Simultaneous Equation and Instrumental Variable Models for Sexiness and Power/Status

We would like ideally to determine whether power is indeed sexy, or whether sexiness is powerful. We here describe the most rigorous (though hardly infallible) methods for constructing models to answer such a question that we could estimate. The approach used depends on whether we are treating women's status and sexiness as in question, or men's, since we found individual status to be related to sexiness for women, while dyadic power was related to sexiness for men. This implies the possibility of an individual-level analysis for women, but not for men. We discuss first our models for women, and then those for men.

Models for Women

We found that at least in the more male-dominated groups, men (and to a marginal degree, women) are more likely to see as sexy those women who are of high status. But could it be that women who are seen as sexy achieve high status in the group? This implies an individual–level relationship between status and sexiness, simplifying our analysis. Status is an unproblematic individual interval-level variable. We may consider ourselves to possess two different estimates of any woman's sexiness, the first by men (considered as a whole) and the second by women (considered as a whole). For women, these quantities are the "other-sex" attractiveness as measured by

$$Q^{O}{}_{jg} = \left[\frac{\sum_{i \in O(j)} x_{ijg}}{\sum_{i \in O(j), k \in S(j)} x_{ikg}} \right] \tag{B-1}$$

and the "same-sex" attractiveness measured by

$$Q^{s}{}_{jg} = \left[\frac{\sum_{i \in S(j)} x_{ijg}}{\sum_{i,k \in S(j)} x_{ikg}} \right] \tag{B-2}$$

where all terms are as defined in the text. We may consider these separate estimates of a single, individual level attractiveness, or independent individual characteristics.

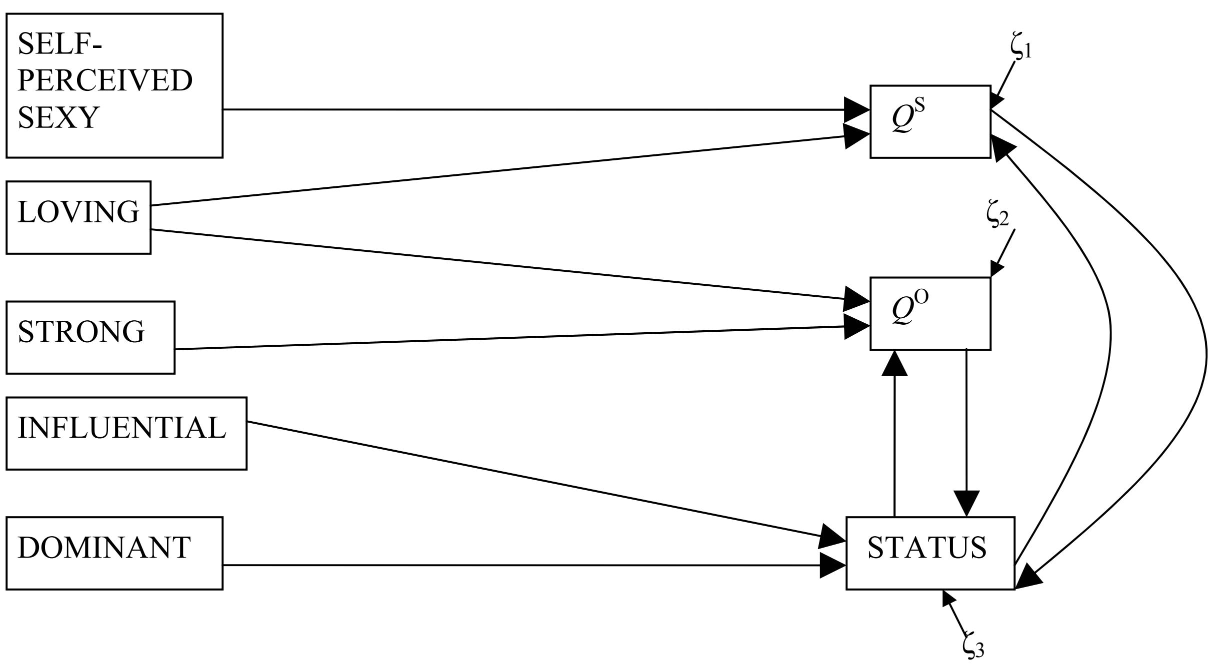
We can compose similar individual-level measures of the extent to which any woman was perceived as any of the other characteristics asked in the survey. Since any disentangling of reciprocal causation would require instruments, we mined the data for variables that were correlated with women's status but not with her sexiness (as seen by either men or women), as well as variables that were correlated with women's sexiness but not with her status. We then entered these in independent regressions to determine which were most strongly related in the multivariate context. (Some theoretically interesting variables such as age did not retain their significance and hence are not examined.)

We found self-perceived sexiness related to same-sex attractiveness but not to status, while "strength" of personality was negatively related to other-sex attractiveness but not to status. Being considered "loving" was related to both measures of sexiness but not to status, while being considered influential or dominant was related to status but not sexiness.

We then fit maximum likelihood estimates to a combined model of these equations, as indicated in Figure B-1. (Note that to avoid cluttering the diagram, we do not draw covariance relationships between exogenous variables, but all were unconstrained.) We used AMOS 5.0 to obtain estimates; the model chi-square was 14.0 with 8 degrees of freedom. (Error terms added to endogenous variables were given 0 mean and unit variance to identify the equations.) All path coefficients were in the predicted direction, and statistically significant at $p<.01$ except for the effect of strength (STRONG) on Q^O, and all the reciprocal paths of interest (that is, the effect of Q^O on status, the effect of status on Q^O, the effect of Q^S on status, and the effect of status on Q^S). While the coefficients corresponding to these paths were all quite small, one was much larger than the others, and came nearer to significance ($p=.293$ as opposed to .970 for the reverse path). This was the effect of status on Q^O, the very effect most called into question.

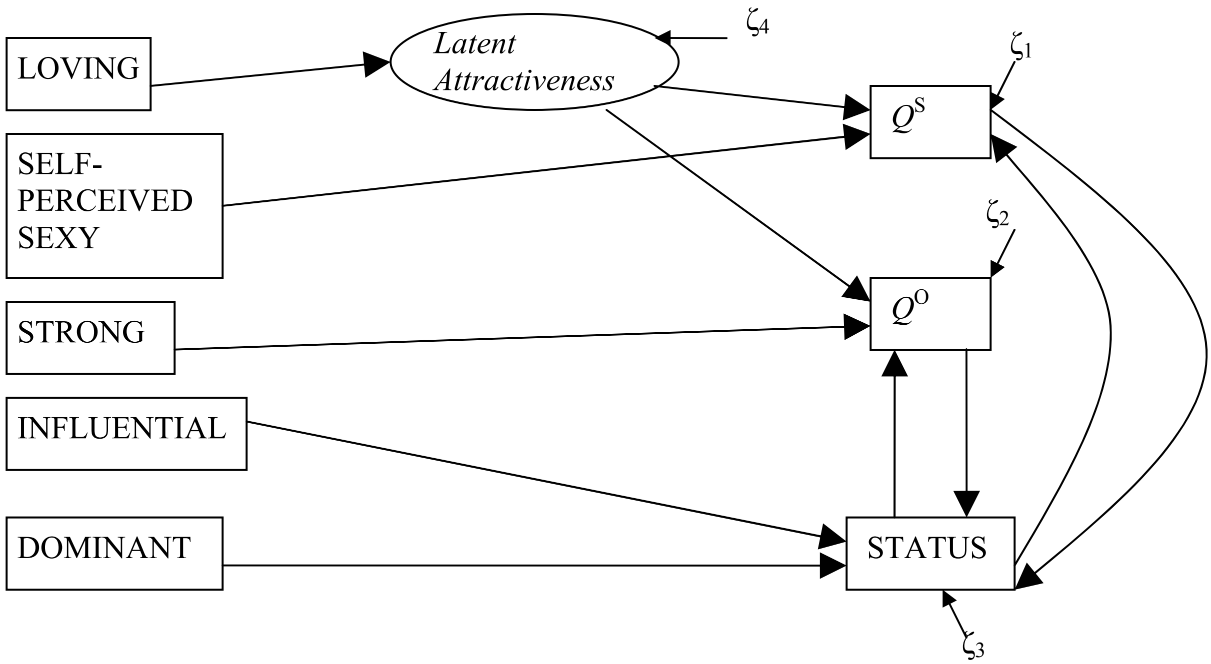
More specifically, the effect of Q^O on status was -.005 ($p=.970$), while the effect of status on Q^O was .168 ($p=.293$). The effect of Q^S on status was .017 ($p=.877$), and the effect of status on Q^S was -.005 ($p=.959$). The conclusion, then, is not that model is successful at disentangling these effects, but that it gives us no reason to suspect that we have reversed the causal order between women's attractiveness to men and their status.

Figure B-1—Simple Model of Reciprocal Causation



However, it may well be that this specification, which considers Q^O and Q^S to be independent of each other (except insofar as each is predicted by LOVING), is either (1) incorrect or (2) at odds with the alternate model implied by Reviewer B. Note that ζ_1 and ζ_2 are uncorrelated in Figure B-1; this would not be the case if there was, say, some combination of general physical attractiveness and pleasing personality which influenced both men's and women's reports. In that case, we might expect a model more like that graphed in Figure B-2 below.

Figure B-2—Model of Latent Sexiness and Reciprocal Causation



The main difference here is that we assume that Q^O and Q^S both tap a single trait of attractiveness, and that the reason both Q^O and Q^S were related to LOVING was that LOVING people are more attractive in general (thus a physically well formed person with a hateful personality may not be seen as attractive). We still have status affected by reports of sexiness and not latent attractiveness itself, which is not only necessary for our disentangling project, but theoretically reasonable. If the relation between status and sexiness is that women who are seen as sexy by men gain status, we would expect a direct relationship of Q^O on status, but no direct relationship between either attractiveness or Q^S on status. Similarly, we have status affect not latent attractiveness itself, but reports of sexiness, which is also reasonable.

Fitting this model estimates only one additional path, since the variance of the unobserved variable sets the metric for this variable (chi-square for this model= 8.6, d.f.=7). Once again, all path coefficients were in the predicted direction, and statistically significant at $p<.01$ except for the effect of STRONG on Q^O, and all the reciprocal paths of interest. And once again, the effect of status on Q^O was the strongest of a weak bunch. The effect of Q^O on status was .024 (p=.853), while the effect of status on Q^O was .132 (p=.406). The effect of Q^S on status was <.001 (p=.997), and the effect of status on Q^S was as -.002 (p=.984).

To conclude our discussion of the results for female alters, there is no evidence that instead of men being attracted to high-status women, it is really that women who are attractive to men gain a higher status. Further, when all the non-significant reciprocal paths are removed, the effect of status on men's judgment, *even when we postulate this latent attractiveness at odds with the theoretical approach of this paper*, and without any further tweaking of the model, is strong and nearly statistically significant (p=.057).

Model for Men

In the case of male alters, we are interested in dyadic-level variables, which complicates our analysis somewhat. First, we are likely to have correlated errors across dyads in the way discussed in the paper; however, we are ignoring this problem for now. Presumably, we will look for differences in magnitude of effect first and foremost, and statistical significance may not become crucial. Second, our endogenous variables are both dichotomies (does ego see alter as sexy or not; does ego see alter as having more power or not), which means that we cannot use a standard Structural Equation Model to disentangle the effects. (Standard loglinear models do not distinguish between reciprocal structural effects and hence are of no help.)

We can most generally consider this a problem of the endogeneity of one variable when using it to predict another. In conventional econometrics, it does not matter whether this endogeneity comes from reciprocal causation or some other source; the solution is (as Reviewer A suggested) to use an instrumental variable approach. Here we adopt an overarching probit-type framework as laid out by Heckman. We consider the observed dichotomies to be realizations of underlying latent variables, our observations being 1 when the value of the latent variable passes some threshold. It might seem that the most straightforward way of going about this disentangling is to consider the dichotomous variables to directly affect one another. However, this leads to the specification of an incoherent system of equations. So instead, we assume that the latent variables affect one another.

In this case, we use predictions for the endogenous variable as a lever to determine the real effect of this variable on our dependent variable. This approach seems to be the best available solution to the case of reciprocal causation between dichotomous variables.[1] The procedure requires finding variables (instruments) correlated with one variable but not the other. Looking only at the dyads with men as alter, we found that sexiness (but not deference to alter) was correlated with reporting the relationship to be sexual, with claiming to sleep with alter, and with claiming to spend free time with alter. Deference to alter (but not sexiness) was correlated with ego seeing alter as dominant, as strong and as a significant person. Typical instrumental variable analysis was used to account for the endogeneity of alter's sexiness when estimating its effect on ego deferring to alter, and vice-versa, with two important adaptations. The differences between

[1] Here we rely on a recent and as of yet unpublished paper by Robert W. Walker, University of Rochester, who conducted a simulation study. The standard errors produced by the procedure we employ below are generally wrong (though there are algorithms that can correct them), but in our case this will prove to be unimportant, as we can rely on the magnitude and direction of the coefficients. We thank Walker for allowing us to use his results and for consultation on this problem.

the general instrumental variable approach and that used here are, first, that a probit as opposed to a linear regression was used, given that the dependent variables are both dichotomies. A program has been written for STATA (ivprob) by Joseph Harkness to do this. However, given that the endogenous variable is also dichotomous, a second adaptation had to made to the program, namely to use a probit equation to provide provisional estimates of the endogenous variable instead of a linear regression. (This does not change the results substantially; we get the same results treating the endogenous variables as linear.)

Table B-1, Model 1 presents the results for ego naming alter as sexy for the dyads in which women reported on men; Table B-2, Model 1 presents the results for naming alter as more powerful. Comparing the first coefficient in each model shows that while we do indeed find that men with power are more sexy to women than are men without power—and that this can be interpreted as a structural, as opposed to a merely descriptive finding—the reverse is not true. There is no evidence that men who are seen as sexy become more powerful than men who are not seen as sexy. Indeed, the sign of the coefficient is in the wrong direction, a surprising finding. Comparing Models 2 of these two tables shows that the exact same results are reached when we look at men's reports on men. There is no evidence of a reciprocal effect.

Now it should be emphasized that we do not place much confidence in these findings. In general, sociologists have learned to be very skeptical of such methods for disentangling reciprocal causation, and in cases in which the application of causal models is unclear or analogical, doubly so. However, given the importance of reciprocal causation, if there was any indication that our results were based on a misspecification, we would need to rethink the analytic approach. It is quite encouraging that our best efforts to model such reciprocal causation do not lead us to change our findings. The results, we should point out, come from standard models (as opposed to QAP models), and so may mis-state the standard errors of the coefficients. But since our conclusions comes about on the basis of the *sign* of the crucial coefficient being in the wrong direction (and not a significant difference of magnitude), this cannot change our results.

Also, it may be that in some cases, such a difference might depend on the quality of the instruments used. The last row in each table gives the "pseudo-R-square" (a conventional rule of thumb treating changes in the log-likelihood as if they could be turned into a proportion, which they really can't) as a rough indicator of the strength of the instruments. There is a difference in their strength when it comes to women's reports, which perhaps could be imagined to lead to the observed pattern. But when we examine men's reports, which produce the same finding of an insignificant effect of sexiness on power, we see no difference in strength between the instruments, suggesting that the former result is not an artifact.

In sum, once again, our best attempt to model reciprocal causation only gives us increased confidence that the models proposed in the paper are not leading us astray because of reversing the true causal priority.

Table B-1: Instrumental Variable Probit Models for Ego Names Alter as Sexy

	Model 1 Female Ego	Model 2 Male Ego
ALTER HAS POWER	.688***	.392*
	(.173)	(.168)
SLEEPS WITH	.763**	.343
	(.269)	(.356)
SEXUAL	.558*	.[a]
	(.248)	
CLOSE	.368*	.369*
	(.172)	(.181)
Constant	-1.089	-1.519
Pseudo-R^2 for Endogenous Variable Probit	.064	.083

[a] could not be estimated because it was a perfect predictor; removed from models
* p<.05; ** p<.01; ***p<.001; two-tailed tests

Table B-2: Instrumental Variable Probit Models for Ego Sees Alter as More Powerful

	Model 1 Female Ego	Model 2 Male Ego
ALTER IS SEXY	-.057 (.143)	-.163 (.230)
ALTER SIGNIFICANT	.485** (.155)	.441*** (.123)
ALTER DOMINANT	.600*** (.144)	.829*** (.156)
ALTER STRONG	.466** (.156)	.401** (.149)
Constant	-.983	-1.368
Pseudo-R^2 for Endogenous Variable Probit	.172	.062

* $p<.05$; ** $p<.01$; ***$p<.001$; two-tailed tests