Specification Issues in Assessing the Moderating Role of Issue Importance:

A Comment on Grynaviski and Corrigan (2006)

Neil Malhotra (corresponding author)
Graduate School of Business
Stanford University
518 Memorial Way
Stanford, CA 94305
(408) 772-7969
neilm@stanford.edu

Alexander Tahk
Department of Political Science
Stanford University
Encina Hall West, Room 100
Stanford, CA 94305
tahk@stanford.edu

Abstract

In this note, we comment on Grynaviski and Corrigan (2006), who recommend *not* including a main effect for issue importance when estimating models assessing the interactive relationship between importance and policy proximity. According to the authors, including the main importance term is incorrect because it is not necessary in representing a scale invariant functional form under some assumptions and is insufficient under others. In deriving their reduced-form expression, the authors interpret scale invariance to apply to *the policy space* rather than *the mapping of the policy space into the utility function*, which misses the point. We argue that scale invariance with respect to the former but not the latter produces a model which is unintuitive and inappropriate for most data. We find that the unconstrained model—the one used by previous researchers such as Krosnick (1988)—is indeed scale invariant and that inclusion of the main importance term is necessary for scale invariance with respect to the mapping of the policy space into the utility function. It has the added bonus that it flexibly frees the main effect of importance from being fixed to zero—an assumption that has little empirical basis. Hence, the Grynaviski and Corrigan approach is clearly inferior to the traditional approach of including both main effects and the interaction term.

Many models of voting behavior posit that citizens compare the issue positions of candidates to their own positions when casting votes in elections. *Ceteris paribus*, the voter should maximize utility by voting for the candidate whose policy positions are closest to his or her own policy positions, though closeness can be defined in various different ways (e.g., Merrill 1995; Merrill and Grofman 1999; Macdonald, Rabinowitz, and Listhaug 2001; Rabinowitz and Macdonald 1989; Westholm 2001). Recently, Grynaviski and Corrigan (2006) contributed to the policy voting literature by comparing two different measures of distance (Euclidean vs. city-block), comparing two different ways to specify the candidate position (individual perceptions vs. average sample perceptions), and by investigating the moderating impact of issue importance on the relation between issue proximity and candidate preference.

With respect to this last point, political psychologists have argued that the relationship between issue positions and candidate preference should be greatest for the issues that are personally important to the voter, or those upon which he or she places greatest weight (e.g. Krosnick 1988). Traditionally, one would evaluate this hypothesis by predicting a dependent variable (e.g. vote choice or candidate favorability) with issue distance, issue importance, and the interaction between the two. A positive, significant sign of the interaction term would indicate the importance moderates the relationship between distance and candidate preference. However, Grynaviski and Corrigan argued that past investigations had misspecified the analytic models they employed and that the correct specification (which excludes the main effect of importance) makes the apparent moderating impact of importance disappear. Grynaviski and Corrigan (2006) justified omission of the main effect of importance in their analyses with a discussion of scale invariance, which they defined to mean that inference is unaffected by an additive or multiplicative change in the scale of either the importance measure or the policy space measure.[1]

1. Conceptual Overview

As mentioned above, the main problem with Grynaviski and Corrigan's mathematical derivation is that they interpret scale invariance to apply to *the policy space* rather than *the mapping of the policy space into the utility function*.[2] While perhaps seemingly innocuous, the choice has a significant impact on their conclusions. If a model is scale invariant with respect to the policy space, then, under the assumptions made by the constrained model, the model exhibits only multiplicative scale invariance with respect to the mapping of the policy space into the utility function. The model cannot capture an additive shift in this mapping. Invariance to an additive shift in the mapping of the policy space into the utility function is implicit in the estimation of many models, because any such shift can be picked up by the intercept term. But in the constrained model of interest here, this is not true; excluding this possibility has strong implications.

To illustrate the problem with regard to importance judgments, consider the intuitive example of two voters, *A* and *B*, who are rating candidates *C* and *D*. Voters *A* and *B* have identical policy preferences on all issues: they are extremely conservative on all issues, including abortion. Voters *A* and *B* are also identical to one another in terms of the amount of importance

[1] Grynaviski and Corrigan (2006) used the term "scale invariance" to refer to both additive and multiplicative transformations. An alternative approach sometimes encountered would be to define "scale invariance" as meaning only that results are unaffected by a multiplicative transformation and to define "location invariance" to mean that results are unaffected by an additive transformation. The term "location-scale invariance" would then be used to mean what Grynaviski and Corrigan (2006) refer to as "scale invariance." In this paper, we have use the terminology used by Grynaviski and Corrigan. When referring to invariance only with regard to a multiplicative transformation, we use the term "multiplicative scale invariance."

[2] By "the mapping of the policy space into the utility function," we mean that portion of the utility function that is generally the application of a distance metric to the positions of a voter and candidate. Most commonly, it is the square of the difference between the values of the two positions. We do not use the term "distance function," which Grynaviski and Corrigan use, or the term "metric" because we wish to include a broader range of functions that need not meet the definitional requirements of these terms.

they attach to all issues (all are moderately important to them) except abortion. Voter *A* considers abortion to be extremely personally important, whereas Voter *B* considers abortion not to be important at all ($w_A > w_B$).

Candidate *C* takes extremely liberal positions on all issues except abortion, on which he takes a moderately conservative stand. This means that voters *A* and *B* disagree entirely with his positions on all issues other than abortion, but agree almost (but not quite) completely with his position on abortion. Candidate *D* takes the same extremely conservative position as *A* and *B* on all issues except abortion, on which he takes an extremely liberal position. Hence, voters *A* and *B* agree with him on all issues except abortion, on which they vastly disagree.

Intuitively, Voter *A* should gain more utility from candidate *C* than does Voter *B*, because Voter *A*'s agreement with Candidate *C* is worth more to Voter *A* (who considers abortion to be important) than the same level of agreement with Candidate *C* is to Voter *B* (who considers abortion to be unimportant). Likewise, Voter *A* should gain less utility from candidate *D* than does Voter *B*, because Voter *A*'s disagreement with Candidate *D* is more important to Voter *A* than the same level of disagreement is to Voter *B*.

However, this is not what the Grynaviski and Corrigan (2006) analytic approach posited. They represented the utility of a candidate to a voter as:

$$U_{ij} = -\| v_i - c_{ij} \| \beta \circ w_i + \alpha \qquad (1)$$

where U_{ij} is the utility of the j^{th} candidate to the i^{th} voter, v_i is a vector of the voter's positions on a set of issues, c_{ij} is a vector of the voter's perceptions of the j^{th} candidate's positions those issues, β is the importance of an issue dimension for the average voter, w_i is a vector of weights that voter *i* places on each policy dimension, and α represents the average voters' utility for candidate

j.[3] Thus, as the distance between the voters' issue positions and the candidate' issue positions decreases, the utility of the candidate to the voter becomes less negative and therefore increases. And the more importance is attached to an issue by the voter, the more the distance on that issue influences overall utility.

Although this approach seems quite reasonable at first glance, it is obviously problematic when considered in light of our example involving Voters *A* and *B*, Candidates *C* and *D*, and the issue of abortion. According to this analytic approach, the small distance between the voters and the candidates on abortion is multiplied by an unknown coefficient and a large weight for Voter *A* and by a smaller weight for Voter *B*. Thus, if the coefficient is negative, this approach posits that Voter *B* should gain slightly more utility from Candidate *C* than does Voter *A*, whereas the equally close proximity of the candidate to both voters on abortion should be more valuable to Voter *A* than to Voter *B*. If the coefficient is positive, this approach posits that Voter *A* should gain slightly more utility from Candidate *D* than does Voter *B*, whereas the large distance between either voter and the candidate on abortion should matter more to Voter *A* than to Voter *B*. Either one dislikes a candidate more when attaching more importance to an issue on which one agrees with the candidate or one likes a candidate more when attaching more importance to an issue on which one disagrees with the candidate. Both possibilities seem counterintuitive.

In mathematical terms, under the Grynaviski and Corrigan approach (assuming a Euclidean distance metric and perceived candidate placements), the utility of voter i from candidate j is $U_i(j) = \varphi + \gamma_1 w_i (v_i - c_j)^2 + \gamma_2 (v_i - c_j)^2$. By assumption, $w_A > w_B$ and $v_A = v_B$. Aside from the case where $\gamma_1 = 0$, either $U_A(C) < U_B(C)$ (if $\gamma_1 < 0$) or $U_A(D) > U_B(D)$ (if $\gamma > 0$), neither of which seems sensible. If $\gamma_1 = 0$, $U_A = U_B$ and issue importance has no effect. This is equivalent

[3] We assume throughout that weights, w_i, are non-negative. To do otherwise introduces even more counterintuitive results.

to using a model without weights. We do not wish to exclude this possibility, but our model should not require it to be true to produce sensible results if we wish to consider the possibility that issue importance does matter.

Under the traditional approach (i.e. considering the mapping of the policy space into the utility function), the utility of voter i from candidate j is

$U_i(j) = \varphi + \gamma_1 w_j (v_i - c_j)^2 + \gamma_2 (v_i - c_j)^2 + \gamma_3 w_j$. In this case, $U_A(j) > U_B(j)$ whenever $(v - c_j)^2 < \gamma_3 / \gamma_1$ and $U_A(j) < U_B(j)$ whenever $(v - c_j)^2 > \gamma_3 / \gamma_1$ (where $v = v_A = v_B$). That is, Voter *A* will gain more utility from Candidate *C* than does Voter *B* so long as Candidate *C*'s position is not too far from the position of Voters *A* and *B* on abortion. Likewise, Voter *A* will gain less utility from Candidate *D* than does Voter *B* so long as Candidate *D*'s position is sufficiently far from the positions of Voters *A* and *B* on abortion. Hence, the utility function incorporates the substantively sensible consideration that voters derive utility from candidates that are close to them and lose utility from candidates that are far from them on issues that are important to them, which is lacking the alternative approach.

Another problem with the Grynaviski and Corrigan (2006) approach is that if Voters *A* and *B* agree completely with Candidate *C* on abortion, Voter *A* would be posited to gain no more utility from Candidate *C* than did Voter *B*. But it seems much more plausible that this perfect agreement would be worth more to Voter *A*, who attaches more importance to the issue. Our model should at least allow for this possibility.

If instead of assuming that scale invariance applies only to the policy space, we assume that scale invariance applies to the mapping of the policy space into the utility function as well, then these counterintuitive results disappear.[4] The slight disagreement Voters *A* and *B* have with

[4] Note that, under these assumptions, scale invariance with respect to utility implies scale invariance with respect to policy positions.

Candidate *C* on abortion can still translate into positive utility on the issue, and, thus, the greater weight placed on the issue by Voter *A* would lead to this amount being multiplied to give Voter *A* greater overall utility from Candidate *C*. However, if we also require scale invariance to the mapping of the policy space into the utility function, the results presented in Grynaviski and Corrigan (2006) no longer hold true, and the traditional approach appears correct under two of the cases presented by Grynaviski and Corrigan.

2. Formal Proofs

To demonstrate this, we present two theorems along the lines of those presented by Grynaviski and Corrigan (2006). We make the following assumptions. As did Grynaviski and Corrigan, we define a voter's utility for a candidate as:

$$U_{ij} = \sum_{k} \beta_k w_{ik} p_{ik} \ \ v_{ik}, c_{ik} \ \ + \alpha, \tag{3.2}$$

where $p_{ik} \ \ \cdot,\cdot \ \ $ is the partial utility function that gives a mapping from the positions of the voter and candidate to an unweighted utility for voter i along dimension k. In the case of the Euclidean distance metric, our measure of the partial utility function is

$$p'_{ik}\left(v', c'\right) = -\left(v' - c'\right)^2. \tag{3.3}$$

Likewise, in the case of the city block distance metric, our measure of the partial utility function is

$$p'_{ik}\left(v', c'\right) = -\left|v' - c'\right|. \tag{3.4}$$

Our measures, v', c', and w', are linear transformations of the true measures of the weights, policy space, and partial utility functions. Further, our assumed partial utility function is a linear transformation of the true partial utility function.[5] This means that the results are invariant to transformations $v = a_v + b_v v'$, $c = a_c + b_c c'$, $w = a_w + b_w w'$, and $p(\cdot,\cdot) = a_d + b_d p'(\cdot,\cdot)$. To keep the policy space of the candidate and voter the same, $a_c = a_v$ and $b_c = b_v$. Note that these assumptions mirror Grynaviski and Corrigan's (2006), except for the assumption that the true partial utility function is a linear transformation of our assumed function. If the assumed partial utility function is taken to be the true partial utility function, then the assumptions match those of Grynaviski and Corrigan precisely.

Proposition 1. For Euclidean distance metric with perceived candidate placements, a scale invariant form is $U = \phi + \gamma_1 w'\left(v' - c'\right)^2 + \gamma_2\left(v' - c'\right)^2 + \gamma_3 w'$.

Proof. For the Euclidean distance metric, by expressions (1) and (2)

$$U = \beta w p(v,c) + \alpha = \beta\left(a_w + b_w w'\right)\left(a_p + b_p\left(\left(a_v + b_v v'\right) - \left(a_c + b_c c'\right)\right)^2\right) + \alpha.$$

By assumption, $a_c = a_v$ and $b_c = b_v$. Then,

$$\begin{aligned} U &= \beta\left(a_w + b_w w'\right)\left(a_p + b_p\left(\left(a_c + b_c v'\right) - \left(a_c + b_c c'\right)\right)^2\right) + \alpha \\ &= \beta a_w a_p + \beta b_w a_p w' + \beta a_w b_p b_c^2\left(v' - c'\right) + \beta b_w b_p b_c^2 w'\left(v' - c'\right) + \alpha, \end{aligned}$$

satisfying the definition of a scale invariant function

$U = \phi + \gamma_1 w'\left(v' - c'\right)^2 + \gamma_2\left(v' - c'\right)^2 + \gamma_3 w'$ where $\phi = \beta a_w a_p + \alpha$, $\gamma_1 = \beta b_w b_p b_c^2$, $\gamma_2 = \beta a_w b_p b_c^2$, and $\gamma_3 = \beta b_w a_p$. $\square$

[5] In the cases of Euclidean or city block norms, invariance to a linear transformation of the partial utility functions implies invariance to a linear transformation of the policy space.

Corollary 1. For the unweighted Euclidean distance metric $w=1$ with perceived candidate placements, a scale invariant form is $U=\phi+\gamma_1\left(v^{'}-c^{'}\right)^2$.

Proof. Follows obviously from Proposition 1 and the assumption that $w=1$. □

Proposition 2. For city block distance metric with perceived candidate placements, a scale invariant form is $U=\phi+\gamma_1 w^{'}\left|v^{'}-c^{'}\right|+\gamma_2\left|v^{'}-c^{'}\right|+\gamma_3 w^{'}$.

Proof. For the city block distance metric, by expressions (1) and (3)

$$U=\beta w p \;\; v,c \;\; +\alpha=\beta\left(a_w+b_w w^{'}\right)\left(a_p+b_p\left|\left(a_v+b_v v^{'}\right)-\left(a_c+b_c c^{'}\right)\right|\right)+\alpha.$$

By assumption, $a_c=a_v$ and $b_c=b_v$. Then,

$$\begin{aligned}U&=\beta\left(a_w+b_w w^{'}\right)\left(a_p+b_p\left|\left(a_c+b_c v^{'}\right)-\left(a_c+b_c c^{'}\right)\right|\right)+\alpha\\&=\beta a_w a_p+\beta b_w a_p w^{'}+\beta a_w b_p b_c\left|v^{'}-c^{'}\right|+\beta b_w b_p b_c w^{'}\left|v^{'}-c^{'}\right|+\alpha,\end{aligned}$$

satisfying the definition of a scale invariant function $U=\phi+\gamma_1 w^{'}\left|v^{'}-c^{'}\right|+\gamma_2\left|v^{'}-c^{'}\right|+\gamma_3 w^{'}$ where $\phi=\beta a_w a_p+\alpha$, $\gamma_1=\beta b_w b_p b_c$, $\gamma_2=\beta a_w b_p b_c$, and $\gamma_3=\beta b_w a_p$. □

Corollary 2. For the unweighted city block distance metric $w=1$ with perceived candidate placements, a scale invariant form is $U=\phi+\gamma_1\left|v^{'}-c^{'}\right|$.

Proof. Follows obviously from Proposition 2 and the assumption that $w = 1$. □

3. Conclusion

The results show that with the assumptions outlined, both the models for Euclidean distance metric and city block distance metric are scale invariant. Models including both main effects, as is recommended throughout the literature, are therefore not misspecified if workings of proximity models are carefully considered, as our brief example has shown. On the other hand, models excluding one main effect are scale invariant but invoke the problematic assumption that the excluded effect is zero, which, as described above, may be substantively and empirically insensible. Hence, we recommend that researchers studying issue proximity and analyzing the moderating role of issue importance (or any other moderating variable, for that matter), should not exclude the main effect in their regression models.

References

Grynaviski, Jeffrey D., and Bryce E. Corrigan. 2006. "Specification Issues in Proximity Models of Candidate Evaluation (with Issue Importance)." *Political Analysis*. 14(4): 393-420.

Krosnick, Jon A. 1988. "The Role of Attitude Importance in Social Evaluation: A Study of Policy Preferences, Presidential Candidate Evaluations, and Voting Behavior." *Journal of Personality and Social Psychology*. 55 (2): 196-210.

Macdonald, Stuart Elaine, George Rabinowitz, and Ola Listhaug. 2001. "Sophistry Versus Science: On Further Efforts to Rehabilitate the Proximity Model." *The Journal of Politics*. 63(2): 482-500.

Merrill, Samuel. 1995. "Discriminating Between the Directional and Proximity Spatial Models of Electoral Competition." *Electoral Studies*. 14(3): 273-287.

Merrill, Samuel, and Bernard Grofman. 1999. *A Unified Theory of Voting: Directional and Proximity Spatial Models*. New York: Cambridge University Press.

Rabinowitz, George, and Stuart Elaine Macdonald. 1989. "A Directional Theory of Issue Voting." *American Political Science Review*. 83(1): 93-121.

Westholm, Anders. 2001. "On the Return of Epicycles: Some Crossroads in Spatial Modeling Revisited." *The Journal of Politics*. 63 (2): 436-481.