al. [1997], Bateman et al. [2005].

[12] See Anderson [2003] for a review.

[13] One possible reason for the lack of a coherent explanation for SQB is that the term *status quo* itself is poorly defined. In various field and experimental studies, the status quo is defined as an option that has been chosen previously [Samuelson and Zeckhauser, 1988], an option that is already owned [Knetsch, 1989], the "default choice" [Ritov and Baron, 1992] and the option expected by the decision maker [Tversky and Shafir, 1992]. While in most cases the status quo object

of decision avoidance. The *conflict* model describes a DM endowed with a potentially incomplete preference relation. In choice sets in which the preference relation determines a best alternative, the DM will choose that option regardless of the status quo. However, if their preference relation does not provide a best alternative, they may choose the status quo in order to avoid the difficult decision. The *information overload* model generalizes the conflict model to allow for preferences to become less complete in larger choice sets.

Both the conflict and the information overload model allow for the possibility that a DM may switch to choosing the status quo in larger choice sets in line with the findings of Iyengar and Lepper [2000] and Tversky and Shafir [1992]. However, the circumstances under which each model predicts this will occur are very different. Under the conflict model, a DM may switch to choosing the status quo if objects are added to the choice set that the DM finds difficult to compare to the current best option. In contrast, the information overload model allows for the DM to be overwhelmed by the sheer number of alternatives, leading them to switch to choosing the status quo in larger choice sets independently of which alternatives are added.

Axiomatically characterizing both the decision avoidance and the preference-based model of SQB makes clear the behavioral patterns consistent with each explanation. Section 3 will make use of these axioms in order to interpret the behavior of experimental subjects making choices in the presence of a status quo.

2.1 Notation

This section introduces the notation necessary to formally describe the various models of SQB.[14] Let X be a finite set of objects, with a typical element $x \in X$ representing a particular option, or alternative.[15] A choice set is a non-empty subset of X, and $\mathcal{X}$ is the set of all choice sets (i.e. $\mathcal{X} = 2^X/\varnothing$). Let $\diamondsuit$ be some object outside of X. A *choice problem* is a choice set and information about any status quo

combines the role of a reference point and the option that obtains when the DM does not make an active choice, it is clear that these different versions of the "status quo" could have different behavioral implications. Previous experiments [Ritov and Baron, 1992; Schweitzer, 1994] have attempted to differentiate between the implications of *pure* status quo bias (a preference for the current state of affairs) and *omission bias* (a preference for inaction). The former study found evidence only for omission bias, whereas the latter found both effects to have similar consequences.

[14] The notation largely follows that of Masatlioglu and Ok [2005].

[15] The assumption that the set of feasable objects X is finite is made in part for convenience of exposition, and in part because the concept of information overload is best considered in cases where choices are between finite groups of distinct objects. An appendix [TO BE COMPLETED] describes some of the subtleties of extending the various models to infinite domains.

point, which must be an element of the choice set. Formally, a choice problem is a tuple (Z, s) where $Z \in \mathcal{X}$ and $x \in Z \cup \Diamond$. The symbol $s = \Diamond$ is used to denote a choice problem with no status quo. Let $\mathcal{C}(X)$ be the set of all choice problems, so that

$$\mathcal{C}(X) = \{(Z, s) | Z \in \mathcal{X} \ , s \in Z \cup \Diamond\}$$

The behavior of the DM is captured by a choice correspondence which maps choice problems to selected options.

$$C : \mathcal{C}(X) \to \mathcal{X}$$

such that, $\forall \ \{Z, s\} \in \mathcal{C}(X)$

$$C((Z, s)) \subset Z$$

This correspondence is non-empty valued by construction.

2.2 Preference-Based Models

This section describes the class of *preference-based* models of status quo, in which changes in the status quo act to change the DM's tastes. Almost all the current models of SQB within economics fall into this category [Apesteguia and Ballester, 2004; Girand, 2004; Masatlioglu and Ok, 2005; 2007, Sagi, 2006], as do more generalized models of reference dependence such as Kahneman and Tversky [1991], Rubinstein and Zhou [1999] and Koszegi and Rabin [2006].

The unifying theme of these models is that they assume that each status quo will give rise to a set of preferences upon which the DM will base their choice. There may be many reasons for a DM's preferences to change based on a particular status quo. It could be that the DM sees the status quo as containing information about the state of the world, which they use to update their beliefs about how good various options are. For example an investor may assume that the default investment fund in a 401k plan is recommended by the provider as a sensible option. Alternatively, it could be that the status quo affects a DM's preferences through psychological factors such as loss aversion [Tversky and Kahneman, 1991].

A general form of the preference-based model of SQB that encompasses the above models can be written as follows:

Definition 1 *A choice correspondence* $C : \mathcal{C}(X) \rightarrow \mathcal{X}$ *admits a* ***preference-based*** *model of status quo dependence if, for every* $s \in X \cup \Diamond$*, there exists a complete preference relation* $\succeq_s$ *on* X *such that:*

$$C(Z, s) = \{z \in Z | z \succeq_s y \textit{ for all } y \in Z\}$$

The relation $\succeq_s$ is a preference relation that captures the DM's preferences under status quo s[16] and $\succ_s$, $\sim_s$ refer to the asymmetric and symmetric parts of $\succeq_s$ respectively.

The key behavioral characteristic of these models is that the DM's choices are *consistent* for a fixed status quo: If the status quo does not change, a DM will act as if they are maximizing a complete preference relation. They will therefore look like a "standard" decision maker. Violations of the Weak Axiom of Revealed Preference (WARP) are only observed across choice problems with different status quos. This is equivalent to the assumption that the WARP holds for choices made with a fixed status quo, a property I call Status Quo Conditional Consistency.[17]

Axiom P1: Status Quo Conditional Consistency (SQCC): *For any* (A, s), $(B, s) \in \mathcal{C}(X)$

- *Property* α*: If* $x \in A \subset B$ *and* $x \in C(B, s)$ *then* $x \in C(A, s)$
- *Property* β*: If* $y, z \in C(A, s)$, $z \in B$ and $y \in C(B, s)$ *then* $z \in C(B, s)$

Thus far, the preference-based model captures only the fact that different status quos give rise to different preference relations. It places no structure on the relationship between a particular status quo and the preferences that it elicits. Most models that attempt to capture status quo *bias* assume that an object is at least as popular when it is the status quo than when it is not. I refer to this property explicitly as status quo bias.

Definition 2 *A preference-based model of status quo dependence exhibits* ***status quo bias*** *if*

$$y \succeq_x z \Rightarrow y \succ_y z \textit{ for all } z \in X, \; x \in X \cup \Diamond, \; y \in X/x$$

[16] By definition, a preference relation is reflexive and transitive.

[17] The axiom is presented in two parts, as is standard in the related literature.

The behavioral implication of this assumption is captured by the status quo bias axiom of Masatlioglu and Ok [2005]:

Axiom P2: Status Quo Bias: $\forall \{Z, x\} \in \mathcal{C}(X)$, $y \in X$, $x \in X/y$, *if* $y \in C(Z, x)$ *then* $\{y\} = C(Z, y)$

The relation between these axioms and the preference-based model is stated in the following observation:

Observation 1 *A choice correspondence* $C : \mathcal{C}(X) \rightarrow X$ *admits a preference-based model of status quo dependence if and only if it satisfies P1. It admits a preference-based model that exhibits status quo bias if and only if it satisfies P1 and P2.*

The existing literature contains models of SQB that, while not explicitly described as capturing changes in preferences, fit into the above structure. Important examples are the models of Masatlioglu and Ok [2005, 2007]. These papers describe a two-stage choice procedure under which the DM first looks for objects that dominate the status quo according to some incomplete preference relation. If no such objects exist, then the DM chooses the status quo. If such an object does exist, then they choose the "best" of the objects that dominate the status quo point. While this motivation sounds different from the preference-based model described above, it generates behavior that satisfies P1 and P2, and so can be thought of as a special case of the preference-based model. Other models do violate SQCC in some ways, but maintain some of its structure in others. For example, Tapki [2007] describes a model of SQB which violates property β from axiom P1, but maintains property α. Section 3 shows experimental violations of SQCC that are violations of property α, and so invalidate this model as well.

2.3 Models of Decision Avoidance

In this section I introduce an alternative class of models of SQB based on the psychological concept of decision avoidance. In a recent survey article Anderson [2003] describes decision avoidance as "[. . .] a tendency to avoid making a choice by postponing it or by seeking an easy way out which involves no action or no change." [pp 139]. Status quo bias is seen as one manifestation of decision avoidance, because selecting the status quo is seen as "not choosing". This interpretation can be taken literally; if a DM ignores the fact that there is a choice to make, then the status quo is what they will end up with. However, the selection of the status quo as a form of "not choosing" can also be interpreted as a psychological phenomenon - sticking with the current choice "seems" like less of an active decision than changing to a new alternative. The overarching notion of decision avoidance links status quo bias to other phenomena, such as the desire to put off choices until the last possible moment (choice deferral), a preference for options which require little action (inaction inertia), the selection of options that others have selected, and an increased desire to search for more options from which to choose [Anderson, 2003].

This paper characterizes two versions of the decision avoidance model based on the concept of *selection difficulty,* which assumes that a DM may indulge in decision avoidance when they find it difficult to identify the best option in a choice set. The first model is based on the idea of *conflict*, discussed by Shafir, Simonson and Tversky [1993]. Their paper describes a decision making process in which the DM searches for reasons to choose one option over the others which are available. If they cannot find a good reason to choose any particular option, the choice problem creates *selection difficulty* for the DM, who may react by choosing the status quo if one is available. The second model, which is a generalization of the conflict model, incorporates the idea of *information overload,* by which the DM may find it harder to compare objects in larger choice sets than smaller ones and so may be more likely to indulge in decision avoidance.

The defining characteristic of the decision avoidance class of models is that a status quo can only have a limited effect on choice. These models focus on the role of the status quo as a default: what happens if no *active* choice is made. In any given choice problem, the DM may be able to find the best option, in which case they will choose it, or they may not, in which case they will choose the status quo. There is no role for a more "reference-dependent" type of interaction between status quo and choice. This property, which I call *Limited Status Quo Dependence* is captured in an axiom that is common to both types of decision avoidance model. This axiom states that, in any given choice problem, either the decision maker will choose the status quo, or the status quo will not affect their choices:

Axiom D1: Limited Status Quo Dependence (LSQD) $\forall \{Z, s\} \in \mathcal{C}(\mathcal{X})$,

$$C(Z, s) \in \{s, C(Z, \Diamond)\}$$

Under this behavioral model, one can think of SQB as revealing that the DM finds it difficult to identify the best option in a particular choice set. Choice sets can therefore be categorized into two types: those in which the DM can identify a best element, and those in which they cannot and so suffer from selection difficulty. In the latter category, the DM's choices will be affected by the status quo, whereas in the former they will not. One can therefore partition $\mathcal{X}$ into sets which create selection difficulty for the decision maker and those that do not, depending on whether or not changes in status quo affects the choices made in that set. I define the set of "no selection difficulty" (NSD) choice sets, denoted as $\mathcal{N}$, as follows:

$$\mathcal{N} = \{Z \in \mathcal{X} | C(Z, s) = C(Z, s') \text{ for all } s, s' \in Z \cup \Diamond\}$$

For any such sets, one can define a status quo independent choice function, $\bar{C} : \mathcal{N} \to \mathcal{X}$, such that

$$\bar{C}(Z) = C(Z, \Diamond)$$

As $Z \in \mathcal{N}$, it must be the case that $\bar{C}(Z) = C(Z, \Diamond) = C(Z, s)$ for all $s \in Z \cup \Diamond$.

The next two subsections describe the conflict and information overload models in detail.

2.3.1 The Conflict Model of Decision Avoidance

The conflict model of decision avoidance captures the behavior of a DM who may not be able to make comparisons between all the available objects in a choice set. If the DM can find some object in the choice set that they prefer to all the others that are available, then they will happily choose such an object. If not, they will find the choice difficult, and try to avoid the decision by selecting the status quo. If no status quo is available, they will use some other method to make their choices. For concreteness, I assume that the DM will "think harder" about the problem, allowing them to compare more and more objects until they can identify a favorite alternative.[18] The model also allows for the possibility that, if the status quo is "too bad", the DM may choose to ignore it, even if they are suffering from selection difficulty.

The comparisons that a DM can make between objects are represented by a (possibly incomplete) preference relation $\succeq$ on X.[19] The objects in a particular choice set Z that are not good enough to

[18] One could make other assumptions about the decision making process in the absence of a suitable status quo which would not affect the character of the decision avoidance model. The key property is that choice is independent of status quo if no suitable status quo exists.

[19] Meaning that $\succeq$ is transitive and reflexive, but not necessarily complete.

act as an effective status quo are represented by a mapping $T(Z)$. In this basic version of the conflict model, the only structure put on this mapping is that if some object $x \in T(Z)$, then the object chosen over x when it is the status quo must be preferred to x.[20] Finally, a binary relation $\trianglerighteq$ on X is used to capture the completed preference relation the DM will use to make their choices in the absence of a suitable status quo. The relation $\trianglerighteq$ must be a complete transitive extension of $\succeq$, which means that it is a complete preference relation which agrees with the symmetric and asymmetric parts of $\succeq$.[21]

Definition 3 *A choice correspondence $C : \mathcal{C}(X) \rightarrow \mathcal{X}$ admits a* ***Conflict Decision Avoidance (CDA)*** *representation if there exists a preference relation $\succeq$ with a complete transitive extension $\trianglerighteq$ and a mapping $T : \mathcal{X} \rightarrow \mathcal{X}$ such that $T(Z)$ is a strict subset of Z and*

1. *$\forall \{Z, s\} \in \mathcal{C}(\mathcal{X})$, choice is defined by*
   (a) *$C(Z, s) = \{x \in Z | x \succeq y \text{ for all } y \in Z\}$ if such set is non-empty*
   (b) *otherwise $C(Z, s) = s$ if $s \in Z/T(Z)$*
   (c) *otherwise $C(Z, s) = \{x \in Z | x \trianglerighteq y \text{ for all } y \in Z\}$*
2. *If, for some $Z \in \mathcal{X}$, $x \in T(Z)$ and $x \neq y \in C(Z, x)$, $y \succeq x$*

The behavioral implications of this model can be captured by a set of axioms which are both necessary and sufficient to guarantee a conflict decision avoidance representation. In addition to the Limited Status Quo Dependence axiom introduced above, the CDA model implies three behavioral conditions. The first two govern the relationship between choice sets in which the DM exhibits no status quo bias, and therefore is not suffering from selection difficulty.

Axiom D2: NSD Expansion: Z, $Z' \in \mathcal{N}$ and $\bar{C}(Z) \cap Z' \neq \varnothing$ implies that $Z \cup Z' \in \mathcal{N}$

Axiom D3: NSD Contraction: If, for some $Z \in \mathcal{X}$ there exists $x \in Z$ such that, for all $y \in Z$, there exists $Z' \supset Z$ such that $x \in C(Z', y)$ then $Z \in \mathcal{N}$

The first of these axioms considers the case of two NSD sets Z and Z' such that there is some item chosen from Z which appears in Z'. As these are NSD sets, the DM must be happy to determine one

[20] In the working paper version of the paper I discuss models that put more structure of the mapping T. For example, the conflict model can be extended in such a way that $T(Z)$ can be represented as the set of objects that have a utility lower than the best option in Z by an amount that exceeds some threshold ε.

[21] i.e. $x \succeq y$ implies $x \trianglerighteq y$ and $x \succ y$ implies not $y \trianglerighteq x$.

of the elements of Z' as (weakly) better than all the other elements in Z', one of which is, in turn, weakly better than all the elements in Z. Assuming the DM's judgments are transitive, the DM should be able to identify the best element from the union of Z and Z', which should therefore be a NSD set.

The second axiom considers the following case: Take a set Z which contains some element x that has been chosen over every other element $y \in Z$ in some choice set even when y is the status quo. This implies that x must be preferred to every other element in Z, so Z should be a NSD set.[22]

The next axiom imposes consistency requirements on choices in the case where there is no status quo.

> **Axiom D4: No Status Quo WARP:** For $Z, Z' \in \mathcal{X}$, $x, y \in Z \cap Z'$ then $x \in C(Z, \Diamond)$, $y \in C(Z', \Diamond)$ implies $x \in C(Z', \Diamond)$

Axioms D2-D4 provide the particular structure on choices made in NSD choice sets which is required for the CDA representation. This result is described in the following lemma:

Lemma 1 *For any choice correspondence $C : \mathcal{C}(X) \rightarrow \mathcal{X}$ satisfying axioms D2-D4 there exists a preference relation $\succeq$ with a complete transitive extension $\trianglerighteq$ such that:*

1. *$Z \in \mathcal{N}$ if and only if $\{x \in Z | x \succeq y$ for all $y \in Z\}$ is non-empty*
2. *$\bar{C}(Z) = \{x \in Z | x \succeq y$ for all $y \in Z\}$ for all $Z \in \mathcal{N}$*
3. *$C(Z, \Diamond) = \{x \in Z | x \trianglerighteq y$ for all $y \in Z\}$ for all $Z \in \mathcal{X}$*

The proofs of all observations, theorems, propositions and lemmas are in the appendix.

Together with D1, these three axioms are enough to guarantee a CDA representation.

Proposition 1 *A choice correspondence $C : \mathcal{C}(X) \rightarrow \mathcal{X}$ satisfies axioms D1-D4 if and only if it admits a CDA representation*

[22] The axiom specifies this requirement only if x is chosen over y when y is the status quo in a superset of Z. D2 and D3 between them imply that this must also be true if the preference revelation occurs in *any* set. Writing the axiom this way clarifies the relation between the conflict and information overload models of SQB.

2.3.2 Information Overload

The conflict model of decision avoidance formalizes the notion of a DM who has a set of incomplete preferences, and that status quo bias indicates that these preferences do not provide a best option in a particular choice set. It assumes that the DM's ability to compare objects is independent of the size of the choice set. However, recent literature within psychology has introduced the concept of information overload. This suggests that people's ability to make "good" choices can decrease with the size of the choice set [Iyengar and Lepper, 2000]. To capture this possibility, I relax the CDA model to account for information overload by allowing a DM's ability to compare alternatives to worsen as the size of the set increases.[23] In practical terms, this means replacing the fixed preference ordering $\succeq$ on X from the CDA model with a collection of set-dependent preference relations $\succeq_Z$ for every set $Z \in \mathcal{X}$. These preference relations are related in the sense that they are all restrictions of some primitive preference relation $\trianglerighteq$, with preferences becoming less complete in larger choice sets. I describe such preference relations as *nested*.[24]

Definition 4 *A set of preference relations $\trianglerighteq$ on X and $\succeq_Z$ on Z for all $Z \in \mathcal{X}$ are* ***nested*** *if, for any $Z, W \in \mathcal{X}$ such that $W \subseteq Z$, it is the case that, for any $x, y \in W$,*

$$x \succeq_Z y \Rightarrow x \succeq_W y \Rightarrow x \trianglerighteq y$$
$$x \succ_Z y \Rightarrow x \succ_W y \Rightarrow x \triangleright y$$

A formal statement of the information overload model is as follows:

Definition 5 *A choice correspondence $C : \mathcal{C}(X) \rightarrow \mathcal{X}$ admits an* ***Information Overload Decision Avoidance (IODA)*** *representation if there exists a set of nested preference relations $\trianglerighteq$, $\succeq_Z$ $\forall$ $Z \in \mathcal{X}$ and a mapping $T : \mathcal{X} \rightarrow \mathcal{X}$ such that $T(Z)$ is a strict subset of Z and*

1. *$\forall$ $\{Z, s\} \in \mathcal{C}(\mathcal{X})$, choice is defined by*

   (a) *$C(Z, s) = \{x \in Z | x \succeq_Z y$ for all $y \in Z\}$ if such set is non-empty*

[23] I do not specify the mechanism by which a DM is able to compare x to y in a small set but not in a large set. It could be that the DM has only a certain amount of cognitive resources with which to make comparisons, or it could be that the DM does not 'see' x and y in the same way in the larger choice set. Some of these possibilities are discussed in more detail in the next steps portion of section 5.

[24] Tyson [2008] uses a similar construction in the context of a model of satisficing.

(b) *otherwise* $C(Z,s) = s$ *if* $s \in Z/T(Z)$

(c) *otherwise* $C(Z,s) = \{x \in Z | x \trianglerighteq y \text{ for all } y \in Z\}$

2. *If, for some* $Z \in \mathcal{X}$, $x \in T(Z)$ *and* $x \neq y \in C(Z,x)$, $y \succeq_Z x$

In behavioral terms, the difference between the CDA and IODA representations is D2 – the NSD Expansion axiom. While this is implied by the CDA model, it may be violated in the IODA model. The DM may be able to determine a best option in the smaller choice sets, but this does not imply they can do so in the larger choice set, allowing NSD Expansion to fail.

Proposition 2 *A choice correspondence* $C : \mathcal{C}(X) \to \mathcal{X}$ *satisfies axioms D1, D3 and D4 if and only if it admits a IODA representation*

2.3.3 A Multi-Utility Representation

Before comparing it to the preference-based class of models, I present a multi-utility representation of the decision avoidance model. For brevity, the representation is shown only for the conflict model, but similar representations exist for the information overload model.

The key idea behind the representation is Ok's [2002] observation that incomplete preference can be represented by a vector-valued utility function, which has the property that an object x is preferred to object y if and only if the utility of x is higher than the utility of y along all dimensions. Thus, the incomplete preference $\succeq$ in the CDA model can be represented by a vector-valued utility function, while the complete extension $\trianglerighteq$ can be represented by a function that aggregates the vector-valued utility function in a strictly increasing way.[25] The multi-utility representation is described formally below. Bold letters are used to denote vector values. For n length vectors I use the definitions $\mathbf{x} \geq \mathbf{y} \iff \{x_i \geq y_i \ \forall \ i \in \{1, ..n\}\}$ and $\arg\max_{x \in Z} \mathbf{u}(x) = \{x \in Z | \mathbf{u}(x) \geq \mathbf{u}(y) \ \forall \ y \in Z\}$.

Proposition 3 *A choice correspondence* $C : \mathcal{C}(X) \to \mathcal{X}$ *admits a Conflict Decision Avoidance representation if and only if there exists a positive integer* n, *a function* $u : X \to \mathbb{R}^n$ *and a strictly increasing map* $f : u(X) \to \mathbb{R}$ *such that*

1. $\forall \ \{Z, s\} \in \mathcal{C}(\mathcal{X})$, *choice is defined by*

[25] Masatlioglu and Ok [2005] use a similar representation.

(a) $C(Z, s) = \arg\max_{x \in Z} \mathbf{u}(x)$ *if* $\arg\max_{x \in Z} \mathbf{u}(x) \neq \varnothing$

(b) *otherwise* $C(Z, s) = s$ *if* $s \in Z/T(Z)$

(c) *otherwise* $C(Z, s) = \arg\max_{x \in Z} f(u(x)) \; \forall \; Z \in \mathcal{X}$

2. *If, for some* $Z \in \mathcal{X}$, $x \in T(Z)$ *and* $x \neq y \in C(Z, x)$, $u(y) \geq u(x)$

One can think of the model as capturing the decisions of a DM who ranks options in terms of a number of different attributes.[26] A DM is happy to say an option x is (weakly) better than an option y if and only if it is ranked higher in terms of all attributes. In any given choice set, the DM is happy to make a decision if there is some option which beats every other option along all dimensions. However, if a choice set does not have a clear "winner" in this sense, then the DM may try to avoid the decision. If a suitable status quo option is available they will select it, and so avoid the decision. If no status quo option is available, then the DM has no way to avoid the decision and must think harder about the problem, aggregating the attributes to give a single utility value to each option in the choice set. They then choose according to this utility value.[27]

2.4 Differentiating between Preference-Based and Decision Avoidance Models of SQB

This paper has presented paradigmatic versions of the preference-based and decision avoidance models of SQB. This section draws out the distinctions between the two. The two models are not nested – there

[26] This representation clarifies the relationship between the CDA model and the concept of reason-based choice introduced by Shafir, Simonsen and Tversky [1993].

[27] This is just one interpretation of the "attribute numbers" that are described in the multi-utility representation. The key observation is that these attribute numbers are outputs of, rather than inputs to, the representatation theorem. They are not directly observable, but can be pinned down to a certain degree of accuracy by a DM's behavior (if this behavior satisfies the necessary conditions). The same is true of utility numbers in the standard choice model; utility itself is not directly observable, but if choices obey WARP, then a utility function can be assumed from their behavior. This function is unique up to positive affine transformations. One way to think of the attribute numbers in the multi-utility representation of the CDA model is that they relate to the DM's preferences over actual physical characteristics of the object on offer. However this is potentially misleading. It could be that a DM does indeed have preferences over such criteria, and uses these preferences in order to make choices in line with the CDA model. Nonetheless, were the DM to reveal these preferences to an observer, they would be very different from those inferred from the choices that the DM has made – though there would of course be some RBDA representation which had exactly the same attribute preferences. The problem is that observations of choice behavior alone are not enough to uniquely determine the attribute values of each object. Thus, a more palatable interpretation of these attribute numbers is that they represent a DM's preferences in various different states of the world. The DM has some uncertainty about their preferences when they come to actually consume the object that they choose. The various different possibilities are represented by the different "attribute numbers" in the CDA model. Under this interpretation, the DM is happy to make a decision if there is one available alternative that they would prefer in *all* states of the world. However, if this is not the case, then the DM will be conflicted and will try to avoid such a decision.

exist choice correspondences that satisfy the preference-based models but not the decision avoidance models and vise versa. Thus it is necessary to document what behavior the preference-based model allows that decision avoidance models do not, and vice versa.

The first difference between the models, and the motivation for introducing the concept of decision avoidance, is that they allow for a mechanism by which people may switch to choosing the status quo in larger choice sets. This accords with the findings of Iyengar and Lepper [2000] and Tversky and Shafir [1992]. Such behavior violates the independence of irrelevant alternatives (IIA) with a fixed status quo, and so is ruled out by preference-based model. However, the decision avoidance models do allow such violations. Under very weak conditions on the correspondence T[28] this is the only violation of IIA that decision avoidance models allow with a fixed status quo. Under the conflict model, a DM may switch to choosing the status quo if objects are added to the choice set that the DM finds difficult to compare to the current favorite option. Consider a DM who has to choose between three objects a, b and c. The DM prefers a to c and b to c, but cannot compare a and b. According to the conflict model, the DM would choose a from the set $\{a, c\}$, even if c is the status quo. However, from the set $\{a, b, c\}$, they may choose c if it is the status quo in order to avoid the difficult choice between a and b.

The information overload model is less restrictive about which objects cause IIA to fail when added to the choice set. Under the conflict model, a switch to the status quo in larger choice sets occurs only if some of the added objects are incomparable to the objects that are currently being chosen, as in the above example. This means that choices between the currently chosen maximum and the newly added objects should also be affected by the choice of status quo (this is the implication of the NSD Expansion axiom). Because the information overload model allows for preferences to become less complete in larger choice sets, the addition of *any* objects can potentially lead to a DM changing their choice to the status quo.

There is also a class of behavior that the preference-based models allow, but decision avoidance models do not: Preference-based models do not assume Limited Status Quo Dependence. In keeping with their focus on the role of the status quo in affecting preferences, preference-based models allow for more generalized effects of making an object the status quo than merely increasing the propensity for that object to be chosen. For example, the models of Masatlioglu and Ok [2005; 2007] explicitly allow for the *asymmetric reference point effect* as demonstrated by Hearne [1998] and Masatlioglu and Uler

[28] The required assumption is that if, for some set $Z \in \mathcal{X}$, x is chosen while $y \in T(Z)$ then $y \in T(Z')$ for any $Z' \supseteq \{x\}$. Without this assumption, it is possible that people may violate WARP by switching to the status quo in smaller choice sets.

[2008]. These experiments show that introducing a reference point that is strictly dominated by some, but not all, objects in a choice set makes it more likely that the dominant options will be chosen. I term such status quo effects *Generalized Status Quo Dependence* (GSQD).

These behavioral differences between the two classes of model form the basis of the experimental tests performed in the next section of the paper.

3 Experimental Evidence

This section of the paper uses evidence from laboratory experiments to determine the cases in which decision avoidance models can capture status quo dependent behavior. To prelude the results I find evidence of decision avoidance behavior in large choice sets: as the size of a choice set increases, subjects switch their choices away from other options and towards the status quo. The majority of violations of IIA with a fixed status quo are of this type, in line with the predictions of the decision avoidance model. I also find that the switch towards the status quo is driven by information overload, rather than conflict decision avoidance. Even when a choice set is increased in size by adding "dominated" alternatives people still switch to choosing to the status quo. However, in small choice sets, the decision avoidance model breaks down. The introduction of a somewhat risky status quo can lead people to choose an extremely risky option, violating LSQD. This effect dissipates as the size of the choice set increases.

These results are demonstrated using three sets of experiments. Experiment 1 tested for the presence of decision avoidance type behavior as the size of the choice set increases. Subjects made choices from three nested sets of lotteries with a fixed status quo. Preference-based models predict no violations of the independence of irrelevant alternatives from such choices. In contrast, the decision-based model allows for subjects switching their choices towards the status quo as the size of the choice set increases. Experiment 2 tested the NSD Expansion and NSD Contraction axioms. Subjects again made choices from nested sets of lotteries, but in this case the size of the choice set was altered by adding and subtracting stochastically dominated lotteries (which were almost never chosen regardless of status quo). NSD Expansion implies that adding dominated lotteries should not increase SQB, while NSD Contraction implies that removing dominated lotteries should not increase SQB. Thus the CDA model implies that SQB should be the same in the larger and smaller choice sets, while the IODA model is violated only by a decrease in SQB in larger choice sets. Experiment 3 tested LSQD in small and large choice sets by comparing the choices of subjects endowed with a risky status quo to those with no status quo. Decision avoidance models predict that the only effect of the status quo should be to increase the proportion of people choosing that option at the expense of other options. Preference-based models allow for more general effects of status quo on choice.

3.1 Related Literature

While many previous experimental studies have examined status quo bias (and the related phenomena of the endowment effect and reference dependant preferences)[29] the results reported here represent novel contributions in several respects.

First, this study is the first to establish that subjects may switch their choices towards the status quo in larger choice sets, and that these are the predominant departures from IIA with a fixed status quo. Tversky and Shafir [1992] and Iyengar and Lepper [2000] show violations of IIA as the size of the choice set increase, but do not establish the role of the *status quo* in this effect, as they do not vary the status quo between treatments. Samuelson and Zeckhauser [1988] show an increase in *relative* status quo bias (the fraction of people changing their choice due to the status quo) as the size of a choice set increases, but do not establish an increase in *absolute* status quo bias (the number of people choosing the status quo). This is important because the latter is inconsistent with the preference-based model of SQB while the former is not. Kempf and Ruenzi [2006] show that there is a higher autocorrelation in investment fund growth in sectors that offer more funds. This result is consistent with stronger SQB in larger choice sets, but has a number of other possible interpretations.

Second, I show that the switch to the status quo is due to information overload rather than conflict decision avoidance. While both Tversky and Shafir [1992] and Iyengar and Lepper [2000] show a higher proportion of people choosing the default option in larger choice sets, the two studies draw very different conclusions as to the cause of this switch. Tversky and Shafir [1992] propose a conflict explanation while Iyengar and Lepper [2000] suggest that information overload is the key variable.

Third, these experiments are the first to demonstrate that a risky status quo point can lead to a

[29] Studies that have examined the endowment effect include Knetsch and Sinden [1984], Coursey et al. [1987], Knetsch [1989], Kahneman, Knetsch and Thaler [1990], List [2003] and Plott and Zeiler [2005]. Those that have looked at status quo bias more generally include Samuelson and Zeckhauser [1988], Tversky and Shafir [1992], Ritov and Baron [1992], Schweitzer [1994], Herne [1998], Moshinsky and Bar-Hillel [2004], Roca et al. [2006] and Masatlioglu and Uler [2008]. Studies that look at reference dependence as distinct from status quo include Bateman et al. [1997] and Bateman et al. [2005].

generalized increase in risk appetite. The possibility of a stochastic status quo has been largely ignored in both the theoretical and empirical literature.[30] The closest experimental results to these are those of Roca et al. [2006], which show that subjects may choose an ambiguous alternative over a risky alternative if the ambiguous alternative is the status quo. However, this study does not demonstrate that a risky or ambiguous status quo can affect risk/ambiguity attitudes more generally by leading subjects to choose some *other,* more risky object.

The final innovation of this paper is to show within a unified experimental framework the presence of preference-based and decision avoidance based status quo effects. Other studies have shown that a change from one strictly dominated reference point to another can affect choice behavior (for example Hearne [1998] and Masatlioglu and Uler [2008]), and that defaults may be chosen more often in larger choice sets [Tversky and Shafir, 1992; Iyengar and Lepper, 2000]. However, this is the first study to show that both effects can manifest themselves in the same experimental setup.

3.2 Experimental Design

The results described in this paper come from a sequence of experiments run at the Center for Experimental Social Sciences at New York University between January and October 2008. In all treatments subjects were asked to make choices from groups of lotteries presented to them on a computer terminal. Each lottery had either one or two prizes, varying in value from \$0 and \$45, and was represented on screen in the form of a bar graph.[31] Subjects each took part in between 13 and 28 rounds. Each round was of one of two types - a status quo round or a no status quo round. At the end of the experiment one round was selected at random for each subject and the subject played the lottery that was their final choice in that round for real money, in addition to a \$5 show up fee. On average, subjects earned \$12 in total, and the experiments lasted approximately 30 minutes.

In a no status quo round the subject was presented with between 3 and 20 lotteries on screen. The subject could select a lottery by clicking on it, then clicking on a separate button to move on to the next round. Whatever was selected at this stage was recorded as the subject's final choice for that round.

In order to induce a "status quo" or default option for the subjects, I adapted a technique used

[30] On the theoretical side, Koszegi and Rabin [2007] are a notable exception, discussion the implications of a stochastic reference point.
[31] An example of a typical screenshot is shown in figure 1.

by Samuelson and Zeckhauser [1988]. Subjects were offered choices in two stages, with their choice in the first stage becoming the status quo in the second stage. Thus a status quo round consisted of two parts. First, the subject was presented with a group of three lotteries from which they were asked to make a choice (just as in a no status quo round). Having made this choice, their selected lottery was presented at the top of a screen along with a selection of other lotteries in a second stage. The subject could then click on a button marked "keep current selection" in order to keep the lottery selected in the first round, or could click on one of the new lotteries in order to select it. If they did click on a new lottery, they were offered the choice to either "change to selected lottery" or to "clear selection" (thus reselecting the status quo lottery). Figure 1 shows typical first and second stage screenshots.

FIGURE 1 ABOUT HERE

In order to allow the experimenter to control the status quo in each round, the lotteries offered in the first stage of a status quo round consisted of a target lottery and two decoy lotteries. The decoy lotteries were designed to have expected values of less than half that of the target lottery, thus ensuring that the target lottery was almost always chosen, and so became the status quo in the next round. Any choice set/status quo pair in which a decoy lottery was chosen over a target lottery more than twice was discarded. This method of eliciting status quo bias encompasses two key properties of a status quo. The status quo object is both the subject's current selection and the object they receive if they do not make an active choice in the second round.

To mitigate the effect of learning, no subject was presented with the same choice set on two separate occasions with different status quos. Furthermore, the order in which rounds were presented was reversed for half the subjects, allowing one to control for order effects.

A sample set of instructions are included in the appendix.

3.3 Experiment 1: Decision Avoidance

The first experiment was designed to test for the existence of decision avoidance behavior by examining the choices of a group of subjects with a fixed status quo as the size of the choice set increases. Subjects chose from nested sets of lotteries of size 3, 12 and 20, each consisting of lotteries that are not ranked according to stochastic dominance. The status quo, which I call lottery R, had an 80% chance of paying

$4 and a 20% chance of paying $20.[32]

Using a within-subject design, subjects were grouped into three categories depending on the pattern of their choices: those that violate IIA by switching to the status quo in larger choice sets, those that violate IIA in other ways, and those that do not violate IIA. Preference-based models only allow for the latter group. The decision avoidance models allows also for the switching towards the status quo in larger choice sets. Table 1 shows the fraction of subjects in each group.

TABLE 1 ABOUT HERE

The results show that, of 35 subjects, 17 had no IIA violation (49%), 13 violated IIA only by switching to the status quo (37%) in larger choice sets, while 5 violated IIA in other ways (14%). 72% of people who violated IIA did so only by switching to the status quo in larger choice sets.

I benchmark these results in two different ways, both reported in table 1. First, I compare these proportions to those that would be observed under random choice.[33] Under such conditions, one would expect to see only 6% of subjects violate IIA only by switching to the status quo in larger choice sets, while 52% would violate IIA in other ways. As a more stringent benchmark, I consider a DM who makes choices according to a logistic choice function with probabilities equal to the population frequency of choosing each option in the size 20 choice set. This benchmark can be considered as a generalization of the preference-based model of status quo to allow for "random utility". Under such a model, one would expect to see 14% of subjects violating IIA only by switching to the status quo, and 31% violating IIA in other ways. The decision avoidance model performs better than both these benchmarks at the 1% significance level (one sample z-test of proportion).

To test the importance of status quo in the above result, I ran a further treatment, in which the subjects made the same sequence of choices, but with no status quo. In this case, only 2 out of 16 (12%) subjects violated IIA only by switching to the lottery R. This is significantly lower than when R was the status quo, and in line with the logistic benchmark. Thus the switching to the lottery R in the larger choice sets is driven by the fact that it is the status quo.[34]

[32] A list of all 20 lotteries is shown in the appendix.

[33] In each choice set, the DM has an equal chance of selecting any of the objects abailable to them.

[34] This difference is sigificant at the 7% level, two sample test of proportion.

3.4 Experiment 2: Testing NSD Contraction and NSD Expansion

The second set of experiments examined the effect of adding stochastically dominated lotteries to a choice set. This experiment has two advantages. First, it provides a potentially starker test for whether or not people switch to the status quo option as the choice set increase. Second it allows one to explicitly test two key axioms of the conflict model of decision avoidance: NSD Expansion implies that *adding* dominated lotteries to the choice set should not increase status quo bias, while NSD Contraction implies that *removing* dominated lotteries from the choice set should not increase SQB. Thus the CDA model implies that SQB should be the same in the larger and smaller choice sets, while the IODA model is violated only by a decrease in SQB in larger choice sets.

The first suite of experiments were designed explicitly to test the NSD Expansion and NSD Contraction axioms by examining choices in 4 different choice sets containing the lottery R (described above) and lottery M, which has a 50% chance of paying \$4 and a 50% chance of paying \$9.

1. $\{R, M\}$: The lotteries R and M only.
2. $\{R, r_1...r_5\}$: The lottery R along with 5 lotteries stochastically dominated by R.
3. $\{M, m_1, ..m_5\}$: The lottery M and 5 lotteries dominated by M.
4. $\{R, M, r_1...r_5, m_1, ..m_5\}$: The lotteries R, M and the 10 stochastically dominated lotteries.

NSD Expansion implies that, if status quo does not affect choice in the sets 2 and 3, then adding the 10 stochastically dominated lotteries should not increase status quo bias. NSD Contraction implies that, as long as choices respect stochastic dominance regardless of status quo, SQB should not be increased by the removal of the 10 stochastically dominated lotteries.[35]

[35] The former follows from the fact that, under No Conflict Expansion, if $\{R, r_1...r_5\}\{M, m_1, ..m_5\} \in \mathcal{N}$, then $\{R, M\} \in \mathcal{N}$ implies that $\{R, M, r_1...r_5, m_1, ..m_5\} \in \mathcal{N}$ and so $\{R, M + 5_R + 5_M\} \in \mathcal{N}$. The latter follows from the fact that, if $\{R, r_1...r_5\}\{M, m_1, ..m_5\} \in \mathcal{N}$, then

$$\begin{aligned} R &\in C(\{R, r_1...r_5\}, r_i) \ \forall\, i \in \{1, ...5\} \\ M &\in C(\{M, m_1...m_5\}, m_i) \ \forall\, i \in \{1, ...5\} \end{aligned}$$

Thus, if $\{R, M, r_1...r_5, m_1, ..m_5\} \in \mathcal{N}$, then either

$$R \in C(\{R, M, r_1...r_5, m_1...m_5\}, M)$$

or

$$M \in C(\{R, M, r_1...r_5, m_1...m_5\}, R)$$

implying that $\{R, M\} \in \mathcal{N}$.

NSD Expansion and NSD Contraction can be tested by comparing choices in each choice set under two treatments. For $\{R, M\}$ and $\{R, M, r_1...r_5, m_1, ..m_5\}$ I compare the choices made with status quo R to those made with status quo M. For the set $\{R, r_1...r_5\}$ I compare the choices made with status quo R to those made with status quo r_1, one of the stochastically dominated lotteries. Similarly, in the set $\{M, m_1, ..m_5\}$ I compare the choices made with status quo M to those made with status quo m_1, which is one of the stochastically dominated lotteries.[36]

FIGURE 2 ABOUT HERE

Figure 2 shows the results of these treatments (experiment 2a), which demonstrate a dramatic rejection of NSD Expansion. In the set $\{R, M\}$ the effect of changing the status quo was small and insignificant. 8 of 17 subjects (47%) chose R when it was the status quo, compared to 7 of 19 (37%) when M was the status quo. In the sets $\{R, r_1...r_5\}$ and $\{M, m_1, ..m_5\}$, the stochastically dominant option was chosen on all but one occasion, regardless of the status quo. However, in the set $\{R, M, r_1...r_5, m_1, ..m_5\}$, 19 of 19 (100%) subjects chose R when it was the status quo, compared to 10 out of 20 (50%) of subjects when M was the status quo.[37] Thus, SQB, as measured by the proportion of people who change their choices due to a change in the status quo, increased from 10% in the smaller choice set to 50% in the larger choice set in line with NSD Contraction, but violating NSD Expansion. These results are therefore consistent with the information overload model but not the preference-based or conflict models. However, the results also highlight that the increasing power of the status quo is not universal. Although the proportion of people choosing R when it is the status quo does increase with the size of the choice set, the number of people choosing M does not. I return to this issue in section 5.

In order to explore this result further, I ran another sequence of experiments in which stochastically dominated options were added to a choice set containing the lotteries R and E (which has a 80% chance of paying \$3 and a 20% chance of paying \$23). Subjects made choices in sets of size 2, 6, 12 and 20, and in two treatments: R as the status quo (20 subjects) and E as the status quo (24 subjects). This second set of experiments (experiments 2b) test the robustness of the previous result, and help to determine the point at which a choice set becomes large and so causes information overload. Figure 3 shows the

[36] I am assuming that if one stochastically dominated lottery is not chosen when it is the status quo then none of them will be, or that $r_1 \notin T(\{R, r_1...r_5\})$ and $m_1 \notin T(\{M, m_1, ..m_5\})$.

[37] Difference significant at the 1% level, Fisher's exact test. The proportion of people choosing R when it was the status quo is greater in the large choice set that the small set (significant at the 1% level). There was no significant difference in the proportion of people choosing M when it is the status quo between the large and the small choice set.

proportion of people choosing the lottery R in each choice set.

FIGURE 3 ABOUT HERE

The results from experiment 2b show the same pattern as those from experiment 2a. In the size 2 choice set, there was no effect of changing the status quo. However, as the size of the choice set increased, status quo had a large and significant effect on choice.[38] Moreover, this occurs even in relatively small choice sets: status quo bias was significant even in the choice set of size 6. Again, the only significant change was an increase in SQB in larger choice sets in line with NSD Contraction but violating NSD Expansion.[39]

3.5 Experiment 3: Limited Status Quo Dependence

The final set of experiments tested the Limited Status Quo Dependence axiom central to the decision avoidance models. This axiom states that the only possible effect of making some object x the status quo is to cause people to switch to choosing x instead of choosing some other object. Experiment 3 contrasts this hypothesis with a particular type of preference-based status quo dependence, in which the introduction of a risky status quo can increase a subject's attitude to risk, and so potentially violating LSQD.

The first experiment (experiment 3a) examined the choices of subjects between the lotteries R, M and E described earlier. Lottery M is a low risk lottery (with a mean payoff of 6.5 and a standard deviation of 2.5), lottery R is a higher risk lottery (mean 7.2, standard deviation 6.4) and E is an "extremely" risky lottery (mean 7.0, standard deviation 8.0).

Experiment 3a compared two treatments - one with no status quo, and one in which the status quo is R. According to LSQD, the only effect of making R the status quo should be to increase the proportion of people choosing R at the expense of M and E. However, if the introduction of a risky status quo does increase risk attitudes, then the proportion of people choosing the lottery E could also increase. Figure 4 shows the result of experiment 3a.

FIGURE 4 ABOUT HERE

[38] Effect of status quo insigificant for choice set size 2, significant at the 1% level in set size 6 and 20 and significant at the 3% level set size 12, all Fisher's exact test.

[39] The slight decrease in SQB between size 6 and size 12 is not significant.

The results show a clear rejection of LSQD. When there was no status quo, 5 out of 34 (15%) subjects chose lottery E compared to 15 out of 34 when R is the status quo (44%). This difference is significant at 2% (Fishers exact test). Thus, experiment 3a demonstrates GSQD in small choice sets..

This is a particularly stark rejection of LSQD. First, E has a *higher* standard deviation and *lower* mean than R, so the selection of E over R represents risk-loving behavior. Second, assigning R as the status quo actually *decreased* the proportion of people that chose the lottery R, from 52% to 32% (marginally significant at the 8% level using Fishers exact test).

The next set of experiments tested whether the GSQD demonstrated in experiment 3a also occurs in larger choice sets, given the findings of experiment 1 that suggests decision avoidance drives SQB in larger choice sets. Subjects chose from a set of 20 lotteries, containing R, M, E and 17 other (non-stochastically ranked) lotteries (experiment 3b). I again ran treatments in which R is the status quo and there is no status quo, but also added a treatment in which E is the status quo. Figure 4 shows the results which demonstrate that the GSQD apparent in small choice sets dissipates in the larger choice sets. The only significant effect of setting R as the status quo was to increase the proportion of people choosing R (marginally significant at the 10% level), while the only effect of setting E as the status quo was to increase the proportion of people choosing E (significant at the 1% level).

In order to further explore the relationship between risky status quo and risk attitudes in small choice sets, I ran a third experiment (3c). In this experiment subjects chose between R, M and a sure thing of \$6, under three further treatments: no status quo, a status quo of R and a status quo of \$6. These treatments test the robustness of the relation between risky status quo and choice. First, if more people choose the lottery R when M is the status quo than when there is no status quo, this is further evidence that the result of experiment 3a is due to a change in risk attitudes, rather than something particular to the lottery E. Second, by comparing choices when \$6 is the status quo to when M is the status quo, one can confirm that the result of 3a is being driven by a *risky* status quo, rather than any arbitrary status quo.

The results of experiment 3c are shown in figure 5, and confirm the results of experiment 1a. 16 out of 32 (50%) people chose R when M was the status quo, compared to 7 out of 35 (20%) when \$6 was the status quo, and 4 out of 23 (17%) when there was no status quo.[40] In both cases, the increased selection of R was at the expense of choosing \$6. The proportion of people who chose M is similar in

[40] Difference between M status quo and no status quo and M status quo and \$6 status quo both significant at the 2% level.

both treatments.

FIGURE 5 ABOUT HERE

3.6 Summary

These experiments show that the information overload model of SQB does a good job of capturing behavior in larger choice sets. There is no evidence of GSQD or violations of NSD Contraction in such choice sets. However, there is strong evidence that people switch their choices to the status quo in larger choice sets even when the size of the choice set is expanded by adding dominated options, ruling out both the preference-based and conflict decision avoidance model.

However, the preference-based model is necessary to understand choices in smaller choice sets. The introduction of a somewhat risky status quo in such sets can lead people to switch their choices to an extremely risky option, violating Limited Status Quo Dependence. Thus neither the decision avoidance nor the preference-based class of models provide a complete description of the effect of status quo on choice.

4 "Benign Paternalism" and Policy Implications

One of the reasons that SQB is of particular interest is its policy relevance. There are numerous examples of economists and policy makers advocating and implementing policies based on the manipulation of defaults. Cases in which such policies are being used or discussed include organ donation, the design of 401(k) retirement plans, and the selection of medical procedures.[41] Such policies have been advocated as a form of "light", or "asymmetric" or "libertarian" paternalism (for which I use the umbrella term "benign" paternalism). This is advocated as preferable both to no paternalism, and to traditional "heavy" paternalism, in which people's choices are restricted.

It is clear that policies based on the setting of defaults have had a massive impact on behavior (for example the Save More Tomorrow plan advocated by Benartzi and Thaler [2004]). In many simple cases such policies may be unambiguously considered as leading to socially beneficial outcomes (for example organ donation rates are higher in countries that operate opt-out, rather than opt-in schemes,

[41] See Benartzi and Thaler [2004], Gale et al. [2005] and Halpern et al. [2007].

as shown by Johnson and Goldstein [2003]). However, as the use of defaults as a policy tool spreads to more and increasingly complicated domains, it is important to examine the assumptions underlying the implementation of such policies. In the following sections, I examine the implications of the above findings for the "benign" manipulation of status quos.

4.1 When is Status Quo Manipulation Benign?

Benign paternalism describes a set of policy prescriptions suggested by, for example, Thaler and Sunstein [2003], Camerer et al. [2003] and Loewenstein and Haisley [2008]. It advocates policies based on:

> "steer[ing] human behavior in more beneficial directions while minimizing coercion, maintaining individual autonomy, and maximizing choice to the greatest extent possible." [Loewenstein and Haisley, 2008 pp 213]

In contrast to traditional "heavy handed" paternalism, benign paternalists suggest the use of frames, cues, defaults and reference points in order to guide people's decisions towards beneficial choices. This approach is considered preferable to a complete lack of parternalistic intervention on the basis that people sometimes make "sub-optimal" decisions:[42] an option selected by an external planner may be better than that selected by the agent themselves.[43] However, light paternalism is also considered better than traditional "heavy" paternalism, which proscribes the options that an individual must choose. One argument in favor of benign paternalism is that in some cases people may have well formed preferences for one particular option over another. If there is heterogeneity in the population as to what this preferred option is, or if the planner cannot always identify the preferred option, then any proscriptive paternalism can impose some cost on those who are blocked from choosing their favorite option. However, if these well formed preferences are invariant to framing effects and status quo bias, then benign paternalism will affect only the choices of those who do not have well formed preferences in the first place. Therefore light paternalism only changes people's choices between objects over which

[42] "The false assumption is that almost all people, almost all of the time, make choices that are in their best interest or at the very least are better, by their own lights, than the choices that would be made by third parties. This claim is either tautological, and therefore uninteresting, or testable. We claim that it is testable and false, indeed obviously false." [Thaler and Sunstein, 2003 pp 4]

[43] This claim is strengthened by Thaler and Sunstien [2003] to say that in many cases there may be no alternative to some form of paternalism - for example *any* choice will have a default in the sense of an outcome that will occur in the DM does nothing.

they have no clear preference.

This paper formalizes this view by thinking of a planner attempting to implement the following **paternalistic decision making procedure**. Let X be a set of possible alternatives. Consider a DM who has a set of (transitive and reflexive) preferences $\succeq$ on X which are not necessarily complete. A paternalistic planner has a complete preference ordering, $\blacktriangleright$ also on X. The planner wants to respect the preferences of the DM, but would like to impose their own preference ordering in cases where the DM does not have clear desires. In other words, for all $\{Z, s\} \in \mathcal{C}(\mathcal{X})$ the planner wishes the DM's choices to be of the form

$$\begin{aligned} C(Z,s) &= \{x \in Z | x \blacktriangleright y \text{ for all } y \in U_{\succeq}(Z)\} \\ \text{where } U_{\succeq}(Z) &= \{x \in Z | y \succ x \text{ for no } x \in Z\} \end{aligned}$$

The paternalists' favored element is chosen out of the set of objects that are undominated according to the DM's preferences. Thus, if the DM's preferences identify the best option in a particular choice set, then that is the option that should be chosen. However, if there are several undominated options then the paternalist would like to choose between them on behalf of the DM.

In such a setting, I define the attempt to implement a paternalistic decision making procedure via the manipulation of status quos as **benign according to** $\succeq$ if it cannot lead a DM choose to an option that is dominated by another available option, according to their preferences. In other words, for all $\{Z, s\} \in \mathcal{C}(\mathcal{X})$

$$C(Z,s) \subset U_{\succeq}(Z)$$

Of course, whether or not a particular model of status quo bias is benign depends on how preferences are defined, and in particular what type of behavior is assumed to *reveal* one option to be preferred to another. Under some definitions of revealed preference, the claim that status quo manipulation is benign is tautological. For example, Bernheim and Rangel [2008] consider a definition of revealed preference based on the idea that x is preferred to y if y is never chosen over x in *any* choice set, or under any status quo. However, under less demanding definitions of revealed preference the question as to whether status quo manipulation is benign is an empirical one.

One such definition of revealed preference can stem from a willingness to ignore choice data from sets above a certain size. For example, if y is always chosen over x in any choice set of size less than

100 items regardless of status quo, but x is chosen from a choice set which contains x and y as well as 99 other objects, one might be willing to conclude that y is robustly preferred to x, and that it is likely that the DM was simply unaware of the availability of x in the larger choice set.[44] Using this intuition to define the concept of (strict) $n-$preference, denoted $\succ^n$ such that x is $n-$preferred to y if y is never chosen over x in any choice sets of size n or less, regardless of the status quo.

$$\begin{aligned} x &\succ {}^n y \Longleftrightarrow \\ \forall \{Z,s\} &\in \mathcal{C}(\mathcal{X}) \text{ s.t. } |Z| \leq n,\ x \in Z \\ y &\notin C(Z,s) \end{aligned}$$

Note that, if $n = |X|$, this definition of revealed preference converges to that discussed by Bernheim and Rangel [2008].

Using this definition, one can reformulate the claim that status quo manipulation is benign for any level of $n-$preference:

Definition 6 *Manipulation of status quos in $n-$benign if, for all $\{Z,s\} \in \mathcal{C}(X)$*

$$\begin{aligned} x &\in C(Z,s) \\ &\Rightarrow y \succ^n x \text{ for no } x \in Z \end{aligned}$$

4.2 Policy Implications

The results presented in the paper have several implications for the implementation of benignly paternalistic policies based on the manipulation of status quos or defaults. Conceptually, they raise questions about the extent to which the manipulation of status quo is benign. Using the concept of $n-$benignness introduced above, one can show that preference-based models of SQB are more benign that decision avoidance models.[45] At one end of the spectrum, the preference-based model with status quo bias implies 2-benignness, while the preference-based model without status quo bias can guarantee 3-benignness. At the other end of the spectrum, neither of the decision avoidance models can guarantee

[44] The possibility of ignoring the evidence from certain choices on the basis of lack of focus, or unawareness, is discussed in Bernheim and Rangel [2008].

[45] Note n-benignness is a stricter concept for lower values of n, in that n-benignness guarantees m-benignness for $\forall$ $m \geq n$. In fact, $|X|$-benignness is tautological.

$n-$benignness for any n less than $|X|$, while a rejection of the conflict model in favor of the information overload model implies a violation of $2-$benignness for single-valued choice correspondences.

The experimental results reported in section 3 make it clear that status quo bias in large choice sets can indeed overcome preferences that are status quo independent in smaller choice sets. Everyone chose R in larger choice sets when it is the status quo, yet roughly half the people chose M over R in smaller choice sets regardless of status quo. Yet restricting the size of the choice set to avoid this problem reduces the perceived benefit of benign paternalism, as it restricts the choices available to the DM.

The finding that the increased power of status quo in large choice sets is driven by information overload points to a potential solution to this problem. The experimental results suggest that if a choice from a large choice set was broken down into a series of sequential choices then this might nullify the increased power of the status quo. For example, the results from experiment 2a suggest that if a person was initially offered a choice between R and M before being offered the choice between their selected option and the lotteries 5_R and 5_M, their choices would not be overly affected by the status quo. In comparison, those who have to choose directly from all 12 objects at the same time are likely to be strongly affected by the status quo.

A second important practical implication of this work is the finding that GSQD can be important in small choice sets. In practice, most policies that advocate the manipulation of status quos, or defaults, assume that the effect will be to increase the likelihood that the status quo will be chosen (see for example Gale et al. [2005] and Halpern et al. [2007]). The results of experiment 3 suggest that this is a potentially dangerous assumption. Moreover, the type of GSQD demonstrated here is of particular importance for policies regarding the manipulation of status quos in 401(k) funds. Some have advocated the use of defaults to overcome the problem of "millions of workers [who] are overconcetrated in [...] safe but low-yielding money market funds." [Gale et al. 2005 pp8]. The finding that a somewhat risky status quo can lead people to choose very risky options, even to the point of exhibiting risk-loving behavior, suggests a potential danger in this policy. To the extent that a default 401 (k) investment can act to alter people's preference in this way, the inclusion of riskier investment elements such as equities in the default may act to increase investors' appetite for risk more than the policy maker intended.

5 Conclusions and Next Steps

The aim of this paper has been to extend our understanding of the way in which status quos can affect the choices people make. It has shown that, as the size of the choice set increases, people may suffer from "information overload", making them more likely to choose the status quo. However, in small choice sets, the status quo may act to change people's preferences, meaning that a somewhat risky status quo can lead people to choose extremely risky option. Both of these findings have implications for policy makers who wish to use status quos to guide the decisions that people make.

Beyond any interest that these results may have in themselves, they point to a sequence of further research questions, which I discuss briefly here.

First, the relationship between set size, status quo and choice is clearly extremely rich and has many aspects not explored in this paper. Our results show that two lotteries can be equally popular in small choice sets regardless of the status quo, but only one will increase in popularity as the size of the choice set increases, and then only when it is the status quo. Our current work has little to say about why this might be. A second question is how choice may be modified in large choice sets in the absence of a suitable status quo; a third is to understand the determinants of the point at which information overload takes over and begins to affect choice.

One approach to answering these questions is to examine the relationship between choice set size and the way in which people acquire information about the available alternatives. Clearly, as the size of a choice set increases, it becomes more difficult for someone to gather complete information on all of the alternatives, and previous work by Payne, Bettman and Johnson [1993] has suggested that information gathering strategies may be affected by choice set size. Yet the relationship between status quos and information search has not been well studied. In other research [Caplin and Dean, 2008], I am developing theoretical and experimental tools that allow insight into the way in which people search through the available options in a choice set.

A second set of questions revolves around the relationship between riskiness of status quo and risk attitudes documented in this paper. While I have shown that a risky status quo tends to increase risk appetite, experimental and modelling questions remain about the effect. For example, is the difference solely between risky and risk-free status quos? Or does the "riskiness" of the status quo affect choice more subtly?

A third group of questions center on the various possible roles that a status quo can play. In previous work, a status quo has been defined as an object that has been chosen previously [for example Samuelson and Zeckhauser, 1988], an option that is already owned [Knetsch, 1989], the "default choice" [Ritov and Baron, 1992] and the option expected by the decision maker [Tversky and Shafir, 1992]. The experimental part of my study combines the "previous ownership" and the "default" role of the status quo, but does not capture some other possibilities, such as the perception that the status quo might be viewed as some form of recommendation. These different aspects of the status quo might have different effects on behavior. While some previous studies have started to unpack these different effects [Ritov and Baron, 1992; Schweitzer, 1994], it is clearly important to understand the extent to which different types of status quo can give rise to different types of behavioral phenomena, such as GSQD and information overload.

A final question is the validity of the experiments reported here in helping to understanding behavior in "real life" economic situations such as 401(k) investment. While the existence of status quo bias in real world environments is widely accepted, information overload and GSQD have yet to be demonstrated outside the laboratory. To this end, I am currently working with a provider of 401(k) investment funds to secure the data necessary to test for such effects amongst pension plan investors.

The use of defaults and status quos clearly has great potential to shape the choices that people make. It is only through a thorough understanding of the way in which status quo can affect choice that this potential can be fully realized.

6 Bibliography

Anderson, Christopher J. 2003, "The Psychology of Doing Nothing: Forms of Decision Avoidance Result from Reason and Emotion", *Psychological Bulletin,* Vol. 129, pp. 139-167

Apesteguia, J. and M. Ballester, 2004, "A Theory of Reference-Dependent Behavior", *mimeo*, Universitat Autonoma de Barcelona.

Agnew, Julie, Pierluigi Balduzzi and Annika Sundén, 2003, "Portfolio Choice, Trading and Returns in a Large 401(k) Plan" *American Economic Review,* 93(1)

Ameriks, John and Stephen P. Zeldes, 2000, "How Do Household Portfolio Shares Vary With Age?" *TIAA-CREF Working Paper.* Available at SSRN: http://ssrn.com/abstract=292017

Bateman, I., D. Kahneman, A. Munro, B. Rhodes, C. Starmer, and R. Sugden, 2005, "Testing Competing Models of Loss Aversion: An Adversarial Collaboration", *Journal of Public Economics*, 89, 1561-1580

Bateman, I., A. Munro, B. Rhodes, C. Starmer, and R. Sugden, 1997, "A Test of the Theory of Reference-Dependent Preferences", *Quarterly Journal of Economics*,112, 479-505

Benartzi, Shlomo and Richard H. Thaler, 2004, "Save More Tomorrow: Using Behavioral Economics to Increase Employee Saving" *Journal of Political Economy*, Vol. 112, No. 1, pp. S164-S187

Bernheim, B. Douglas and Antonio Rangel, 2008, "Toward Choice-Theoretic Foundations for Behavioral Welfare Economics", *The Foundations of Positive and Normative Economics*, A. Schotter and A. Caplin (Eds.).

Beshears, John, Choi, James J., Laibson, David I. and Madrian, Brigitte C., 2006, "The Importance of Default Options for Retirement Savings Outcomes: Evidence from the United States", *NBER Working Paper Series*, Vol. w12009, pp. -, 2006. Available at SSRN: http://ssrn.com/abstract=881243

Bossert, W and Y. Sprumont, 2002, "Non-Deteriorating Choice", *mimeo*, Université deMontréal

Camerer, Colin, Samuel Issacharoff, George Loewenstein, Ted O'Donoghue and Matthew Rabin, 2003, "Regulation for Conservatives: Behavioral Economics and the Case for 'Asymmetric Paternalism"', *University of Pennsylvania Law Review*, 1151(3), 1211-1254

Caplin, A., and M. Dean, 2008, "Search, Choice and Revealed Preference", *Working Paper,* New

York University

Choi, James, David Laibson, Brigitte Madrian, and Andrew Metrick, 2004, "For Better or For Worse: Default Effects and 401(k) Savings Behavior", In David Wise, ed., *Perspectives in the Economics of Aging,* Chicago: University of Chicago Press: pp. 81-121

Coursey, D. L., J. L. Hovis, and W. D. Schulze, 1987, "The Disparity Between Willingness to Accept and Willingness to Pay Measures of Value" *Quarterly Journal of Economics* 102, pp. 679–690

Gale, William G, Mark J. Iwry, and Peter R. Orszag, 2005, "The Automatic 401(k): A Simple Way to Strengthen Retirement Savings" *The Retirement Security Project*

Giraud, R., 2004,"Reference-Dependent Preferences: Rationality, Mechanism and Welfare Implications", *mimeo*, Universit e Paris I.

Halpern S. D., P.A. Ubel, D. A. Asch, 2007, "Harnessing the Power of Default Options to Improve Healthcare" *New England Journal of Medicine*; 357:1340-44.

Hartman, R., M. Doane and C.K. Woo, 1991, "Consumer Rationality and the Status Quo", *Quarterly Journal of Economics,* 106, pp. 141–162

Herne, K., 1998, "Testing the Refence-Dependent Model: An Experiment on Asymmetrically Dominated Reference Points" *Journal of Behavioral Decision-Making*, 11, 181-192.

Iyengar, S., G. Huberman, and W. Jiang, 2004, "How Much Choice is Too Much?" *Contributions to 401(k) Retirement Plans.* Oxford University Press.

Iyengar, S. S., M. R. Lepper, 2000,."When Choice is Demotivating: Can One Desire Too Much of a Good Thing?" *Journal of Personality and Social Psychology*, 79, 995-1006

Johnson, Eric J and Daniel G. Goldstein, 2003, "Do Defaults Save Lives?" *Science,* 302: 1338–1339

Johnson, E., J. Hershey, J. Meszaros, and H. Kunreuther, 1993, "Framing, Probability Distortions,and Insurance Decisions", *Journal of Risk and Uncertainty*, 7, 35-53

Kahneman, D., J. L. Knetsch and R. H. Thaler, 1990 "Experimental Tests of the Endowment Effect and the Coase Theorem" *Journal of Political Economy* 98 6, pp. 1325–1348

Kempf, Alexander and Stefan Ruenzi, 2006,"Status Quo Bias and the Number of Alternatives: An Empirical Illustration from the Mutual Fund Industry", *Journal of Behavioral Finance,* 7:4,204-213

Koszegi, B. and M. Rabin, 2006, "A Model of Reference-Dependent Preferences", *Quarterly Journal of Economics*, 121(4), 1133-1165

—, 2007, "Reference-Dependent Risk Attitudes" *American Economic Review,* 97(4): 1047–1073

Knetsch, J.L., 1989, "The Endowment Effect and Evidence of Non-Reversible Indifference Curves", *American Economic Review,* 79 5, pp. 1277–1284

Knetsch, J.L. and J.A. Sinden, 1984, "Willingness to Pay and Compensation Demanded: Experimental Evidence of an Unexpected Disparity in Measures of Value", *Quarterly Journal of Economics*, 99(3), 507-521

List, John A, 2003, "Does Market Experience Eliminate Market Anomalies?", *Quarterly Journal of Economics,* 118(1), 41-71.

Loewenstein, G and E. Haisley, 2008, "The Economist as Therapist: Methodological Ramifications of 'Light' Paternalism", *The Foundations of Positive and Normative Economics*, A. Schotter and A. Caplin (Eds.).

Madrian, B. and D. Shea, 2001, "The Power of Suggestion: Inertia in 401(k) Participation and Savings Behavior", *Quarterly Journal of Economics*, 116, 1149-1187

Masatlioglu, Y. and E. A. Ok, 2005, "Rational Choice with Status-Quo Bias", *Journal of Economic Theory*, 121, 1-29

—, 2007, "Reference-Dependent Procedural Decision Making", *Working Paper*, New York University

Masatlioglu, Y and N. Uler, 2008, "Understanding the Reference Effect", *Working Paper*, University of Michigan

Moshinsky, A., and M. Bar-Hillel, 2005, "Loss Aversion and the Status-Quo Label Bias", *Working Paper*, Hebrew University

Ok E.A., 2002, "Utility Representation of an Incomplete Preference Relation", *Journal of Economic Theory*, 104, 429-449

Payne, J. W., J. R. Bettman, and E. J. Johnson, 1993, "The Adaptive Decision-Maker", Cambridge University Press

Patel, J., R. Zeckhauser, and D. Hendricks, 1991 "The Rationality Struggle: Illustrations from Financial Markets", *American Economic Review Papers and Proceedings*, 1991, pp. 232-236

—, 1994, "Investment Flows and Performance: Evidence from Mutual Funds, Cross-Border Investments, and New Issues", In R. Sato, R.M. Levich, and R.V.Ramachandran, eds., *Japan, Europe, and International Financial Markets: Analytical and Empirical Perspectives.* Cambridge, U.K.: Cambridge University Press, pp. 51–72

Plott, Charles R. and Kathryn Zeiler, Kathryn, 2005, "The Willingness to Pay/Willingness to Accept Gap, the Endowment Effect, Subject Misconceptions and Experimental Procedures for Eliciting Valuations" *American Economic Review* 95(3), 530-545

Ritov, I. and J. Baron, J., 1992, "Status-Quo and Omission Biases", *Journal of Risk and Uncertainty*, 5, 49-61

Roca, M., R. M. Hogarth, and A. J. Maule, 2006, "Ambiguity Seeking as a Result of the Status Quo Bias", *Journal of Risk and Uncertainty*, 72 (3), 175–194.

Rubinstein, Ariel and Lin Zhou, 1999, "Choice Problems with a 'Reference' Point", *Mathematical Social Sciences*, Elsevier, vol. 37(3), pages 205-209

Sagi, J. 2006, "Anchored Preference Relations", *Journal of Economic Theory*, 130(1), 283-295

Samuelson, W. and R. Zeckhauser, 1988, "Status Quo Bias in Decision Making", J*ournal of Risk and Uncertainty*, 1, 7-59

Schweitzer, M., 1994, "Disentangling Status Quo and Omission Effects: Experimental Analysis", *Organizational Behavior and Human Decision Processes*, 58(3), 457-476

Shafir, E., I. Simonson, and A. Tversky,1993, "Reason-Based Choice", *Cognition*, 49, 2, 11-36.

Tapki, I., 2007, "Revealed Incomplete Preferences under Status-Quo Bias", *Mathematical Social Sciences*, Vol. 53, 274-283

Thaler, Richard H. and Cass R. Sunstein, 2003, "Libertarian Paternalism is not an Oxymoron", *Conference Series; [Proceedings], Federal Reserve Bank of Boston*

Tversky, A. and D. Kahneman, 1991, "Loss Aversion in Riskless Choice: A Reference-Dependent Model", *Quarterly Journal of Economics*, 106, 1039-1061

Tversky, A., E. Shafir, E., 1992, “Choice Under Conflict: The Dynamics of Deferred Decision”, *Psychological Science,* 3 (6), 358-361

Tyson, C., 2008, “Cognitive Constraints, Contraction Consistency, and the Satisficing Criterion”, *Journal of Economic Theory,* 138 51

A Proofs

In this appendix I provide proofs of the lemmas and propositions in the paper.

A.1 Proof of Lemma 1

The lemma states:

For any choice correspondence $C : \mathcal{C}(X) \rightarrow \mathcal{X}$ satisfying axioms D2-D4 there exists a preference relation $\succeq$ with a transitive completion $\trianglerighteq$ such that:

1. $Z \in \mathcal{N}$ if and only if $\{x \in Z | x \succeq y \text{ for all } y \in Z\}$ is non-empty
2. $\bar{C}(Z) = \{x \in Z | x \succeq y \text{ for all } y \in Z\}$ for all $Z \in \mathcal{N}$
3. $C(Z, \Diamond) = \{x \in Z | x \trianglerighteq y \text{ for all } y \in Z\}$ for all $Z \in \mathcal{X}$

Proof

First, note that WARP holds for NSD sets: For $Z, Z' \in N$, $x, y \in Z \cap Z'$ then $x \in \bar{C}(Z)$, $y \in \bar{C}(Z')$ implies $x \in \bar{C}(Z')$. This follows from the fact that, if $Z, Z' \in \mathcal{N}$, then $x \in \bar{C}(Z)$**,** $y \in \bar{C}(Z')$ implies that $x \in C(Z, \Diamond)$, $y \in C(Z', \Diamond)$, which, by D4 implies that $x \in C(Z', \Diamond)$ qand so $x \in \bar{C}(Z')$. I call this result **NSD WARP.**

Next, define the following two relations

$$
\begin{aligned}
x &\succeq y \text{ iff } \{x, y\} \in \mathcal{N} \text{ and } x \in \bar{C}(\{x, y\}) \\
x &\trianglerighteq y \text{ iff } x \in C(\{x, y\}, \Diamond)
\end{aligned}
$$

I next prove the following claims

1. $\succeq$ **is a preference relation.** First I show that $\succeq$ is transitive. If $x \succeq y$ and $y \succeq z$ then this implies that $\{x, y\} \in \mathcal{N}$, $\{y, z\} \in \mathcal{N}$ and that $y \in \bar{C}(y, z)$. By D2, this implies that $\{x, y, z\} \in \mathcal{N}$. Furthermore, $x \in \bar{C}(\{x, y, z\})$ by NSD WARP: as $\bar{C}(\{x, y, z\})$ is non empty, $y \in \bar{C}(\{x, y, z\})$ implies $x \in \bar{C}(\{x, y, z\})$ and $z \in \bar{C}(\{x, y, z\})$ implies $y \in \bar{C}(\{x, y, z\})$. This, by D3, implies that

$\{x, z\} \in \mathcal{N}$ and, by NSD WARP, $x \in \bar{C}(\{x, z\})$. By definition, this implies $x \succeq z$. That $\succeq$ is reflexive follows immediately.

2. $\trianglerighteq$ **is a complete extension of** $\succeq$. The fact that $\trianglerighteq$ is complete follows from the fact that $C(., \Diamond)$ is non-empty. That $\trianglerighteq$ is an extension of $\succeq$ is shown as follows

$$\begin{aligned} x &\succeq y \Rightarrow \\ x &\in \bar{C}(\{x, y\}) \Rightarrow \\ x &\in C(\{x, y\}, \Diamond) \Rightarrow \\ x &\trianglerighteq y \end{aligned}$$

furthermore

$$\begin{aligned} x &\succ y \Rightarrow \\ y &\notin \bar{C}(\{x, y\}) \Rightarrow \\ y &\notin C(\{x, y\}, \Diamond) \Rightarrow \\ & x \triangleright y \end{aligned}$$

3. $Z \in \mathcal{N}$ **if and only if** $\{x \in Z | x \succeq y \text{ for all } y \in Z\}$ **is non-empty**. Say $Z \in \mathcal{N}$, and consider any $x \in \bar{C}(Z)$. By D3, this implies that $\{x, y\} \in \mathcal{N}\ \forall\ y \in Z$. Furthermore, by NSD WARP, $x \in \bar{C}(\{x, y\})\ \forall\ y \in Z$ and so $x \succeq y$ for all $y \in Z$. Now say that, for some Z, there exists $x \in Z | x \succeq y\ \forall\ y \in Z$. This implies that $\{x, y\} \in \mathcal{N}$ and $x \in \bar{C}(\{x, y\})\ \forall\ y \in Z$. By D2, this implies that $Z \in \mathcal{N}$

4. $\forall\ Z \in \mathcal{N}$, $\bar{C}(Z) = \{x \in Z | x \succeq y \text{ for all } y \in Z\}$. Let $x \in \bar{C}(Z)$. By D3, this implies that $\{x, y\} \in \mathcal{N}\ \forall\ y \in Z$. Furthermore, by NSD WARP, $x \in \bar{C}(\{x, y\})\ \forall\ y \in Z$, implying $x \succeq y\ \forall\ y \in Z$. Now, say $x \succeq y\ \forall\ y \in Z \in \mathcal{N}$,. This implies that $x \in \bar{C}(\{x, y\})\ \forall\ y \in Z$. By NSD WARP, this implies that $x \in \bar{C}(Z)$

5. $C(Z, \Diamond) = \{x \in Z | x \trianglerighteq y \text{ for all } y \in Z\}\ \forall\ Z \in \mathcal{X}$. This follows directly from D4 and the definition of $\trianglerighteq$.

A.2 Proof of Proposition 1:

The proposition states:

A choice correspondence $C : \mathcal{C}(X) \rightarrow \mathcal{X}$ satisfies axioms D1-D4 if and only if it admits a CDA representation

Proof

I first show that the axioms imply the representation. As D2-D4 hold, by lemma 1 there exists preference relation $\succeq$ with a transitive completion $\trianglerighteq$ with the properties required. If $\{x \in Z|x \succeq y \ \forall \ y \in Z\}$ is non empty then $Z \in \mathcal{N}$ and $C(Z,s) = \{x \in Z|x \succeq y \ \forall \ y \in Z\} \ \forall \ s \in Z$. If $\{x \in Z|x \succeq y \ \forall \ y \in Z\}$ is empty, then $Z \notin \mathcal{N}$. Axiom D1 establishes that, $\forall \ Z \in \mathcal{X}/\mathcal{N}$, $C(Z,s) \in \{C(Z,\Diamond), s\}$. Define the mapping $T : \mathcal{X} \rightarrow \mathcal{X}$ as follows:

$$
\begin{aligned}
T(Z) &= 0 \text{ if } Z \in \mathcal{N} \\
&= \{z \in Z|C(Z,z) = C(Z,\Diamond)\} \text{ otherwise}
\end{aligned}
$$

Notice that this implies that $T(Z)$ is a strict subset of Z, as if $C(Z,z) = C(Z,\Diamond) \ \forall \ z \in Z$, then $Z \in \mathcal{N}$.

I claim that the relations $\succeq$, $\trianglerighteq$ and the mapping T form a Conflict Decision Avoidance representation. To see this, note the following:

- By lemma 1, $\succeq$ is a preference relation and $\trianglerighteq$ is a transitive completion of $\succeq$. As is shown above, $T(Z)$ is a strict subset of Z.
- For any $\forall \ (Z,s) \in \mathcal{C}(X)$
  - By lemma 1, if $\{x \in Z|x \succeq y \ \forall \ y \in Z\}$ is non-empty, then $C(Z,s) = \{x \in Z|x \succeq y \ \forall \ y \in Z\}$
  - If $\{x \in Z|x \succeq y \ \forall \ y \in Z\}$ is empty, and $s \in Z/T(Z)$, then by construction $C(Z,s) \neq C(Z,\Diamond)$. Thus by D1, it must be that $C(Z,s) = s$
  - If $\{x \in Z|x \succeq y \ \forall \ y \in Z\}$ is empty, and $s \in T(Z)$, by construction $C(Z,s) = C(Z,\Diamond)$, and by lemma 1$\{x \in Z|x \trianglerighteq y \ \forall \ y \in Z\}$
- If, $x \in T(Z)$ and $x \neq y \in C(Z,x)$, then, by D3, it must be the case that $\{x,y\} \in \mathcal{N}$. Furthermore,

by D1, it must be the case that $y \in C(Z, \lozenge)$. D4 therefore implies that $y = C(\{x, y\}, \lozenge)$, and so $y = C(\{x, y\}, x)$, implying $y \succeq x$

Next I show that the representation implies the axioms: This proof will rest on the claim that, if $x \in C(Z, y)$ then $x \succeq y$. One can see this by considering two cases. First, if $\{x \in Z | x \succeq y \ \forall \ y \in Z\}$, is non-empty, then

$$C(Z, y) = \{x \in Z | x \succeq y \ \forall \ y \in Z\}$$

and so $x \in C(Z, y)$ implies $x \succeq y$. Second, if $\{x \in Z | x \succeq y \ \forall \ y \in Z\}$ is empty, then the fact that $y \neq x \in C(Z, y)$ implies that $y \in T(Z)$, and so $x \succeq y$.

- **D1: Limited Status Quo Dependence:** Either $\{x \in Z | x \succeq y \ \forall \ y \in Z\}$ is non empty, in which case $C(Z, s) = C(Z, \lozenge) \ \forall \ s$, or it is empty, in which case $C(Z, s) = s$ if $s \notin T(Z)$ or $C(Z, s) = C(Z, \lozenge)$ if $s \in T(Z)$.

- **D2: NSD Expansion:** I need to show that, $\forall \ Z, Z' \in \mathcal{N}$, $\bar{C}(Z) \cap Z' \neq \varnothing$ implies that $Z \cup Z' \in N$. If $Z \in \mathcal{N}$, then $z \in \bar{C}(Z)$ implies that $z \in C(Z, y) \ \forall \ y \in Z$. As is shown above, this implies that $z \succeq y \ \forall \ y \in Z.$. Let $x \in \bar{C}(Z) \cap Z'$. As $Z' \in \mathcal{N}$, then $\exists \ y \in Z'$ such that $y \succeq z \ \forall \ z \in Z'$, and so $y \succeq x$. Furthermore $x \succeq w \ \forall \ w \in Z$. Thus, by the transitivity of $\succeq$, $y \succeq v \ \forall \ v \in Z \cup Z'$. This implies that $\{x \in Z | x \succeq y \ \forall \ y \in Z \cup Z'\}$ is non-empty, and so $C(Z \cup Z', s) = \{x \in Z | x \succeq y \ \forall \ y \in Z \cup Z'\}$ $\forall \ s \in Z \cup Z' \cup \lozenge$, and so $Z \cup Z' \in \mathcal{N}$.

- **D3: NSD Contraction:** It is necessary to show that If, for some $Z \in \mathcal{X}$ $\exists$, $x \in Z$, such that, $\forall \ y \in Z$, $\exists \ Z' \supset Z$ such that $x \in C(Z', y)$ then $Z \in \mathcal{N}$. As is shown above $x \in C(Z', y)$ implies that $x \succeq y$. Thus, if $y \in Z$, $\exists \ Z' \supset Z$ such that $x \in C(Z', y)$, it must be the case that $x \succeq y$ $\forall$ $y \in Z$, implying $C(Z, s) = \{x \in Z | x \succeq y \ \forall \ y \in Z\} \ \forall \ s \in Z \cup \lozenge$, and so $Z \in \mathcal{N}$.

- **D4: No Status Quo WARP:** This follows directly from the fact that $\forall \ Z \in \mathcal{N}$, $C(Z, \lozenge) = \{x \in Z | x \trianglerighteq y \ \forall \ y \in Z\}$.

A.3 Proof of Proposition 2

The proposition states:

A choice correspondence $C : \mathcal{C}(X) \rightarrow \mathcal{X}$ satisfies axioms D1, D3 and D4 if and only if it admits a IODA representation

Proof

I first construct a set of nested relations $\trianglerighteq$ and $\succeq_z$, then show that they have the necessary properties. Define $\trianglerighteq$ as

$$x \trianglerighteq y \text{ if and only if } x \in C(\{x, y\}, \lozenge).$$

By axiom D4 $\trianglerighteq$ is a complete preference relation, and that it represents the choices in cases where there is no status quo. For each $Z \in \mathcal{X}$, define $\succeq_Z$ as

$$\begin{aligned} x &\succeq \ _Z y \text{ if } x \in C(Z', y) \text{ for some } Z' \supset Z \\ \text{or } x &= y \end{aligned}$$

$\succeq_Z$ is clearly reflexive. To see that it is transitive, say that $\{x, y, w\} \subset Z$ and $x \succeq_Z y \succeq_Z w$. This implies that there are two sets $Z' \supset Z$ and $Z'' \supset Z$ such that

$$\begin{aligned} x &\in C(Z', y) \\ y &\in C(Z'', w) \end{aligned}$$

Assuming that $x \neq y$ and $y \neq w$ (otherwize transitivity is trivial), this implies that $C(Z', y) \neq y$ and $C(Z'', w) \neq w$. By D1, this implies that $C(Z, y) = C(Z', \lozenge)$ and $C(Z'', w) = C(Z'', \lozenge)$. However, as x and y exist in both Z' and Z'', then D4: No Status Quo WARP implies that $x \in C(Z'', \lozenge) = C(Z'', w)$, and so $y \succeq_Z w$.

Next I show that for any $Z \in \mathcal{X}$, $\trianglerighteq$ restricted to Z is an extension of $\succeq_Z$. To see this, note that for $x \neq y$, $x \succeq_Z y$ if and only if x is chosen when y is the status quo in some set. By D1, this implies that x is chosen over y in the same set when there is no status quo, implying that $x \trianglerighteq y$. Moreover, if y is also chosen over x when x is the status quo, this implies that $y \trianglerighteq x$. By D4 and D1, this implies that, in any choice set in which x and y are available, and the status quo is not chosen, then if x is selected then y must be also. Thus, if $x \succeq_Z y$, $x \trianglerighteq y$ and $y \trianglerighteq x$, then it implies that $y \succeq_Z x$, confirming that $\trianglerighteq$ is an extension of $\succeq_Z$

Next I show that, for $Z \subset W$, it is the case that $\succeq_Z$ is an extension of $\succeq_W$ restricted to Z. The fact that $x \succeq_W y$ implies that $x \succeq_Z y$ follows immediately from the construction of the preference relations, and the fact that any superset of W is also a superset of Z. To see that $x \succ_W y$ implies that $x \succ_Z y$ note that it was shown above that $y \succ_Z x$ implies that $y \trianglerighteq x$ and so if x is chosen over some status quo, and y is available, then y will be chosen also, implying $y \succ_Z x$

Finally, define $T : \mathcal{X} \rightarrow \mathcal{X}$ as

$$\begin{aligned} T(Z) &= \varnothing \text{ if } Z \in \mathcal{N} \\ &= \{x \in Z | C(Z, x) \neq x\} \text{ otherwise,} \end{aligned}$$

I now show that these preference relations and the mapping T describe choice in the appropriate way. This requires showing four things:

1. $C(Z, s) = \{x \in Z | x \succeq_Z y \ \forall \ y \in Z\}$ if such a set is non-empty. Say that $\{x \in Z | x \succeq_Z y \ \forall \ y \in Z\}$ is non empty. This implies that, there exists some x such that, for all $y \in Z$ there exists $Z' \supset Z$ such that $x \in C(Z', y)$ for some $Z' \supset Z$. By D3: NSD Contraction, this implies that $Z \in \mathcal{N}$, and so $C(Z, s) = C(Z, \lozenge) . \forall \ s \in Z \cup \lozenge$. Moreover, by the definition of $\succeq_Z$, if $x \in \bar{C}(Z)$ then $x \succeq_Z y$ $\forall \ y \in Z$. If it were the case that $x \succeq_Z y$ for some $x \in Z / \bar{C}(Z)$ and $y \in \bar{C}(Z)$ this would imply that $x \trianglerighteq y$, violating the fact that $\trianglerighteq$ represents $C(Z, \lozenge)$
2. $C(Z, s) = s$ if $\{x \in Z | x \succeq_Z y \ \forall \ y \in Z\}$ is empty and $s \in Z / T(Z)$. By the construction of $\succeq_Z$, if $\{x \in Z | x \succeq_Z y \ \forall \ y \in Z\}$ is empty then $Z \notin \mathcal{N}$, and so by definition of $T(Z)$ then if $s \in Z / T(Z)$ $C(Z, s) = s$
3. Otherwise $C(Z, s) = \{x \in Z | x \trianglerighteq y \ \forall \ y \in Z\}$. This follows directly from D1: Limited Status Quo Dependence and the fact that $\trianglerighteq$ represents $C(., \lozenge)$
4. $x \in T(Z)$ and $y \in C(Z, x)$ then $y \succeq_Z x$ This follows from the definition of $\succeq_Z$

Next I have to show that the model implies the axioms:

- **D1: Limited Status Quo Dependence**: There are three possibilities
  - $C(Z, s) = \{x \in Z | x \succeq_Z y \ \forall \ y \in Z\}$ if such a set is non-empty, in which case $C(Z, s) = C(Z, \lozenge) \ \forall \ s$
  - otherwise $C(Z, s) = s$ if $s \in Z / T(Z)$

– otherwise $C(Z,s) = \{x \in Z | x \trianglerighteq y \; \forall \; y \in Z\} = C(Z, \Diamond)$

- **D3: Limited Status Quo Dependence**. If, for some $x, y \in Z'$, $x \in C(Z', y)$, it must be the case that, either $\{x \in Z | x \succeq_{Z'} y \; \forall \; y \in Z'\}$, or $y \in T(Z')$, in which case $x \succeq_{Z'} y$. Thus, if for some Z, $\exists \; x \in Z$ such that $\forall \; y \in Z'$, exists $Z' \supset Z$ $x \in C(Z', y)$ then $x \succeq_{Z'} y$ for some superset of Z. As the preference relations are nested, this implies that $\{x \in Z | x \succeq_Z y \; \forall \; y \in Z\}$, and so $C(Z,s) = \{x \in Z | x \succeq_Z y \; \forall \; y \in Z\}$ and $Z \in \mathcal{N}$

- **D4: No Status Quo WARP:** This follows directly from the fact that $C(., \Diamond)$ is representable by $\trianglerighteq$.

A.4 Proof of Proposition 3:

The proposition states:

A choice correspondence $C : \mathcal{C}(X) \rightarrow \mathcal{X}$ admits a Conflict Decision Avoidance representation if and only if there exists a positive integer n, a function $u : X \rightarrow \mathbb{R}^n$ and a strictly increasing map $f : u(X) \rightarrow \mathbb{R}$ such that

1. $\forall \; \{Z, s\} \in \mathcal{C}(\mathcal{X})$, choice is defined by

   (a) $C(Z,s) = \arg\max_{x \in Z} \mathbf{u}(x)$ if $\arg\max_{x \in Z} \mathbf{u}(x) \neq \varnothing$

   (b) otherwise $C(Z,s) = s$ if $s \in Z/T(Z)$

   (c) otherwise $C(Z,s) = \arg\max_{x \in Z} f(u(x)) \; \forall \; Z \in \mathcal{X}$

2. If, for some $Z \in \mathcal{X}$, $x \in T(Z)$ and $x \neq y \in C(Z, x)$, $u(y) \geq u(x)$

Proof

To proof requires us to show that a preference relation $\succeq$ with a transitive completion $\trianglerighteq$ can be represented by a positive integer n, a function $u : X \rightarrow \mathbb{R}^n$ and a strictly increasing map $f : u(X) \rightarrow \mathbb{R}$, in the sense that $x \succeq y$ if and only if $u(x) \geq u(y)$[46] and $x \trianglerighteq y$ if and only if $f(u(x)) \geq f(u(y))$. Standard results from decision theory [e.g. Ok, 2002], tell us that there exists a vector-valued utility representation of any preference relation, and that any complete preference relation on a finite set can

[46] which, for the vector-valued utility function u, means that $u_i(x) \geq u_i(y) \; \forall \; i \in \{1, ..., n\}$

be represented by a function $v : X \to \mathbb{R}$. Define the function $f : u(X) \to \mathbb{R}$ as $f(u(x)) = v(x) \; \forall \; x \in X$. The fact that $\trianglerighteq$ is a completion of $\succeq$ guarantees that f is strictly increasing, as

$$\begin{aligned} u(x) &> u(y) \Rightarrow \\ x &\succ y \Rightarrow \\ x \vartriangleright y &\Rightarrow \\ v(x) &> v(y) \Rightarrow \\ f(u(x)) &> f(u(y)) \end{aligned}$$

The converse statement is obviously true, defining $\succeq$ as $x \succeq y$ if and only if $u(x) \geq u(y)$ and $\trianglerighteq$ as $x \trianglerighteq y$ if and only if $f(u(x)) \geq f(u(y))$.The fact that $\trianglerighteq$ is a completion of $\succeq$ stems from the fact that the map f is strictly increasing.

B Extension to Infinite Choice Spaces

TO BE COMPLETED

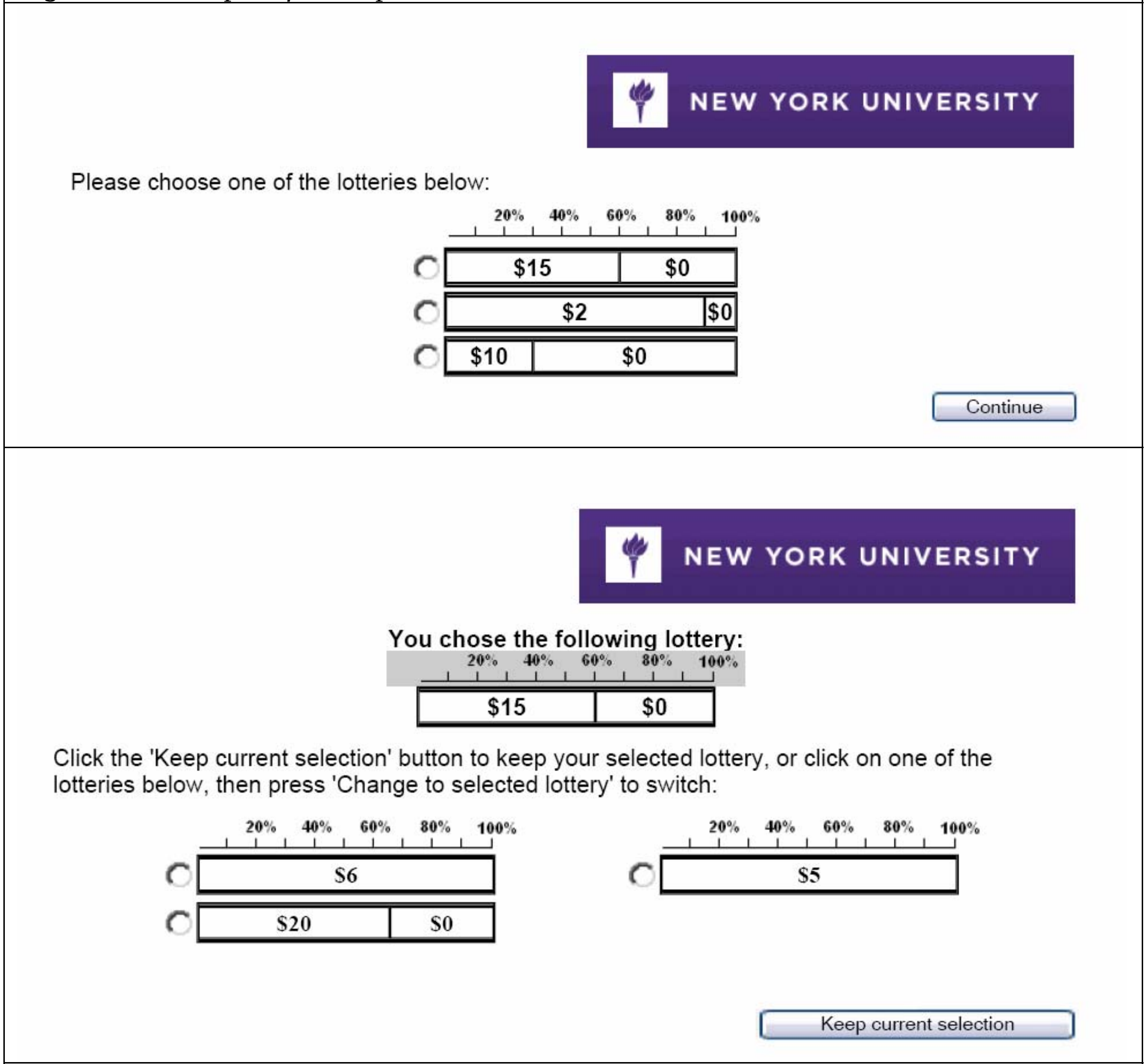
C Instructions

TO BE COMPLETED

D Lotteries Used

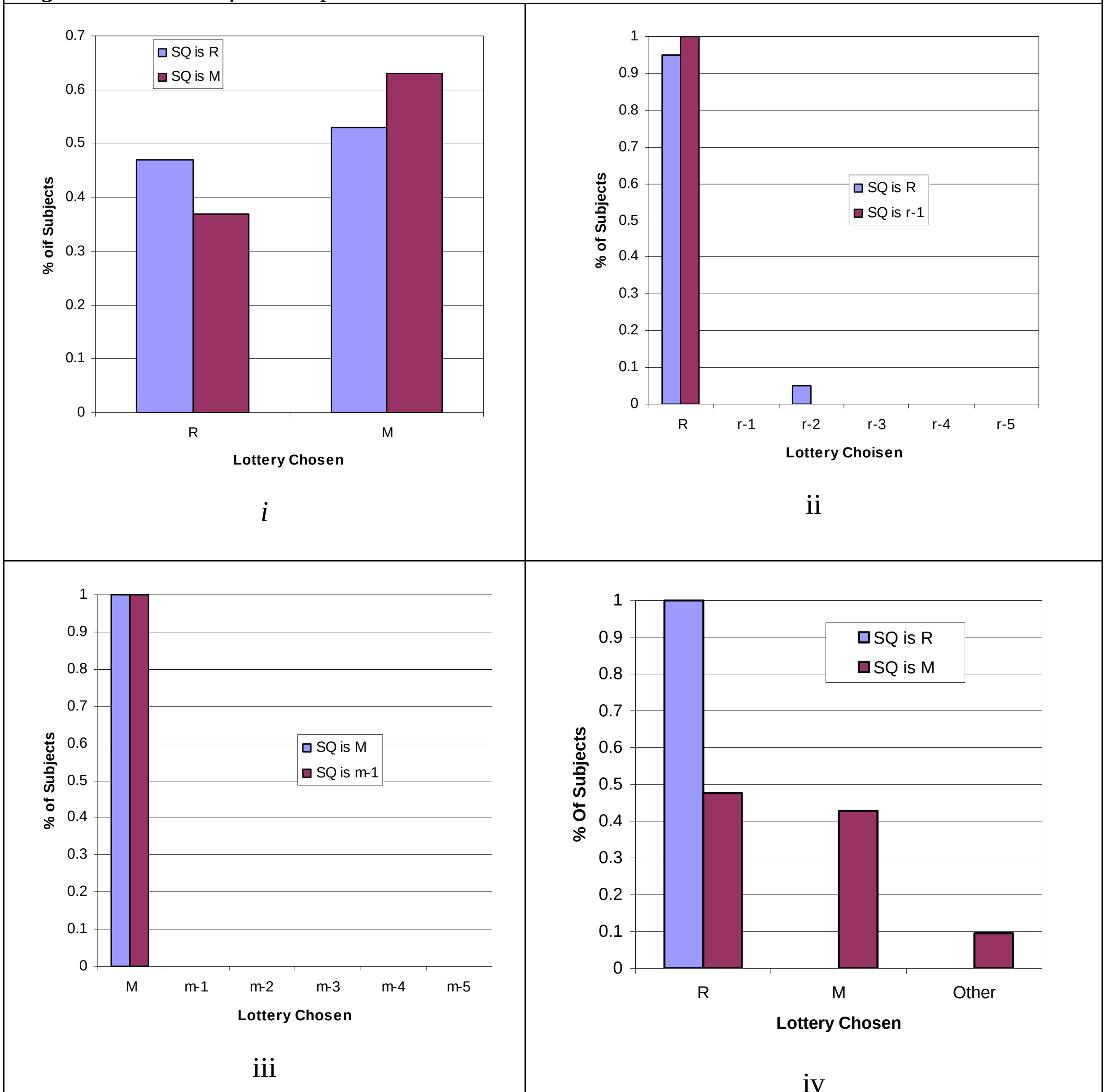
TO BE COMPLETED

Figure 1 – Example of An Experimental Round



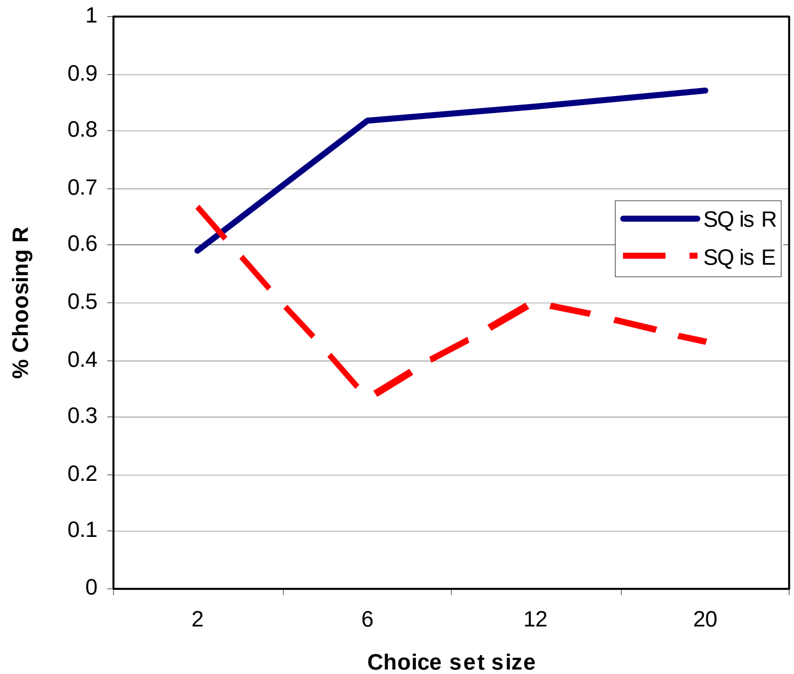
An example of the screens displayed to experimental subjects. The top panel shows the first stage of a choice round, in which subjects are asked to choose between a ‘target’ lottery (in this case 60% chance of $15, 40% chance of $0) and two dummy lotteries. Their choice in the first stage becomes the status quo in the second stage (bottom panel), in which the subject can either stick with their choice or exchange it for another lottery.

Figure 2 - Results from Experiment 2a



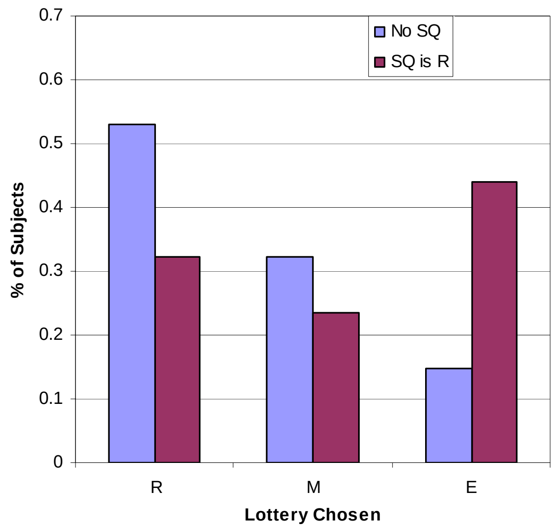
These 4 panels show the results of experiment 2a. Each panel shows the proportion of subjects choosing each option under different status quos. Panel i shows choices from the set {R,M}with status quos R and M. Panel ii shows choices from the set {R,r1..r5} for status quos R and r1. Panel iii shows choices from the set {M,m1,..,m5} for the status quos M and m1. Panel iv shows choices from the set {R,M,r1..r5, m1,..,m5} for the status quos R and M.

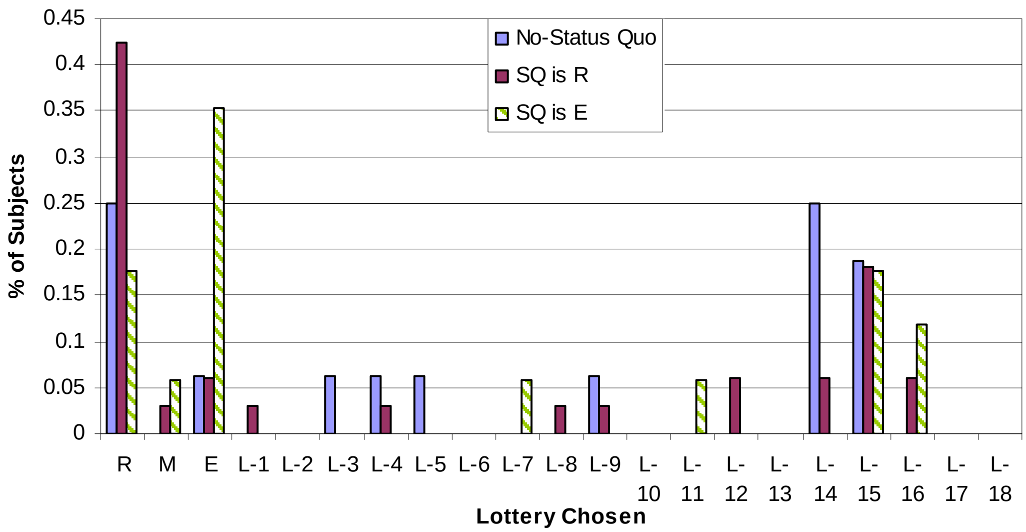
Figure 3 – Results from Experiment 2b



The graph shows the results from experiment 2b. The blue line shows the proportion of people choosing R from each size choice set when R is the status quo. The red line shows the proportion of people choosing R from each choice set when E is the status quo

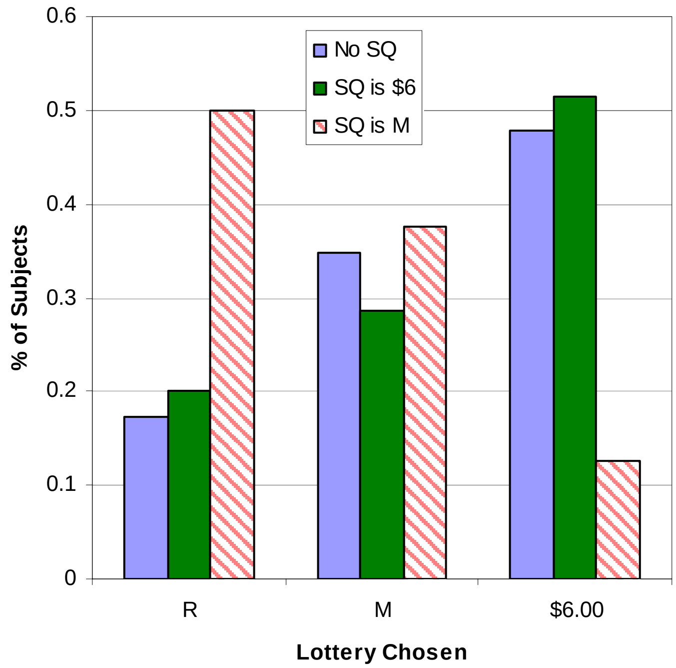
Figure 4 – Results from Experiment 3a and 3b





These two panels show the results of experiment 3a (top panel) and 3b (bottom panel). The top panel shows choices from the set {R,M,E} with no status quo and the status quo R. The bottom panel shows choices from a set of 20 lotteries, including R, M and E, with no status quo, a status quo of R and a status quo of E.

Figure 4 – Results from Experiment 3c



Results from Experiment 3c. The choices made from the set {R, M,$6.00} with no status quo, a status quo of $6 and a status quo of M

Table 1: Results of Experiment 1			
	ISQIV	Other IIA Violation	No Violation
Number	13	5	17
Proportion	37%	14%	49%
Random Benchmark	*6%*	*56%*	*38%*
Logistic Benchmark	*17%*	*30%*	*52%*
No Status Quo	*12%*	*31%*	*56%*

Results from experiment one. Subjects are categorized into three groups: those that violate the independence of irrelevant alternatives (IIA) only by switching to the status quo in larger choice sets, those that violate IIA in other ways, and those that do not violate IIA. The first two rows show the number and proportion of subjects in each group. The third row shows the expected proportion of subjects in each group if choices were made randomly. The fourth row shows the proportion of subjects in each group if choices were made according to a logistic choice function, with probabilities equal to the population frequency of choices in the size 20 choice set. The final row shows the proportion of subjects in each category when there is no status quo (here, the first category is the proportion of people who violate WARP only by switching to the lottery that was the status quo in the previous treatment.