Shortlisting

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Abstract

We study the properties of decisions made by committees who select alternatives by constructing shortlists. We find that even when committees are themselves rational, such procedures may not give rise to rational choices. A necessary condition for this to occur is disagreement between committees. However, we delimit substantially the extent of 'irrationality' that these procedures allow.

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1 Introduction

Suppose that your department has a job opening. Will it make a choice straightaway from the pool of applicants? Almost surely not. Rather, it will first create a *shortlist.* In the simplest case, a committee will screen out some applicants in the first stage, and a second committee (which may or may not coincide with the first) will make a choice in the second stage. Indeed, many decisions by businesses, organizations and individuals are made in this way. Shortlists are typical of recruiting decisions, but there are several other examples, such as the awarding of public contracts or the commissioning of works of art. A less obvious example concerns decisions by individuals, who may effectively implement 'mental shortlists' when choosing among alternatives[1].

The question we ask in this paper is: how rational are decisions based on shortlists? Here we are not interested in *how* a committee arrives at a given selection, i.e. in how individual members' preferences are aggregated. We simply assume that such aggregated preferences exist. Does the ensuing selection process satisfy the standard consistency properties of rational choice?[2]

For example, suppose that Al is recruited when the applicants are Al, Bill and Chris, but Bill is selected when the applicants are just Al and Bill. This strikes one as inconsistent. In particular it is a violation of the property of Independence of Irrelevant Alternatives (equivalent in this context to the Weak Axiom of Revealed Preference), whereby the choice from a larger set must remain the choice if some unchosen alternatives are discarded.

In general, do shortlisting procedures satisfy the standard properties of revealed preference theory? Do they maximize some measure of collective welfare?

Notice that the answers to these questions hinge on two features. On the one hand, they depend on the *rationality of the committees* themselves; one may expect that com-

[1] See e.g. Manzini and Mariotti [2] for a full theoretical exploration of this idea, and Mintz [4] for a specific experimental study of high-ranking US Air Force Officers.

[2] The vast research area in agenda formation and strategic voting tackles a different set of issues, such as the strategic interaction between decisions made by different committees/members in sequential voting. We eschew these issues completely.

mittees with 'irrational' aggregated preferences will produce 'irrational' decisions. On the other hand, they depend on the intrinsic properties of shortlisting as a *method of choice*. It is this latter aspect we are interested in this paper.

We imagine that the two committees (one for each stage) are able to produce strict rankings which are 'rational' in the standard economic sense: they are transitive binary relations. Of course, in practice, this is not necessarily the case. For example, a committee producing a ranking of candidates by means of majority voting over pairs of candidates may notoriously generate cyclical rankings. However, if we want to disentangle the impact on the rationality of the shortlisting method from that of the procedures used to formulate rankings *within* committees, we must rule out this possibility. One can also observe that some pressure towards within-committee consistency may emerge from debate: for example, when classifying candidates often one hears argument such as 'this candidate is better than X and worse than Y', which may lead to transitive rankings.

The two committees may, but need not, have the same membership. An example where committees are different at the two stages is when hiring occurs through recruitment consultant firms, that will typically provide a shortlist of applicants to their clients. Even when the membership of the committees is the same at the two stages, it will typically produce different rankings. The most common reasons for this are *(1)* differential information on the candidates at the two stages (for example, because of an interview at the latter stage), and *(2)* different ranking criteria. And of course, if there were no differences in the views (rankings) of the committees, there would not be any point in having a shortlist!

We accommodate all these cases by simple modelling assumptions:

- Each committee has a strict transitive (though not necessarily complete) ranking on the potential pool of applicants[3];
- The shortlisting procedure leads to a definite choice whatever the actual pool of applicants.

[3] We remain agnostic as to the intepretation of the lack of strict preference (indifference or 'noncomparability').

Observe that the first feature is simply a requirement that each committee be able to *produce* a consistent ranking, as opposed to the committee being 'omniscient' regarding the set of all potential candidates who might turn up. That is, each committee might rely upon a set of criteria against which to evaluate candidates. Although the committees will be faced in practice with a specific pool of applicants, we want them to be able in principle to rank *any* pool that they may have to consider.

These are our main findings:

1. The rationality of the committees does not imply the rationality of the decisions. In particular, cycles and 'menu dependence' can arise.

2. Violations of rationality can only arise if the two committees disagree, in that they have opposite rankings of at least two candidates.

3. The selection process preserves some rationality attributes, by excluding certain types of menu dependence.

In the next section we spell out the model. We devote one section each to the rationality and irrationality properties of shortlisting procedures. Section 5 concludes.

2 The Model

There is a universe A of potential 'applicants'. We choose our terminology to focus on the recruiting example, but all the other examples mentioned in the introduction are accommodated in the model. Whatever *actual* pool of applicants presents itself, it is first screened by a committee C_1 which draws a shortlist. Then a second committee, C_2, makes the final choice of applicant from the shortlist (to avoid technical issues which are peripheral to the main thrust of this paper, we focus on situations where a unique applicant must be selected).

Formally, the pool of actual applicants will be an element of the set, which we denote Σ, of all finite subsets S of A. The selection of each committee (either a shortlist or an applicant from the shortlist) is based on its (strict) ranking on the pool of applicants. The rankings of the two committees C_1 and C_2 are simply denoted by the name of the committee. So we write aC_ib to mean that committee C_i ranks applicant a higher than applicant b. We will indifferently use the term 'committee' to refer to both a collection of members and to its preferences. We assume that C_i is an asymmetric and transitive, not necessarily complete, binary relation on A, for $i = 1, 2$. We assume that C_1 and C_2 are such that an applicant is chosen from any pool of applicants $S \in \Sigma$.[4] The lack of a strict ranking by a committee may be interpreted either as 'indifference'[5] or just as 'inability to rank'.[6]

Let us call the procedure just described a **shortlisting procedure**.

Let $\sigma : \Sigma \to A$ denote the **selection function** resulting from the shortlisting procedure with committees C_1 and C_2. So $\sigma(S)$ is the chosen applicant from pool S. In obvious notation, we have $\{\sigma(S)\} = \max(\max(S, C_2), C_1)$.

3 The Irrationality of Shortlisting

A little thought suffices to show that shortlisting procedures may generate selection functions which are outright irrational in the standard economic sense. In particular they fail the basic test of 'revealing a preference', and (equivalently) they may generate cycles of the selection function. Note well that this happens *even when each committee is rational*, and therefore by itself generates no such inconsistency.

Say that applicant a is *revealed preferred* to applicant b if for some pool of applicants S which contains both a and b, applicant a is selected. A *selection cycle* occurs when this revealed preference is cyclical, that is there are applicants $a_1, a_2, ..., a_n$ such that each a_i is revealed preferred to a_{i+1}, $(i = 1, ..., n-1)$ and a_n is revealed preferred to a_1. If all pools where the revealed preference is expressed contain only two elements, we say that a *pairwise selection cycle* occurs.

[4] One way to guarantee this is to assume that C_2 is a complete ranking, but as this is not necessary we do not assume it (though incomplete, C_2 may be just complete enough to be decisive over all possible pairs of applicants that C_1 does not rank).

[5] In which case the lack of strict ranking will probably be transitive and the ranking-indifference relation will technically be a weak order.

[6] In which case transitivity of the 'non-ranked' relation will probably not apply, and the 'not ranked below' relation will technically be a quasiorder.

Observation A shortlisting procedure may produce selection cycles.

To see this, consider for simplicity a trivial case in which the selection cycle is pairwise. Let the pools of applicants in the cycle be $R = \{a, b\}$, $S = \{b, c\}$ and $T = \{a, c\}$ (this basic example, which is purely instrumental and not particularly interesting for the application of a shortlisting procedure, can obviously be extended to larger pools of applicants). Choose the committees so that $cC_2aC_2bC_1c$ and no other rankings are made except the one resulting from transitivity. These rankings produce a well-defined selection function, and the following pairwise selection cycle is immediately seen to emerge: $\sigma(\{a, b\}) = a$, $\sigma(\{b, c\}) = b$ and $\sigma(\{a, c\}) = c$.

A different but equivalent way of expressing this fact is to refer to the classical Weak Axiom of Revealed Preference, which embodies an idea of rationality of choice first introduced in economics by Samuelson ([6], [7]) and then by Houthakker ([1]). It says that if a is revealed preferred to b (in some pool of applicants) then b cannot be revealed preferred to a (in a different pool of applicants).[7] In other words, there can be no *menu-dependence* in the rankings of applicants implicit in choice. For future reference we state this property below together with a property that, in this context, is equivalent to it[8]:

Weak Axiom of Revealed Preference: If an applicant is selected when a given other applicant is present in the pool, then the latter applicant is never selected from a pool in which the first applicant is present. Formally: If $a = \sigma(S)$, $b = \sigma(T)$ and $b \in S$, then $a \notin T$.

Independence of Irrelevant Alternatives. If an applicant is selected from a pool, it is also selected from any sub-pool that contains that applicant. Formally: If $a = \sigma(T)$ and $a \in S \subset T$ then $a = \sigma(S)$.

From the example given earlier it is easy to check that a shortlisting procedure may lead to failures of the Weak Axiom of Revealed Preference (and of Independence of Irrelevant

[7] Samuelson and Houthakker studied this property in the context of consumer choice out of budget sets. It was Richter [5] who first based revealed preferences on purely set theoretic arguments. See Varian [11] for a recent historical survey of revealed preference theory.

[8] See e.g. Suzumura [10].

Alternatives): whatever the selection out of the pool of applicants $\{a, b, c\}$ one can find a sub-pool that contradicts the initial revealed preference.

These are rather worrying findings, because they show that which applicant is ultimately selected depends on the entire pool of actual applicants, even on those applicants who are not selected: there is *menu-dependence*.

Our first result delimits a class of rankings by committees that prevent irrational selections of this type from occurring. In particular we show that the Weak Axiom of Revealed Preference can be violated only when the two committees **strongly disagree**, that is when for two applicants a and b we have aC_1b and bC_2a. We use the term 'strongly' because - since the strict ranking is not necessarily complete - the rankings of the two committees might not coincide but still not be opposite to each other on a pair of applicants.

Proposition 1 *If the selection function violates the Weak Axiom of Revealed Preference, then the committees strongly disagree.*

Proof: We argue in two steps.
Step 1: Violations of the Weak Axiom of Revealed Preference imply a pairwise selection cycle. Recall that if the Weak Axiom of Revealed Preference is violated so is Independence of Irrelevant Alternatives. Then suppose that the selection function fails the latter, so that if an applicant a is selected from some pool S, then there exists a subpool $S' \subset S$ in which this applicant is present but is not selected, that is $a = \sigma(S)$ and $b = \sigma(S')$, where a and b are both applicants in the pool S'. Regarding the winner in the direct contest between a and b there are two possibilities. Suppose first that $\sigma(\{a, b\}) = a$. This implies that there must exist some other applicant $c \in S' \subset S$ who eliminates a in the first committee, for otherwise b could not be the winner in pool S'. But this generates an immediate contradiction, since cC_1a implies that a can never be selected from the pool S.

Consider then the alternative possibility $\sigma(\{a, b\}) = b$. Since a is selected in pool S, it must be true that *(i)* the first committee does not rank b above a (for otherwise a could not be the overall winner in S), and *(ii)* there must exist some other applicant

$s_1 \in S \backslash S'$ who eliminates b in the shortlisting of the first committee (i.e. before applicant b eliminates applicant a, who we assumed is selected in pool S), so that $s_1 = \sigma(\{b, s_1\})$ and $s_1 C_1 b$. Now if $\sigma(\{a, s_1\}) = a$ we would have generated the pairwise selection cycle $a = \sigma(\{a, s_1\})$, $s_1 = \sigma(\{b, s_1\})$ and $b = \sigma(\{a, b\})$. So suppose $\sigma(\{a, s_1\}) = s_1$. Once again, since a is selected overall out of pool S, this implies that there must be some other applicant s_2 who eliminates s_1 in the first committee, before he can eliminate the overall winner a, that is $s_2 = \sigma(\{s_1, s_2\})$ and $s_2 C_1 s_1$. Note that by the transitivity of the preferences of committee C_1 it also follows that $s_2 C_1 b$. If $\sigma(\{a, s_2\}) = a$ the pairwise selection cycle $a = \sigma(\{a, s_2\})$, $s_2 = \sigma(\{s_1, s_2\})$, $s_1 = \sigma(\{b, s_1\})$ and $b = \sigma(\{a, b\})$ would be generated. Thus let $\sigma(\{a, s_2\}) = s_2$. Continuing in this way, since S is finite we will get to a 'last' applicant s_n which is distinct from all previously considered ones (which follows from the transitivity of the preferences of committee C_1) which cannot be eliminated by any other (unless he is eliminated by a, in which case we would have generated a pairwise selection cycle). But then it could never be the case that a is the overall winner in S, since even if he made it past the shortlisting stage to committee C_2, he would be eliminated by applicant s_n.

Step 2: If there is a pairwise selection cycle, then the two committees strongly disagree.

Obviously if there exists a pairwise selection cycle there exists a 3-cycle. Let this 3-cycle be given by $a = \sigma(\{a, b\})$, $b = \sigma(\{b, c\})$, $c = \sigma(\{a, c\})$. Without loss of generality, let $a = \sigma(\{a, b, c\})$. Then it must necessarily be the case that $c C_2 a$ and not $c C_1 a$ (because *some* committee must rank c over b but it cannot be committee C_1 or the choice from the triple cannot be justified). And it must also be $b C_1 c$, since if c makes it to committee C_2 (starting from the pool $\{a, b, c\}$) it will eliminate a. So it cannot be $a C_1 b$, for otherwise by the transitivity of C_1 we would have $a C_1 c$ contradicting $c = \sigma(\{a, c\})$. Therefore $a C_2 b$, and by transitivity $c C_2 b$. This, together with $b C_1 c$, constitutes a strong disagreement between C_1 and C_2. ■

4 The Rationality Properties of Shortlisting

Starting from the negative finding of the previous section, here we study how much rationality is given up in shortlisting procedures. We will demonstrate that shortlisting procedures, though irrational, nonetheless inherit some consistency properties of the committees involved. The 'menu-dependence' highlighted above, though producing selection cycles, can still be delimited in a stark manner. We will focus on three aspects:

1) Binariness

2) Uncovered set consistency

3) The Weak Axiom of Revealed Preference

4.1 Binariness

The first consistency property we focus upon is related to another classical property of choice, namely **binariness**. It states that an applicant is ultimately selected from some pool if and only if it wins in all direct contests with the other applicants in the pool.[9] This is equivalent to the shortlisting procedure selecting an applicant from any pool so as to maximize a *binary* relation (Sen [8]), hence the terminology.[10] Obviously, the existence of such a relation is a precondition for the existence of a social welfare ordering aggregating the preferences of the two committees.

The same example used to show that the Weak Axiom of Revealed Preference is violated can be used to show that a shortlisting procedure leads to a violation of binariness. However, here we can find a weakening of this rationality requirement that does not suffer from the same problem.

The following terminology is useful:

Definition 2 *Two applicants are* ***congruent*** *on some pool of applicants if whenever one of them is selected in a direct contest over any other applicant in the pool, so is the other.*

[9] Another way of looking at this property is that the information contained in direct contests (the base relation) is sufficient on its own to determine the overall winner: once again, menu effects are excluded.

[10] See also [9] for an enlightening discussion.

*Formally: a and b, with $a, b \notin S$, are **congruent** on S if and only if for all $c \in S$:*

$$\sigma(\{a, c\}) \Leftrightarrow \sigma(\{b, c\})$$

Note that congruence is a symmetric binary relation.

If two applicants are congruent, then they are indistinguishable from one another in a given pool with respect to direct contests with other applicants. Binariness implies in particular that if an applicant is selected in a given pool, then so would an applicant congruent on the rest of the pool who were to take his place.[11] This is the property we study:

Weak Binariness. An applicant is selected from a pool if and only if any other applicant congruent on that pool is also selected. Formally: Let a and b be congruent on S. Then $a = \sigma(\{a\} \cup S) \Leftrightarrow b = \sigma(\{b\} \cup S)$.

Proposition 3 *A selection function satisfies Weak Binariness.*

Proof. By contradiction. Suppose there exists S such that a and b are congruent on S, $a = \sigma(\{a\} \cup S)$ but $b \neq \sigma(\{b\} \cup S)$. Observe that because of congruence, for all $s \in S$ it is true that $s = \sigma(\{a, s\})$ if and only if $s = \sigma(\{b, s\})$, and similarly $a = \sigma(\{a, s\})$ if and only if $b = \sigma(\{b, s\})$.

In order for a to be the selected applicant, it must be that any applicant $c \in S$ for whom $c = \sigma(\{a, c\})$ is eliminated by the first committee, for otherwise, if he made it to the second committee, then a would be eliminated by him in this committee. Consequently, for each such applicant c there must exist some other applicant $s_c \in S$ such that $s_c C_1 c$.

Since $b \neq \sigma(\{b\} \cup S)$, then there must exist at least one applicant $d \in S$ such that $\sigma(\{b, d\}) = d$. For suppose not, so that $\sigma(\{b, s\}) = b$ for all s in pool S. Then either bC_1s, or committee C_1 does not rank s and b and bC_2s. In either case no applicant eliminates b, who is then selected from $\{b\} \cup S$, a contradiction.

[11] In this context, this property also implies an appealing form of impartiality, or neutrality, requiring that the choice among a pool of applicants should be based on the relative rankings emerging from direct contests, not on the *identity* of the applicants.

Therefore, by congruence with a it must be $d = \sigma(\{a, d\})$, and by the reasoning above $s_d C_1 d$ for some $s_d \in S$, so that d can only eliminate b if $dC_1 b$. If $a = \sigma(\{a, s_d\})$, the transitivity of C_1 and $s_d C_1 d$, $dC_1 b$ would imply $s_d C_1 b$, so that $s_d = \sigma(\{b, s_d\})$, contradicting $a = \sigma(\{a, s_d\}) \Leftrightarrow b = \sigma(\{b, s_d\})$. Then it must be $s_d = \sigma(\{a, s_d\})$. But then as we saw above there must exist some $s_{s_d} \equiv s_1 \in S$ such that $s_1 C_1 s_d$. Again it cannot be that $a = \sigma(\{a, s_1\})$, for otherwise by the transitivity of C_1 we would have $s_1 C_1 b$, which generates the same contradiction as before. So it must be $s_1 = \sigma(\{a, s_1\})$. In turn, there must be $s_2 \in S$ such that $s_2 C_1 s_1$, and so on. Since S is finite, either we end up with $a = \sigma(\{a, s_n\})$ or with a C_1 cycle. In both cases we have a contradiction. This shows that $b = \sigma(\{b\} \cup S)$. ■

The proof above shows, as a particular implication, that a selection function satisfies **Condorcet Consistency**: if an applicant is selected in *all* binary contests with each other applicant in the pool (i.e. he is the *Condorcet winner*), then he must be the overall winner. We will show later (proposition 5) that in fact a selection function possesses a much stronger property of this type.

It is remarkable that Weak Binariness must hold, as another property in the same spirit does not. It may seem reasonable to require that the selection from a given pool of applicants is unchanged following the substitution of an unchosen applicant with a congruent one:

Another Binariness Property: Let a and b be two congruent applicants on S. Then $s = \sigma(\{a\} \cup S) \Rightarrow s = \sigma(\{b\} \cup S)$.

This property is not necessary for a selection function, as the following example shows. Suppose the universe of applicants is $A = \{a, b, s, s'\}$ and that preferences for committees C_1 and C_2 be as in table 1, where preferences are displayed vertically in decreasing order.

It is easy to check that these preferences generate the selection function σ below:

$$a = \sigma(\{a, b\}) = \sigma(\{a, s'\}) = \sigma(\{a, b, s'\})$$

$$b = \sigma(\{b, s'\})$$

C_1			C_2
a	a	s	b
s'	b	b	s'
			s
			a

Table 1: Preferences of the two committees.

$$s = \sigma(\{a, s\}) = \sigma(\{b, s\}) = \sigma(\{a, b, s\}) = \sigma(\{a, s, s'\}) = \sigma(A)$$
$$s' = \sigma(\{s, s'\}) = \sigma(\{b, s, s'\})$$

Note that a and b are two congruent applicants on ss'. Since $s = \sigma(\{a, s, s'\})$ whereas $\sigma(\{b, s, s'\}) = s'$, the selection function fails Another Binariness Property.

4.2 Uncovered set consistency

As we saw above, a selection function is Condorcet consistent. We can pursue the analogy with voting theory further. Let us say that an applicant a **beats** another candidate b if a is selected over b in a pairwise contest. Condorcet Consistency expresses an appealing property of the selection function in terms of this 'beating relation': an applicant who beats all others is selected overall. However, this may not be very informative, as in many cases such a Condorcet winner does not exist. A classical alternative is to look at the *uncovered set* (Miller [3]). This is the subpool of all applicants who beat all others in no more than two steps: that is, each applicant in the uncovered set beats any other applicant a either directly, or indirectly because it beats one applicant who in turn beats a:

Definition 4 *Applicant a in pool S belongs to the uncovered set of S if and only, for all $b \in S$, either $a = \sigma(ab)$ or $a = \sigma(ac)$ and $c = \sigma(bc)$ for some $c \in S$.*

It turns out that the selection function has the following desirable property:

Proposition 5 *A selection function always picks an applicant in the uncovered set of S.*

Proof. Suppose $a = \sigma(S)$. If a is not in the uncovered set of S, then there exists some other applicant b that cannot be beaten by a in no more than 2 steps. in particular, it must be $b = \sigma(ab)$. In order for a to be selected overall in pool S, then, there must be another applicant c with cC_1b. If $a = \sigma(ac)$, then a beats b in 2 steps and we're done, so suppose not, that is $c = \sigma(ac)$. Then again there must exist d with dC_1c. By transitivity of C_1 therefore also dC_1b. So if $a = \sigma(ad)$, then a beats b in 2 steps. Iterating this reasoning, since the pool of applicants is finite, leads to a contradiction. ■

4.3 The Weak Axiom of Revealed Preference

The final consistency property we consider is a weakening of the Weak Axiom of Revealed Preference which severely restricts the type of menu-dependence allowed. It requires that if a given applicant beats another in a direct contest and this same applicant is also selected if more applicants are added to these two, then the beaten applicant will never become the winning one if a *smaller* set of those same applicants is added. It may be the case for example that adding some applicants changes the selection (without themselves being selected), for instance because one of them acts as a 'benchmark' against which to evaluate the pre-existing applicants. However, if a group of additional applicants is not effective in this way, then a subset of them will not be effective either.

Based on this reasoning, the ensuing consistency property is:

Weak Axiom of Revealed Preference*: Suppose $a \in S$, $b = \sigma(\{a, b\})$ and $b = \sigma(S)$. Then $a \neq \sigma(R)$ for all pools of applicants R such that $b \in R \subset S$.

Proposition 6 *A selection function satisfies the Weak Axiom of Revealed Preference*.*

Proof.[12] Suppose not, that is $a \in S$, $b = \sigma(\{a, b\})$ and $b = \sigma(S)$, but in violation of the axiom there exists a pool of applicants $R \subset S$ such that $a = \sigma(R)$ and $b \in R$. Since $b = \sigma(\{a, b\})$, in order for a to be the winning applicant from pool R it must be that there

[12] It is possible to show that this property is satisfied even when the committees' preferences are just acyclic (and not transitive) - see Manzini and Mariotti [2].

is some other applicant $c \in R$ such that $c = \sigma(\{b, c\})$ (by Condorcet Consistency). Since then cC_ib for some i, it must be that $i \neq 1$ (for otherwise we could not have $b = \sigma(S)$) and $i = 2$. Furthermore, since $b = \sigma(\{a, b\})$, it must be that bC_ia with $i = 2$ and $i \neq 1$ for otherwise we could not have $a = \sigma(R)$. By the transitivity of preferences in each committee it follows that cC_2a, so that in turn there must exist some applicant d who eliminates c in the first committee, before c can eliminate a, so that dC_1c. But then b survives the shortlist to the second committee, so that a will be eliminated by b in the second committee, contradicting $a = \sigma(R)$. ■

5 Concluding remarks

We have studied the properties of selecting applicants (or general alternatives) by constructing shortlists. We find that, on the one hand, such procedures do not give rise to 'rational' selections in the standard economic sense of the term, as they typically embody some amount of *menu-dependence,* which may possibly lead to cyclical choice behavior. This occurs in spite of the committees themselves being rational in the sense of choosing on the basis of transitive rankings. But, on the other hand, we are also able to delimit substantially the scope and type of menu-dependence that these procedures allow. As we show, they still satisfy some consistency properties.

One interesting insight of our analysis is that disagreement between the two committees is a potential source of inconsistency of the shortlisting procedure. Namely, only when committees rank at least two candidates in opposite ways can the shortlisting procedure generate inconsistent selections. In turn, this means that when committees disagree, and only in this case, the procedure may not maximize any social welfare ordering, even though each individual committee does so.

If one views consistency as a desideratum of collective choice, our paper has highlighted and delimited the *costs* of using shortlists (instead of making a one-off decision). However, this method clearly offers benefits, too, probably in terms of information collection and fairness. A trade-off between these costs and benefits seems difficult to model formally, and is an interesting topic for further research.

References

[1] Houthakker, H. S. (1950) "Revealed Preference and the Utility Function", *Economica* 17: 159-74.

[2] Manzini, P. and M. Mariotti (2005) "Rationalizing Boundedly Rational Choice: Sequential Rationalizability and Rational Shortlist Methods", Working paper EconWPA ewp-mic/0407005.

[3] Miller, N. R. (1980) "A New Solution Set for Tournaments and Majority Voting: Further Graph-Theoretical Approaches to the Theory of Voting" *American Journal of Political Science* 24: 68-96.

[4] Mintz, A. (2004) "Foreign Policy Decision Making in Familiar and Unfamiliar Settings", *Journal of Conflict Resolution* 48: 49-62.

[5] Richter, M. K. (1966) "Revealed preference theory", *Econometrica*, 34: 635-645.

[6] Samuelson, P. (1938) "A note on the Pure Theory of Consumer Behavior", *Economica* 5: 353-54

[7] Samuelson, P. (1950) "The Problem of Integrability in Utility", *Economica* 17: 355-85

[8] Sen, A. K. (1971)."Choice Functions and Revealed Preference", *Review of Economic Studies* 38: 307-17.

[9] Sen, A. K. (1993) "Internal Consistency of Choice", *Econometrica* 61: 495-521.

[10] Suzumura, K. (1983) *Rational Choice, Collective Decisions, and Social Welfare*, Cambridge University Press, Cambridge U.K.

[11] Varian, H. R. (2005) "Revealed Preference", mimeo, Berkley University.