

Why negative affectivity should not be controlled in job stress research: don't throw out the baby with the bath water

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Introduction

In 1987 Watson, Pennebaker, and Folger wrote an influential paper in which they noted the potential importance of negative affectivity (NA) in job stress research, going so far as to suggest the provocative hypothesis that NA biased self-reports of most job stressors (and other measures of work conditions) and job strains. A number of concerned researchers, noting correlations between NA and other variables, have recommended that we statistically control for NA bias in general stress (McCrae, 1990) and job stress (e.g., Brief *et al.*, 1988; Payne, 1988) studies with some form of partialling. While we agree that affective dispositions are important, we disagree that it should become routine to treat them as bias factors to be statistically controlled. Although a number of researchers have noted possible non-bias or substantive roles for NA (e.g., Moyle, 1995; Schaubroeck, Ganster and Fox, 1992; Spector and O'Connell, 1994; Williams, Gavin and Williams, 1996), many researchers have started to routinely control for a NA bias in their studies. However, if indeed NA has a substantive role, one should not partial it as this can lead to removing the effects of the very variables one wishes to study. In this paper we will present arguments that partialling or related statistical techniques merely provide unrealistic hopes and illogical inferences in studying the potential biasing effect. Moreover, we will discuss the role played by NA in the job stress process and demonstrate that it should not just be considered a bias in need of statistical control. Rather NA can play a variety of substantive roles in the job stress process.

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The Nature of NA as a Bias

Research has established individual differences in the tendency to experience negative emotions. The most frequently studied of these dispositions is trait anxiety, although anger and depression have also been given attention. Watson and colleagues (e.g., Watson and Clark, 1984; Watson and Pennebaker, 1989), noting that various measures of affective disorders were strongly inter-correlated, developed the negative affectivity construct, positing that certain individuals were predisposed to experience distress and negative emotions. Thus NA is a broader construct than trait anxiety or other affective dispositions. In the organizational domain researchers have tended to adopt the NA concept when studying affective dispositions, although measures of individual pervasive emotions (e.g., trait anxiety) are often used interchangeably with broader measures that assess a variety of negative emotions.

Watson *et al.* (1987) suggest that individuals who are high in NA tend to report high levels of distress and negative emotions, even in the absence of objective stressors. They suggested that this tendency produced a bias in the measurement of job stressors and job strains, as well as other organizational variables. Although Watson *et al.* (1987) focused mainly on a biasing effect, in other places Watson and colleagues have discussed the possibility of substantive effects, including the likelihood that NA itself can be affected by job strains (e.g., Watson and Slack, 1993). This distinction between bias and substantive is vital in determining the appropriate way in which personality variables in general and affective dispositions such as NA in particular are studied.

To be considered a bias, a variable such as NA must distort the assessment of a particular intended construct (Spector and Brannick, 1995). It cannot be causally interlinked with the true underlying construct as either cause or effect. For example, a response set (e.g., agreement) is the tendency to respond to items in a particular way, independent of the variable intended to be measured. When biases are common across measures, and have an influence of the same direction on independent and dependent variables, they inflate the correlations. In other cases, biases may attenuate correlations (Cote and Buckley, 1988; Williams and Brown, 1994).

Note that bias must be interpreted in view of the intended construct. If a measure of a job stressor is intended to assess the objective work environment, any factor that is independent of that environment, yet influences the measure, will serve as a bias. Hence from this perspective measures of job stressors and other work conditions are all biased because they are affected by many personal factors (Spector, 1992). Given the same objective environment, each individual likely perceives it somewhat differently. However, if such measures are considered to reflect individual perceptions of the environment these personal factors are real causes of the underlying construct of interest—perceptions. After all, it is by no means established that the objective environment can be successfully measured if we partial presumed biases, such as faking, NA, response sets, or social desirability, from self-report measures.

We note four issues that have relevance for the interpretation of biases in assessment of job stressors and job strains.

(1) NA might help explain why two variables are related without being a bias, i.e., it has a substantive role. For example, suppose individuals who are high in NA tend to perform poorly, resulting in punitive supervisor response. Furthermore, the constant negative behavior of the supervisor might produce job strains in the subordinate. We then might observe that NA correlates with incumbent reports of their supervisor's punitive behavior, as well as with job strains, but in this case NA's role is substantive. It helps explain why we have observed the relations between the incumbent measure of supervisor behavior and job strains. On the other hand, if supervisor behavior is unrelated to their subordinates' personality, a correlation between

incumbent reports and NA might reflect bias. If only incumbent report data are available, it is difficult and perhaps impossible, to distinguish bias from substantive roles.

(2) A further complication is that we cannot equate the NA construct with a particular measure of NA. Every measure reflects the influence of multiple constructs (Spector and Brannick, 1995), although we hope that most of the variance in a measure reflects our intended construct. Overlap between a measure of NA and another variable might be due to constructs other than NA itself. For example, perhaps NA and other variables of interest are all affected by mood, making observed correlations due to mood rather than NA.

(3) If we conceptualize our NA measure as an indicator of a stable trait, anything that causes transitory fluctuations in the measure, but not the construct itself, would be a bias. However, in this case it is a bias in the assessment of NA that is at play.

(4) Even if the overlap in variance among NA, job stressors, and job strains can be attributable to bias, it is far from clear that the trait of NA is the cause. Judge, Erez and Martocchio (1995) discussed the opposing effects of NA and social desirability (SD) on measures of job stressors and job strains. Individuals high in NA tend to report high levels, while individuals high in SD tend to report low levels. Furthermore, measures of NA itself have long been known to be affected by social desirability (e.g., Chen *et al.*, 1997). There are likely other biases that might act to attenuate or inflate relations among job stressors and job strains, making it difficult to know how biased an observed correlation might be.

Partiallying out True Variance: Why the Partialling Method should not be Used

Some researchers, appropriately concerned about the possible biasing effects of NA, have advocated controlling its effects with partialling (e.g., Brief *et al.*, 1988; Payne, 1988). We attempted to determine if researchers have adopted the partialling procedure in response to Brief *et al.* (1988), and their follow-up paper (Burke, Brief and George, 1993). We used Social Sciences Citation Index to identify articles that cited these two sources between 1989 and 1996. We were able to locate 111 such studies, of which 13 conducted some form of partialling to control NA bias. An additional 8 authors stated that NA bias was a serious potential shortcoming, although they did not control it.

We consider the use of partialling in this way to be a mistake, because it is not in any way clear that NA has only a biasing effect. Before one can reasonably remove the effects of a variable, it should be clear what that variable is doing. What is the inference researchers wish to make when NA is partialled? Perhaps it is that our self-report measure now reflects the effect of the objective work environment on job strains. However, we cannot magically turn self-report measures into objective measures of the work environment by partialling *one* possible bias. If one is trying to determine if perceptions of job stressors relate to job strains, then why should NA be statistically controlled? Do we believe that high NA people lie about their perceptions, and they really don't see the job as stressful? Perhaps it is the low NA individuals who lie and don't want to admit to anything negative? There is evidence that people in negative emotional states are more rather than less accurate in their perceptions of the environment (e.g., Sacco, 1985; Sinclair, 1988). Certainly lying is possible, but NA is most likely not the reason for lying. Thus what are we actually doing by partialling?

We are not the first to raise concerns with partialling biases from correlations among variables in cross-sectional designs. Paul Meehl (1971) discussed at length the logical and statistical issues that render this practice ‘the commonest methodological vice in contemporary social science research’ (p. 146). In a different domain he notes how this established practice, taken for granted by most social scientists, likely leads to more erroneous inference than merely interpreting zero-order correlations. He notes ‘... statistical manipulations cannot provide an automatic “inference-machine”, but the tendency in social science is to treat control of nuisance variables in that way’ (p. 147). What is required, according to Meehl, before we can partial is knowledge that the variable is biasing the assessment of what we are trying to measure. Epstein and Katz (1992) also recommended against partialling measures of negative emotions in studies of stress.

The problem with the partialling procedure is that it removes variance shared with NA, regardless of why NA correlates with other variables. If NA plays a substantive role, removing it will not necessarily eliminate bias, but distort effects of variables that are causally related. These methods carry the risk that true variance is removed, and lead to erroneous conclusions about the role of NA in self-report studies of stressors and strains. In other words we might well remove the effects of the variables of interest before we test for their relations with one another. This is not to say that partialling should not be used for other reasons, as in the case of establishing a mediator (e.g., James, Mulaik and Brett, 1982). Obviously, this is done because of the substantive role of the mediator in a causal process.

A Variance Partitioning Point of View

Any relation between variables can be conceived from a variance and co-variance partitioning point of view. This means that an NA measure can be divided into components attributable to different factors. One part can be assumed to reflect a stable trait of affective disposition. Others might be due to more transitory factors, such as mood of subjects (‘I feel bad at the moment, therefore I am pessimistic’), or reactions to job stressors at work. For this reason, we are concerned about the problem that true variance shared by stressor and strain might be unintentionally removed when NA is partialled. This can happen even if one assumes that the pure NA trait part is completely stable. But in every *measure* of NA there is one part that has the function of a strain measure which can be influenced by work stressors. From the viewpoint of trait NA, this is systematic error variance, from the viewpoint of traditional stress research this is the target variance. If this unstable part of the variance is shared by other strain measures, this would mean that partialling out NA from a correlation of job stressors, and job strains leads to a reduction of *true* variance. Unfortunately, it is impossible to differentiate the trait NA part from its strain part in cross-sectional questionnaire studies. Therefore, partialling NA from stressor–strain relations means also partialling true variance from stressor–strain relations.

The shared variance among scales can be a function of item overlap in those scales. This is not just a sign of bad construction of these instruments, as often items overlap because constructs overlap. For example, depression has a theoretical connection to anxiety and psychosomatic complaints (cf. Beck, 1972). Consequently, most of the depression scales include items asking about anxious behavior and/or psychosomatic complaints (Mohr, 1986). A similar argument can be made for anxiety; for example, Zung’s anxiety scale (in CIPS, 1977) contains several psychosomatic symptoms like headache or backache. In addition, the fact that many studies on job stress used general health measures such as the Langner scale (Langner, 1962) or the General

Health Questionnaire GHQ (Goldberg, 1972) as dependent variables underscores that strain indicators share some common variance with NA. If this shared variance is partialled out, then true and not artifactual variance is partialled. If the stressor is primarily related to the shared variance of the dependent variables then partialling leads to a breakdown of the stressor–strain correlation. If the stressor is primarily related to the variance of the strain variable which is not shared by the measure of NA then the stressor–strain correlation may even increase, as was the case in some of the partialled correlations in the Frese (1985) and Jex and Spector (1996) studies (to be discussed). A pure item based approach can in some cases solve the overlap problem (as suggested by Chen and Spector, 1991) but because of the true conceptual overlap, there is still a danger of throwing out important strain variance in the partialling procedure even if items that refer to another construct are eliminated.

It follows from these considerations that the partialling effect of NA should be high for variables high in theoretical overlap with NA and low for variables low in theoretical overlap with NA. There is some support in the results we will discuss in a reanalysis of the study by Frese (1985) in that the social stressors and somatic symptoms show the greatest reduction in correlation when NA is partialled, and the lowest correlation reduction occurred for job satisfaction. Similarly, Schaubroeck *et al.* (1992) found the strongest attenuation effect of NA for depression, a medium effect for somatic symptoms, and no effect for job dissatisfaction. All of these reasons suggest that the partialling procedure should not be used. The major reason for this conclusion is the fact that true and interesting variance may be taken out from the correlations of stressors and strains.

The existing research on NA suggests that it has a complex role in the job stress process beyond its possible biasing effect on assessment. It has been shown to correlate significantly with many measures of job stressors and job strains, but the reasons for these relations need to be clarified. We will continue our discussion by overviewing existing findings concerning the bias mechanism. Following that will be a discussion of six substantive mechanisms which seem feasible, and the evidence in support of each. They are not intended to be mutually exclusive and it is possible that they all play a role. The mechanisms are: perception, hyper-responsivity, selection, stressor creation, mood, and causality mechanisms. We will then return to the issue of why partialling can lead to erroneous results.

Empirical Studies of the Bias Hypothesis

As we will show, there is plenty of evidence that NA correlates with a variety of job stressor and job strain variables, but there is very little evidence beyond this for a bias effect. Thus while bias is possible, many other explanations are feasible to explain such correlations. Brief *et al.* (1988) provided the strongest evidence claimed to support the NA bias hypothesis. They found that the correlations between stressful life events (both on and off the job) and affective strains were in many cases reduced considerably when NA was used as a partialled variable. They concluded that NA was a potential nuisance variable and might produce spurious relations between job stressors and strains. They noted the necessity for replicating their findings with more commonly used measures of job stressors.

There have been several answers to the Brief *et al.* (1988) call to replicate their results with other measures and methods. Most of this evidence is based again on correlations between NA and other variables. As with Brief *et al.*, these replicated studies cannot be taken as more than support

for a possibility of bias. Furthermore, these studies have found weaker NA effects than Brief *et al.* (1988). As a group these authors (e.g., Agho, Price and Mueller, 1992; Chen, O'Connell and Spector, 1993; Chen and Spector, 1991; Fortunato, Jex and Heinisch, 1997 (Fortunato, V. J., Jex, S. M. and Heinisch, D. A. (1997). 'Construct validation of the strain-free negative affectivity scale: a comparison with the neuroticism scale of the Eysenck Personality Inventory'. Unpublished manuscript, University of Wisconsin, Oshkosh.); Jex and Spector, 1996; Moyle, 1995; Munz *et al.*, 1996; Schaubroeck *et al.*, 1992; Tombaugh and White, 1989; Williams and Anderson, 1994; Williams, Gavin and Williams, 1996) used both partial correlations and structural equation modeling to test for bias. None of the partialling studies found correlation reductions as large as Brief *et al.* (1988), and none of the structural equation modeling studies found evidence that NA was a serious biasing or confounding variable in measurement.

For example, Williams *et al.* (1996) compared structural models among job stressors and job strains both with and without NA to test for its biasing effect on relations among these variables. Although they found a significant contribution of NA, it had minimal effects on the structural model. Furthermore, they estimated that on average 57 per cent of the variance in job stressors and job strains was attributable to substantive factors and only 5 per cent was attributable to NA. Their results suggest that even if NA is a bias, it does not necessarily inflate correlations among other variables.

One variable that has a strong relation with NA is somatic symptoms where most of the rather modest correlations with job stressors was eliminated after partialling NA in some studies (e.g., Chen and Spector, 1991). Moyle (1995) used multiple regression to test for the effects of NA on relations between job stressors and two job strains—job satisfaction and somatic symptoms. She found a significant effect only for somatic symptoms in that regression coefficients for job stressors declined when NA was added hierarchically. However, she also found for three of four job stressors that NA had a moderator effect as well. High NA individuals showed a stronger reaction in somatic symptoms to job stressors than low NA individuals. It is here with somatic symptoms that we find the greatest potential for bias, but as we will continue to show, we need stronger evidence for bias than has been provided from analyses based on correlations alone.

Moyle (1995) concluded that while NA related to job stressors and strains and accounted for some of the relations, it was not in a general sense the explanation, particularly for psychological strains such as job satisfaction. She noted that NA has a complex and substantive role, rather than just serving as a nuisance.

Evidence for NA as a bias and counterevidence

In a more recent article Burke *et al.* (1993) claimed to have more evidence for the NA bias effect. They compared incumbent reports with more objective sources of data, some of them from our own studies to argue for a bias effect. They again attempted to show that partialling NA led to a strong reduction in correlations between job stressors and job strains by reanalyzing data from these same published studies. Unfortunately, Burke *et al.* (1993) did not have access to the original data, limiting the analyses that they were able to conduct. A more complete reanalysis of our data done as a reaction to their paper leads to other conclusions.

Burke *et al.* (1993) used Frese's (1985) data to compare results of all incumbent measures with some 'objective' measures. They estimated the effects of NA in this study by comparing incumbent reported job stressor versus job strain correlations with correlations between observer and peer job stressor measures and measures of strain. They suggested that differences might well

reflect the biasing effect of NA. They also noted that a measure of NA would have been necessary to draw definitive conclusions.

First, a comparison of incumbents with objective measures is not a fair test of bias. In fact the objective measures are still based on people's subjective appraisal of the work environment. They are only objective in the sense of there being little or no influence of the job incumbent's cognitive and emotional processing on the assessment (Frese and Zapf, 1988). Measures can be classified along an objective versus subjective dimension according to the amount of influence by the target of the study (Zapf, 1989). The more independent the data source, the more objective it is, according to our definition. However, these objective measures are not necessarily more accurate than incumbent measures, although they can still be useful (Frese and Zapf, 1988; Schonfeld, Rhee and Xia, 1995). For example, several authors have noted poor discriminant validity among objective measures of job conditions (e.g., Glick, Jenkins and Gupta, 1986; Spector, Fox and Van Katwyk, in press). Studies of Hackman and Lawler (1971) and Hackman and Oldham (1975) showed that incumbent-observer correlations were higher than incumbent-supervisor or observer-supervisor correlations. Using a structural equations approach, Zapf (1995) (Zapf, D. (1995). 'Stressors at work: subjective versus objective measurement', unpublished manuscript, Justus-Liebig-Universität Giessen.) showed that incumbent reports overestimated, but observer reports in fact underestimated relations between job stressors and job strain.

Second, Burke *et al.* (1993) noted that an NA measure would be needed to draw definitive conclusions about bias from this study. Luckily, such measures were part of the research project upon which Frese (1985) was based. We reanalyzed the data from both Frese (1985) samples, using the same partialling procedure as Brief *et al.* (1988). We present here the results from additional analyses not reported in the original paper. In the Frese study, decision latitude, time pressure/concentration, uncertainty, organizational problems, and environmental stressors were assessed by self-report, expert observation and by using the mean assessment of colleagues working at the same workplace (reliability details of the scales can be found in Frese, 1985, and Semmer, Zapf and Dunckel, 1995). Frese (1985) used psychosomatic complaints as a dependent variable, but there were additional scales for job satisfaction, irritation, depression and anxiety available (details in Mohr, 1986). Trait measures of anxiety and depression were used as alternative indicators of NA as suggested by Watson and Clark (1984).

First, we analyzed the self-report measures of decision latitude and the job stressors using the partialling method suggested by Brief *et al.* (1988). In Sample I the mean reduction of the correlations was from 0.02 to 0.06 and in Sample II was from 0.02 to 0.03. Averaging across all dependent variables in both studies and weighing the correlations by sample sizes, the overall average mean reduction of the correlations is 0.02. As in the study of Chen and Spector (1991), the average reduction of the correlations on job satisfaction was most contradictory to the NA bias hypothesis (similarly, Chen *et al.*, 1993). There were not only reductions but also suppressor effects (Cohen and Cohen, 1983) where the partial correlation was higher than the zero-order correlation. For example, there were 5 suppressors out of 15 cases in Sample II involving depression as the measure of NA.

The explanation suggested for these rather modest reductions of correlations is that the job stressors analyzed have been operationalized more descriptively or objectively than, for example, the life events analyzed in Brief *et al.* (1988). Several authors (e.g., Chen and Spector, 1991; Schaubroeck *et al.*, 1992) argued that the biasing effect of NA is high when the items used are evaluative and affective in tone and low if the items are descriptive and non-affective. In how far one can construct items that are descriptive and little affective, depends on the theoretical construct which is to be measured. It is easier to develop descriptive non-affective measures for variables which refer to concrete environmental or organizational characteristics

(e.g., workload) than for more abstract social aspects of work (e.g., relationships with other people).

We investigated the hypothesis that stressors related to the social environment at work are more affected by NA than scales assessing more concrete aspects of the job. We compared the results discussed above with those using a scale measuring social stressors at work (Frese and Zapf, 1987) from Samples I and II contained in the research project on which the Frese (1985) article is based. This scale comprised items referring to the (bad) social climate in the work group, and conflicts with colleagues and supervisors. The same analyses as for the more concrete job stressors discussed above were conducted. The effects were much stronger than for the job stressors. For irritation and psychosomatic complaints the reduction of correlation was between 0.08 and 0.17 in both samples compared to average reductions of between 0.01 and 0.06 for job stressors discussed earlier. These results suggest that NA is more strongly related to the more abstract and evaluative socially related job stressors than to the more environment and task-based job stressors.

Burke *et al.* (1993) reanalyzed data from Spector, Dwyer and Jex (1988) to show the results of partialling a state, work anxiety measure from job stressors and job strains. They argued that since the instructions referred to the prior 30 days, it could be used as a trait measure, although they acknowledged limitations in using such a measure. Although one can certainly argue that a 30-day time span is too long for a state measure, the specific instructions that refer only to feelings at work make this a very poor measure of a trait. Fortunately, two NA trait measures not discussed in Spector *et al.* (1988) were included in this project (see Jex and Spector, 1996 sample 1 for details). Both the Life Orientation Test (LOT) as a measure of dispositional optimism (Scheier and Carver, 1985) and the trait anxiety scale of the State–Trait Personality Inventory (STPI; Spielberger, 1979) were partialled from correlations between four job stressor and six job strains. Contrary to Burke *et al.* (1993), reductions were quite small, with a mean of 0.0238 for the LOT, not counting the 3 of 24 increases in partial correlation, and 0.0365 for the STPI trait anxiety scale not counting 4 of 24 increases.

Longitudinal studies

Much stronger evidence against NA bias was revealed in two longitudinal studies. Chen *et al.* (1993) conducted a longitudinal study in which NA was assessed prior to job stressors and job strains. Trait anxiety was assessed in a cohort of college students several months before their graduation at Time 1, and approximately one year later those students who were working completed a second questionnaire containing job stressors, job strains, mood, and NA at Time 2. Mean correlation reductions with the Time 1 NA measure averaged across all job stressors and job strains, not counting those with nonsignificant zero-order correlations, was 0.04, but for Time 2 NA, the mean reduction was considerably larger at 0.10, and for Time 2 mood was 0.07. This included both state anxiety and somatic symptoms, which had greater reductions than other job strains. Similar results were found in a longitudinal study by Schonfeld (1994) (Schonfeld, I. S. (1994). 'The relation of negative affectivity to self-report of job stressors and psychological distress', Unpublished paper, City College, New York.) in which partialling NA had small effects on correlations among subsequently measured job stressors and strains. Mean reductions were less than 0.01 for all but somatic symptoms which was 0.10.

If NA is a stable personality characteristic that inflates correlations between stressors and strains, why then didn't the initial measure of NA show the same amount of reduction as the Time 2 in Chen *et al.* (1993)? Since the initial NA measure occurred over a year prior to measures

of job stressors and job strains, and under very different life circumstances (college versus on-the-job), we might consider it to represent the stable trait part of the NA measure. Effects on the NA measure of transitory variables such as mood should have been all but eliminated. Yet this more pure assessment of the NA trait failed to yield much reduction at all. This contrasts with the larger reductions that occurred with the second NA measure and mood. This study provides stronger evidence for a mood effect than a trait effect and casts serious doubt on the bias hypothesis. We will return to this alternative explanation in our discussion of substantive mechanisms.

We reach two conclusions from the studies so far discussed. First, there is really very little evidence that has been provided to support a general bias effect cutting across all variables measured in the job stress and related domains, even if we could attribute all overlap to a bias effect of NA which we cannot. NA correlations are quite small for many popular variables, and partial correlation reductions also tend to be quite modest in most cases, unless the variables in question are very affective and evaluative. Second, even where we find NA effects in the partials, we cannot on the basis of cross-sectional designs conclude that bias is the cause. It would be as correct to conclude that job stressors influence the correlations between the measure of NA and strains, or conversely that job strains influence the correlations between the measure of NA and job stressors based only on cross-sectional data.

Substantive Mechanisms to Explain Why NA Relates to Job Stressors and Job Strains

We will discuss six substantive mechanisms through which NA might affect job stressors and job strains. We chose these six mechanisms because they are all feasible based on available evidence. In point of fact, there is evidence for a stronger substantive effect than bias effect. Most, if not all, evidence for bias consists merely of observed correlations between measures of NA and measures of other variables. We will discuss evidence that goes beyond incumbent reports which supports at least some of these substantive mechanisms.

The perception mechanism

According to this mechanism NA reflects the person's tendency to see the world in a negative way. In other words high NA individuals tend to perceive their jobs as having high levels of stressors, which lead to high levels of job strains. These reports are presumed to accurately reflect people's perceptions and experiences. According to this mechanism, incumbent reports of job stressors are valid indicators of their *perceptions*, but those perceptions are influenced by NA as well as objective job features. Watson and Pennebaker (1989) have discussed several variants of the symptom perception hypothesis which correspond to this mechanism.

Whether or not the perception mechanism is considered to produce bias depends upon one's perspective (Spector and Brannick, 1995). From the perspective that self-reported stressor-strain relations indicate the impact of the objective work environment on the person's health, this mechanism might be interpreted as reflecting that trait NA is artifactually biasing the relations among a measure of the objective job stressor and strains. However, as discussed previously, incumbent measures are generally considered to be measures of perceptions. To produce bias,

NA would have to affect the accuracy of reporting personal experiences, which at this point seems unlikely.

The hyper-responsivity mechanism

It is also possible that individuals high in NA are hyper-responsive to the environment so that they have an exaggerated strain response to stressors. It is likely that high NA people may feel job strains more readily than people with low NA under the same environmental conditions. They do not necessarily perceive stressors differently than a low NA person. It is only their response or strain that differs. This mechanism suggests an interaction between NA and stressors on job strains. Relations of job stressors and strains will be stronger for high NA individuals than low NA individuals (see empirical findings by Moyle, 1995 and Parkes, 1990). Judge and Hulin (1993) argued that affective disposition was the tendency to experience positive or negative emotions in response to the environment. Using structural equation modeling, they found support for their hypothesis that such dispositions were a causal factor in job satisfaction.

The selection mechanism

A third possibility is that high NA people are in more stressful jobs than low NA people. Two studies found that incumbent NA correlated with objective measures of potentially stressful job conditions. Spector, Jex and Chen (1995) found that high NA people were in jobs that were lower in autonomy and job scope, both of which have been considered as job stressors in at least some studies. The job conditions were assessed with job analysis techniques, and the analysts never met or saw the incumbents; thus it was impossible for the incumbents to have influenced the job analysis data. Spector, Fox and Van Katwyk (in press) found significant correlations of NA with job complexity assessed by job analysts and job scope assessed by supervisors. These studies do not give insights into why NA related to job conditions. Possibly, high NA people choose less complex jobs or they are less attractive job candidates for better jobs that tend to be more complex (cf. the drift hypothesis, Kohn and Schooler, 1983). Indirect support for the latter possibility comes from two studies reported by Cook, Vance and Spector (1995). In a laboratory simulation, high NA students performed more poorly in a simulated job interview than low NA students. In a field study, NA significantly predicted the outcome of a preliminary screening interview. High NA college students were less likely to successfully complete an interview for a job after graduation than their low NA counterparts.

The stressor creation mechanism

Depue and Monroe (1986) and Dohrenwend *et al.* (1984) suggested that high NA people by their behavior create or enact adverse circumstances (see also Brief *et al.*, 1988). They may, therefore, create job stressors for themselves. For example, high NAs might get into conflicts with others more often, do a worse job of managing their workflow, and perform worse on the job than low NAs. These behaviors would result in a higher level of job stressors for high NA people. In this case, NA produces higher objective job stressors (objective in the sense that the stressors could be observed by other people) and not biased perceptions, but these higher stressors would be

idiosyncratic. The stressor creation mechanism is particularly plausible with regard to social stressors because of neurotic behaviors leading to negative reactions from others. Thus, the strong bias that NA has in the area of social stressors may be partly due to this stressor creation mechanism. The results of Kohn and Schooler (1982), who found a causal effect of anxiety on time pressure in a longitudinal study, are compatible with this mechanism. In addition there is a large literature showing that people have negative responses to depressed individuals (e.g., Sacco, Dumont and Dow, 1993).

The mood mechanism

Mood can also have an impact on people's reports of job stressors, job strains, and even NA. In their longitudinal study, Chen *et al.* (1993) found partial correlation reductions when either mood or NA were assessed concurrently that were both larger than when NA was assessed prior to the other variables. This suggested that the transitory mood had a larger impact than the stable trait on the observed correlations among job stressors and job strains. Dormann, Zapf and Speier (1996) (Dormann, C., Zapf, D. and Speier, C. (1996). 'Social support, social stressors at work and depression: testing for main and moderating effects with structural equations in a 3-wave longitudinal study', Manuscript: University of Konstanz, unpublished manuscript.) and Marcelissen *et al.* (1988) using a structural equations approach found that cross-sectional stressor-strain correlations were biased by so-called occasion factors that could be interpreted as mood factors (Dwyer, 1983). These results raise also the possibility that the assessment of NA itself is affected by mood. Thus, it may be mood rather than trait NA that reduces stressor-strain relationships with mood influencing stressors, strain, and NA alike.

It also seems quite likely that job conditions affect mood which affects the assessment of NA (Spector, 1992). Perhaps high levels of stressors lead people to frequently feel anxious and upset, and this leads them to score higher on NA, whether or not the underlying NA trait level has changed. If mood is affected by job conditions, and mood affects the measurement of NA, then the correlation between NA and job stressors might well reflect the indirect influence of the job stressors on the report of NA rather than NA on reports of job stressors.

Although we are arguing that mood is a likely bias, we are not arguing that researchers should partial mood rather than trait NA automatically from studies to control its effects. Again this is a dangerous procedure because mood can have a substantive role. If it acts as a job strain, then removing its relation with other job strains would be discarding the true variance of interest. Furthermore, in some cases mood might be an explanation for an individual's perception of job stressors, which can be transitory. A person might perceive job stressors to be higher when they are experiencing negative moods than when they experience positive moods, but their reports of those perceptions might still be accurate. Mood in such a case would not be a bias if assessment of individual perception is of interest.

The causality mechanism

The last possibility is that exposure to high levels of job stressors tends to make people higher in NA. Thus the job affects the trait itself, at least the empirical indicators of NA. This was the case in the studies of Dormann *et al.* (1996), Leitner (1993), and Schonfeld (1992). Watson and Slack (1993) concluded that NA was caused in part by job satisfaction. Individuals who hated their jobs were likely to become higher in NA.

Although NA is conceptualized as a stable trait across time (Watson and Clark, 1984; Watson and Pennebaker, 1989), the variables suggested to be indicators for NA, notably anxiety and depression, have been shown to be likely influenced by job related stressors in three longitudinal studies (Dormann *et al.*, 1996; Leitner, 1993; Schonfeld, 1992) and by stress management intervention in another (Schroeder, 1983). Dormann *et al.* (1996) demonstrated a causal effect of social stressors on depression using a linear structural equations approach in a three-wave longitudinal study. Leitner's (1993) cross-lagged panel study showed a similar effect of work stressors (observed by trained experts) on depression. In Schroeder's (1983) study, NA measures (i.e., Spielberger's trait anxiety scale and the Taylor manifest anxiety scale) were significantly decreased among nurses who participated in a cognitive restructuring intervention. Further, longitudinal research has demonstrated that depression is changed as a consequence of unemployment (e.g., Balz *et al.*, 1985; Frese and Mohr, 1987; Mohr, 1993; O'Brien and Feather, 1990). The above findings suggest that the empirical indicators for NA react to stressors similarly as other strain variables.

Conclusions

Our conclusion is that observed relations of NA with job stressors and strains are due to several factors. We should not assume that correlations among work variables have been inflated by an NA bias. We discussed six plausible mechanisms that explain relations of NA with other variables. These mechanisms deserve research attention to help us understand the interplay of personality and job stressors on job strain.

Partialling is a dangerous procedure because of the potential to remove substantive effects rather than bias. We strongly recommend against partialling *for the purpose of controlling nuisance variance*. This is not to say that we are against using complex statistics for other purposes. In fact we consider the use of partialling by Brief *et al.* (1988) as a highly appropriate first test of the bias hypothesis. Large differences between zero-order and first-order partials would be consistent with the bias hypothesis. However, taken alone this is insufficient evidence, and certainly does not justify concluding that NA is a proven bias that should be statistically controlled in future studies. Only when a variable has been demonstrated conclusively to be a bias and only a bias should it be partialled.

Even more complex statistical control procedures, such as structural equation modeling, are not appropriate in this domain. As we have demonstrated, NA likely has a variety of roles in the job stress process, making simple bias models misspecified. With our present state of knowledge, we should go beyond simple bias models in testing the effects of NA. Models containing substantive effects should be investigated in future studies. Again we consider efforts such as Williams *et al.* (1996) to be appropriate, because their purpose was to test potential NA bias hypotheses and models. However, automatically adding NA to models to control for measurement bias should not be done.

Establishing that a variable is a bias is not a simple procedure. One must show that it relates to one or more measured variables, but that it does not have substantive effects. Multiple methods to assess job stressors and job strains would be needed to help show that NA relates only to self-reports. This alone, however, is insufficient as NA might relate only to perceptions and reactions that are unmeasurable with techniques other than self-report. In the NA domain we already have

evidence for a substantive role, so we are beyond a simple bias mechanism, although it is certainly possible that NA has this role as well.

The empirical results discussed in this article suggest that the *potential* biasing effect of NA is high, when both the stressors and strains have theoretical overlap with NA (which is the case for some life events, daily hassles or interpersonal conflict scales), and when measures have an affective tone. Job strain measures are more strongly correlated with NA than stressor measures in most cases, as we have shown. If stressor measures are used that are descriptive and non-affective, and are related to the objective work environment and, thus, have little theoretical overlap with NA then the partialling effect of NA leads seldom to a reduction of correlations higher than 0.06. If the strain variables show a strong overlap then the partial correlation is often higher than the zero-order correlation. If neither the stressor nor the strain variables are overlapping with NA, as in the case of work stressors and job satisfaction in the Frese (1985) data, then the partialling effect is, of course, approximately zero.

The research attention given recently to NA has been useful because it has contributed to a more careful consideration of stressor–strain relations. However, both the empirical results presented and literature reviewed in this paper indicate that assuming NA has only a biasing effect and partialling it from stressor–strain relations is ‘throwing out the baby with the bath water’. Therefore, we disagree with Brief *et al.*’s (1988), McCrae’s (1990), and Payne’s (1988) conclusion that partialling NA is a must in the assessment of stress at work, because there is the danger of actually subtracting true variance from the stressor–strain relations. In cross-sectional studies based on self-report data, there is no easy statistical way out of methodological problems (Meehl, 1970; 1971). Introducing a measure of NA and using the partialling method is not a useful strategy, and it is quite dangerous. We run the risk of erroneously concluding that job stressors and job strains are unrelated when they really are. Rather, it is better to follow suggestions (e.g., Burke *et al.*, 1993; Ganster and Schaubroeck, 1991) to improve the general quality of the data in job stress research.

Several feasible approaches can be taken to collect more conclusive data about the role of NA in job stress research. (1) Try to optimize measures by reducing the affective tone of items. As discussed above, the potential biasing effect of NA is marginal in such cases. (2) Use objective measures (or measures that are more objective than a simple questionnaire, such as peer ratings of stress, observers, supervisors, codings of interview responses, etc.) to assess job stressors. (3) Use multiple measures for stressors, strains or both. A potential biasing effect of NA can be controlled for when different measurement methods are used for independent and dependent variables. (4) Use more sophisticated designs such as longitudinal or quasi-experimental studies. Most strategies to analyze longitudinal data such as hierarchical regression and structural equation approaches applied to longitudinal data focus on the relations between changes in variables. This is done by partialling the prior from the subsequent measure of a particular variable (e.g., Dwyer, 1983; Williams and Podsakoff, 1989). If the biasing hypothesis is true then trait NA should affect the measures of variables at different points in time similarly. Partialling the prior from the subsequent measure of a variable would automatically control for the effects of stable third variables such as NA. In addition, using structural equation modeling in longitudinal studies allows one to model so-called occasion factors (Dwyer, 1983; Zapf, Dormann and Frese, 1996). These factors represent effects of variables such as mood which are specific to a particular occasion and are uncorrelated with any variable not measured in the same situation. Occasion factors are a possibility to model the ‘mood mechanism’ described above.

If non-affective measures for task-related and organizational stressors are used the partialling effect is minimal, and would be superfluous in such cases. When social job stressors (interpersonal conflicts or organization related critical life events) are used where the partialling effect

is typically higher and, in cases substantial, there is also a higher likelihood for the substantive NA mechanisms. Here, a high quality design is particularly necessary to distinguish between bias and substantive effects.

Part of future efforts should be directed at understanding the role in the job stress process of personality in general, and affective dispositions such as NA in particular. The complex role of personality makes it imperative that partialling is not done to control biases that either don't exist or are confounded with substantive effects.

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