Original Article

Reciprocal Relationships Between Job Demands, Job Resources, and Recovery Opportunities

Alfredo Rodriguez-Muñoz,[1] Ana I. Sanz-Vergel,[2] Evangelia Demerouti,[3] and Arnold B. Bakker[4]

[1]Department of Social Psychology, Complutense University of Madrid, Spain, [2]School of Social and Behavioral Sciences, IE University, Spain, [3]Faculty of Industrial Engineering & Innovation Sciences, Eindhoven University of Technology, Eindhoven, The Netherlands, [4]Department of Work and Organizational Psychology, Erasmus University Rotterdam, The Netherlands

Abstract. The aim of this study was to explore longitudinal relationships between job demands, job resources, and recovery opportunities. On the basis of the Job Demands-Resources model and Conservation of Resources theory we hypothesized that we would find reciprocal relations between job demands, job resources, and recovery opportunities over time. The sample was composed of 502 employees from a chemical processing company in the Netherlands, and we used a time lag of 1 year. Results of structural equation modeling analyses supported our hypotheses. Specifically, it was found that Time 1 (T1) workload was negatively related and autonomy positively related to Time 2 (T2) recovery opportunities. Additionally, T1 recovery opportunities had a negative effect on T2 workload and positive effects on autonomy and feedback. Overall, the findings suggest the presence of a positive upward spiral between job demands, job resources, and recovery opportunities.

Keywords: job demands, job resources, JD-R model, reciprocal effects, recovery opportunities

The idea that job demands inevitably lead to diminished well-being has started to lose strength nowadays. Instead of that, researchers have proposed that health problems are the result of an imbalance between the effort invested at work and the opportunities for recovery (Taris et al., 2006). Recovery has become a hot topic in the field of organizational psychology during the last years, with several cross-sectional and diary studies examining factors that hinder or promote opportunities to recover (e.g., Sonnentag & Kruel, 2006; Sonnentag & Zijlstra, 2006).

Despite the wide number of studies examining this topic, the notion of "*recovery opportunities*" has not been previously operationalized. Taris et al. (2006) suggested that high job demands restrict opportunities to recover. For instance, workload or having to work long hours impedes the possibility to engage in recovery activities outside work (i.e., leisure or social activities). These authors use the concept of recovery opportunities but they do not measure it. In this study, we address this gap by examining this concept. We conceive recovery opportunities as "*the possibility, in terms of available time, to engage in situations that facilitate the psychological experience of recovery*" (e.g., not working too many hours allows having more time for leisure activities).

Moreover, most studies on this topic have used cross-sectional designs or daily diary designs. The main problem with cross-sectional designs is that we lose information about the process of recovery, that is, about what happens before and after recovery takes place (Demerouti, Bakker, Geurts, & Taris, 2009). Diary studies analyze short-term processes, so that we examine variations at the within-person level. However, studies focusing on the long-term relationships between job demands, job resources, and recovery opportunities are still lacking (Sonnentag, Binnewies, & Mojza, 2010). This has led to a call for studies exploring the process of recovery using longer time lags (Sonnentag & Geurts, 2009). Thus, the aim of the present study was to explore longitudinal relationships between the abovementioned variables. Based on the Job Demands-Resources (JD-R) model (Bakker & Demerouti, 2007) and Conservation of Resources (COR) theory (Hobfoll, 1998), we propose reciprocal relationships between job demands (i.e., cognitive demands and workload), job resources (i.e., feedback and autonomy), and recovery opportunities.

The contribution of this study is that we focus on the notion of recovery opportunities, considered as a step that precedes recovery. Moreover, by analyzing the longitudinal relationships we can understand the processes linking recovery and job demands/resources over time. The central question we try to answer is whether having specific job conditions influences our recovery opportunities, or whether

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having recovery opportunities changes the way in which we face job demands and helps us to create resources. The existence of reciprocal relationships would mean that traditional causal models within the field of recovery are not enough for explaining the dynamic chronic processes that may exist. Contrary to most studies on recovery that focus on daily predictors and outcomes of recovery, we examine long-term and lasting effects that go beyond the effect of one day.

Recovery as a Mixture of Terms: Clarifying Concepts

Recovery involves different concepts that need to be distinguished. In general terms, *recovery* refers to a process of psycho-physiological unwinding after effort expenditure (Geurts & Sonnentag, 2006). After that process, considered as opposite to the building up of stress, individuals feel renovated not only at the physiological level (i.e., reduction of cardiovascular activity), but also at the cognitive and affective levels through the restoration of impaired mood or the reduction of psychological strain (Sonnentag & Fritz, 2007).

Sonnentag (2001) started with a classification of the main *activities* that could help employees to recover and found that whereas work-related activities had a negative impact on individuals' well-being at bedtime, social and physical activities had a positive effect. In a more recent study, Sonnentag and Fritz (2007) recognized that the most important issue in recovery was not the activity per se but the underlying psychological process. They distinguished between four *recovery experiences* – psychological detachment from work, relaxation, control over leisure time, and mastery experiences (see Sonnentag & Fritz, 2007, for a review). When analyzing potential antecedents of these recovery experiences, it was found that job stressors were negatively related to three of the four recovery experiences, which implies that job characteristics are somehow related to the opportunities to recover. Another conceptualization of recovery is related to a sense of urgency of taking a break from work demands, which has been called *need for recovery* (Sonnentag & Zijlstra, 2006).

These studies refer to specific activities or mechanisms, but something important is missed: to detach from work, to relax, or to engage in social or leisure activities, people need *recovery opportunities.* When authors talk about recovery, they refer to the fact that not all the activities offer real opportunities to recover. Work-related activities or household tasks may be particularly fatiguing (Sonnentag & Zijlstra, 2006). The latter authors also recognize that when people have the opportunity to satisfy their need for recovery, it will be fulfilled. Moreover, Taris et al. (2006) remark that high demand jobs offer little opportunity to recover from the expended effort. Despite the emphasis put on the need for having recovery opportunities, scholars have not captured this notion as a possible variable of study. This is the reason why in this study we used a specific measure of recovery opportunities.

Theoretical Framework and Hypotheses

Having recovery opportunities depends to a great extent on the specific job characteristics existing on the work settings. According to the JD-R model (Bakker & Demerouti, 2008; Demerouti, Bakker, Nachreiner, & Schaufeli, 2001) characteristics of work environments can be classified into two main categories, namely job demands and resources. Whereas *job demands* are those aspects of the job requiring sustained physical or mental effort and therefore are associated with energetic costs, *job resources* refer to organizational aspects that are functional in achieving work goals, reduce job demands and the associated costs, or stimulate personal growth. The model proposes that the combination of high demands and low resources leads to high levels of strain, whereas the combination of high demands and high resources leads to high levels of motivation. For example, research has shown that job demands such as work pressure, and emotional demands are related to exhaustion and impaired health, whereas job resources such as social support and performance feedback lead to work engagement and organizational commitment (e.g., Bakker, Demerouti, & Schaufeli, 2003; Bakker, Demerouti, & Verbeke, 2004).

These studies reflect the assumption that high job demands and low job resources lead to negative outcomes. In line with this, similarly, Sluiter, de Croon, Meijman, and Frings-Dresen (2003) showed that high cognitive demands predicted need for recovery two years later. Regarding job resources, Sonnentag and Fritz (2007) found that emotional social support was a job resource positively related to several recovery experiences, such as detachment from work and relaxation. Thus, researchers in the field of organizational psychology have started to link job characteristics with different terms related to recovery.

Apart from the JD-R model, within the field of recovery COR theory (Hobfoll, 1998) provides a useful framework to analyze how the process of recovery works. The main assumption of this theory is that people strive to obtain, retain, and protect their resources. Based on this idea, Sonnentag and Fritz (2007) argue that individuals need recovery as a way to gain new resources or restore lost resources (e.g., energy or positive mood). In a longitudinal study, Demerouti, Taris, and Bakker (2007) found a reciprocal and positive relationship between need for recovery and home-work interference over time, suggesting the existence of a negative spiral between the home and the work domain.

Although these studies show that job characteristics have an impact on different aspects of recovery, the truth is that research in this field has mainly focused not on the antecedents but on the potential positive or negative effects of recovery. For instance, in a daily diary study, Sonnentag, Binnewies, and Mojza (2008) found that detaching from work during the evening predicted (reduced) negative activation and fatigue the next morning, whereas relaxation in the evening predicted morning serenity. In a similar vein, a week-level study showed that weekly psychological detachment predicted positive affect at the end of the working week

(Sonnentag, Mojza, Binnewies, & Scholl, 2008). The positive effects of recovery at work have also been demonstrated in a daily diary study in which it was found that the feeling of being recovered after a break at work was positively related to vigor and work-family facilitation at bedtime (Sanz-Vergel, Demerouti, Moreno-Jiménez, & Mayo, 2010). However, as argued above, to achieve a better understanding of the process of recovery, studies should focus not only on the consequences of recovery but also on the specific characteristics that impede or facilitate "*recovery opportunities*."

Another aspect to consider refers to how job demands, job resources, and recovery opportunities relate to each other over time. The classical reasoning in this domain is that high job demands and low job resources lead to lower levels of recovery. This pathway has been confirmed by several studies (e.g., Sluiter, Van der Beek, & Frings-Dresen, 1999; Sonnentag, & Bayer, 2005; Taris, Geurts, Schaufeli, Blonk, & Lagerveld, 2008). For example, in a study conducted among couples, Sonnentag, Kuttler, and Fritz (2010) found that workload and emotional dissonance negatively predicted psychological detachment from work during nonwork time. Similarly, in a cross-sectional study, Sonnentag and Fritz (2007) showed that emotional social support and job control were positively associated to several recovery experiences. There are various ways in which this relationship may operate. First, we consider that working in a situation with exposure to cognitive demands or workload implies an extra effort that may hinder the opportunities for recovery. This is in line with Meijman and Mulder's (1998) Effort-Recovery model, which recognizes that employees who invest an effort to perform well at work need opportunities to recover from this expended effort. Otherwise, psycho-physiological systems do not return to a baseline level and chronic health problems may appear.

Second, regarding job resources, autonomy may offer individuals opportunities to recover because they can organize their tasks at work, so it is easier to decide when to take a break. Along the same line, the possibility to receive adequate feedback about how to improve or change your performance can help individuals to reduce the tendency to worry about work-related issues (Bakker, Demerouti, & Euwema, 2005) and thus to facilitate recovery opportunities. Based on this literature, we propose the next hypotheses:

Hypothesis 1a: Time 1 job demands (i.e., workload and cognitive demands) are negatively related to Time 2 recovery opportunities.

Hypothesis 1b: Time 1 job resources (i.e., autonomy and feedback) are positively related to Time 2 recovery opportunities.

Although this causal pathway is the most accepted within the recovery literature, there are theoretical and empirical reasons to believe that it is also plausible that recovery opportunities have an impact on job demands and resources. In their review about longitudinal research, Zapf, Dormann, and Frese (1996) found that six out of sixteen of these studies showed reversed causal relationships between job conditions and work stress. From a theoretical point of view, there are some mechanisms proposed to explain this reversed causality. Zapf et al. (1996) using the so-called drift hypothesis suggest that individuals with bad health drift to worse jobs, where high job demands are more prevalent. A similar explanation has been proposed by De Lange, Taris, Kompier, Houtman, and Bongers (2005). Furthermore, according to the gloomy perception mechanism, unhealthy employees may evaluate their environment more negatively and thus report less favorable work characteristics. On the one hand, individuals with low recovery opportunities may assess their environment more negatively, perceiving more job demands and less job resources. On the other hand, recovery opportunities may help one to have a more positive view of the work environment, so that people feel full with energy and they invest it in creating new resources (e.g., by organizing their tasks or by asking for feedback). Berg, Wrzesniewski, and Dutton (2010) suggest that individuals who have discretionary use of time and energy are also able to act on meaningful patterns in their work environments that they construe and pursue as opportunities. This is in line with Lazarus's model of stress and coping (1966), whose core assumption is that stress is the result of person-environment transactions, so that not only is the external stressor important but also the person's appraisal of this stressor (e.g., challenging and controllable, or negative and stressful). Thus, we formulated the next hypotheses:

Hypothesis 2a: Time 1 recovery opportunities are negatively related to Time 2 job demands (i.e., workload and cognitive demands).

Hypothesis 2b: Time 1 recovery opportunities are positively related to Time 2 job resources (i.e., autonomy and feedback).

To the best of our knowledge, only a few studies have addressed the relationship between job demands and recovery over time. Sonnentag, Binnewies, et al. (2010) showed that psychological detachment from work predicted emotional exhaustion 1 year later. In the same vein, in a study conducted by Sluiter et al. (2003) it was found that high cognitive demands predicted need for recovery with a time lag of 2 years. Moreover, Demerouti et al. (2007), using a cross-lagged panel design with a 1-month time interval, found that home-work interference and need for recovery were reciprocal and positively related over time, suggesting that insufficient recovery leads to more conflicts between the home and work domain and vice versa.

Taken together, previous literature suggests the likelihood of reciprocal relationships between job demands, job resources, and recovery opportunities. According to COR theory, people have to invest resources to gain new ones; however, after losing resources in the workplace, it is difficult to invest new energy to engage in recovery activities. Recovery is considered as a way of replenishing the internal resources lost during the work day (Sonnentag & Fritz, 2007). Thus, recovered employees will be able to successfully cope with

job demands, which also may be used to activate or create job resources. Consequently, this will facilitate more recovery opportunities, creating a positive upward spiral. This argument leads to our final hypothesis:

Hypothesis 3: Job demands (i.e., cognitive demands and workload), job resources (i.e., feedback and autonomy), and recovery opportunities are reciprocally related.

Method

Procedure and Participants

A two-wave longitudinal study with a 1-year time interval took place among employees from a chemical processing company in the Netherlands. After meetings with the floor managers and the human resources department, it was agreed upon that all employees would have the possibility to fill out an electronic questionnaire (published on a secured website) during work time. At Time 1 (T1) and at the Time 2 (T2) follow-up 1 year later, a newsletter and an email of the management announced to all employees that the questionnaire could be filled out. The newsletter and email explained the purpose of the study, emphasized voluntary participation, and guaranteed confidentiality. At T1 all 1,319 employees were invited by the company's occupational health and safety service to participate in the study that was part of a recurring employee health and well-being survey (response rate 63%; $N = 832$). One year later, at T2, all 1390 employees were invited to participate again in a similar health and well-being survey (response rate 60%; $N = 835$). The panel group that completed both questionnaires and that is used in the present study consists of 502 employees. Thus, 38% of the initial sample was included in the panel.

The panel group included 328 men (65.3%) and 174 women (34.7%). Their mean age was 42.6 years ($SD = 9.0$) and mean organizational tenure was almost 15 years ($M = 14.7$; $SD = 10.31$). In addition, participants reported to work 36.9 hr per week ($SD = 5.23$) on average, and most of the participants had a nonsupervisory position (85.9%).

Measures

All variables were assessed with the same scales at both waves. All items were scored on a 5-point frequency scale, ranging from (1) "never" to (5) "always." The reliabilities of the scales are presented on the diagonal of Table 1.

Recovery opportunities were measured with five items that were specifically developed for the current study. The items indicate the opportunities to recover from work-related effort during off-job time: "When I come home from my work." (1) "I immediately have to start doing housework" (reverse coded); (2) "I have some time for myself;" (3) "I am able to recover from the rigours of the day;" (4) "My attention is completely taken up by my family members (partner, children)" (reverse coded); and (5) "I am able to talk quietly about what happened during the day." The scale showed adequate reliabilities at both waves (Cronbach's $\alpha = .74$ and .77, respectively) and was moderately stable over time (.59, $p < .001$).

Cognitive demands were assessed by a five-item scale developed by the researchers and comparable with the cognitive demands scale of the Dutch Questionnaire on the experience and evaluation of work (Van Veldhoven, de Jonge, Broersen, Kompier, & Meijman, 2002). An example is: "Does your work require constant concentration?" *Workload* was measured with a three-item scale developed by Bakker, Demerouti, Taris, Schaufeli, & Schreurs, 2003. The items refer to quantitative, demanding aspects of the job. An example item is: "My job requires working very hard."

Table 1. Descriptive statistics and correlations among the study variables ($N = 502$)

Variable	*M* (*SD*)	1	2	3	4	5	6	7	8	9	10	11	12
1. Gender	1.35 (0.47)	–											
2. Age	42.69 (9.03)	.20**	–										
3. Recovery opportunities T1	2.69 (0.85)	−.08	.05	−.74									
4. Cognitive demands T1	3.56 (0.58)	−.01	.07	−.04	−.72								
5. Workload T1	3.07 (0.85)	−.02	.06	−.16**	.45**	−.85							
6. Autonomy T1	3.64 (0.76)	.01	.03	.05	.01	−.14**	−.78						
7. Feedback T1	3.66 (0.68)	.01	.13**	.14**	.01	−.01	.30**	−.80					
8. Recovery opportunities T2	2.72 (0.89)	−.13**	.07	.59**	−.06	−.14**	.10*	.01	−.77				
9. Cognitive demands T2	3.47 (0.64)	−.01	.03	−.04	.61**	.28**	−.04	−.01	−.09*	−.79			
10. Workload T2	2.97 (0.79)	−.01	.05	−.16**	.31**	.54**	−.12**	−.01	−.18**	.46**	−.82		
11. Autonomy T2	3.51 (0.73)	−.05	.04	.09*	.01	−.13**	.60**	.25**	.12**	−.03	−.15**	−.75	
12. Feedback T2	3.61 (0.64)	.01	.16**	.13**	.07	−.07	.20**	.46**	.11*	.02	.03	.34**	−.82

Note. Gender was coded as 1 = male; 2 = female. *$p < .05$. **$p < .01$.

Autonomy was assessed with a three-item scale, based on Karasek's (1985) job content instrument (see also, Bakker, Demerouti, & Schaufeli, 2003). An example is: "I can decide myself how I execute my work." *Feedback* was assessed with three items that were validated in previous research (Bakker, Demerouti, Taris, et al., 2003). For example: "I receive information/feedback from my supervisor about how well I do my job". All responses were coded such that higher scores referred to higher job demands and more job resources, respectively.

Statistical Analyses

Data were analyzed using structural equation modeling (SEM) in AMOS 7.0 (Arbuckle, 2006), using the maximum-likelihood method. All variables had acceptable values of skewness (< 2.0) and kurtosis (< 7.0) for the use of this estimation (Curran, West, & Finch, 1996). Following the two-step approach procedure recommended by Anderson and Gerbing (1988), we first tested the measurement models by means of item-level confirmatory factor analyses (CFA) for the two measurement points separately. These analyses showed that a five-factor measurement model (including recovery opportunities, workload, cognitive demands, autonomy, and feedback) showed an acceptable fit to the data at both T1, $\chi^2(115) = 367.58$; GFI = .93, RMSEA = .06 and T2, $\chi^2(115) = 376.87$; GFI = .92, RMSEA = .06. This model showed a significantly better fit as compared to the one-factor model, for T1: $\Delta\chi^2(4) = 1818.62$, $p < .001$; for T2: $\Delta\chi^2(4) = 1872.13$, $p < .001$, and to a model where the two job demands and the two job resources were represented in two general factors, for T1: $\Delta\chi^2(2) = 511.31$, $p < .001$; for T2: $\Delta\chi^2(2) = 554.71$, $p < .001$. Second, we tested the hypotheses by comparing competing models regarding the causal relationships between job demands, job resources, and recovery opportunities. Estimating variables with several numbers of items may yield insufficient power or underidentification (Bentler & Chou, 1987). Therefore, we reduced the complexity of our SEM models by using manifest variables (Jöreskog & Sörbom, 1993). This approach has been used in previous studies in the field of the JD-R model (e.g., Xanthopoulou, Bakker, Demerouti, & Schaufeli, 2009). Synchronous correlations between constructs at the same wave were allowed in all models, to test the longitudinal relations.

We tested four competing models. The first model was the baseline or stability model (M_1) which included temporal stabilities of the same variables over time and correlations of the variables within each measurement wave (synchronous). Second, we tested the normal causation model (M_2). This model resembled M_1, but included additional cross-lagged paths from T1 job demands (workload and cognitive demands) and job resources (autonomy and feedback) to T2 recovery opportunities. Third, the reversed causation model (M_3) resembled M_1, but included cross-lagged paths from T1 recovery opportunities to T2 job demands and job resources. Finally, in the reciprocal causation model (M_4) the relations specified in M_1 were extended with additional reciprocal cross-lagged paths from job demands and job resources to recovery opportunities and vice versa. The competing models were compared by means of the chi-square difference test (Weston & Gore, 2006). Besides this statistic, we additionally inspected the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA). Levels of .90 or higher for CFI and TLI, and .08 or lower for RMSEA indicate a reasonable fit of the model to the data (Byrne, 2002).

Results

Descriptive Statistics

The means, standard deviations, and correlations between the study variables for both studies are presented in Table 1, as well as the reliability coefficients (Cronbach's alpha). All variables had satisfactory internal consistency at both measurement times ($\alpha \geq .72$). The pattern of correlations was in the expected direction. Regarding the test-retest correlations of the variables under study, the stability effects ranged between .46 (for feedback) and .61 (for cognitive demands), indicating that the variables under study show some stability. Additionally, as can be seen in Table 1, gender was related to recovery opportunities at T2 ($r = -.13$, $p < .01$), and age was positively associated to T1 ($r = .13$, $p < .01$) and T2 ($r = .16$, $p < .01$) feedback. Therefore, gender and age were used as covariates in all following SEM analyses.

Cross-Lagged Relationships Between the Study Variables

Table 2 displays the goodness-of-fit indices of the competing models, as well as the model comparisons. The chi-square difference test shows that the reciprocal model (M_4) provided a better fit to the data than the stability model (M_4 vs. M_1; $\Delta\chi^2 = 33.51$, $\Delta df = 8$; $p < .01$), the normal causal model (M_4 vs. M_2; $\Delta\chi^2 = 10.51$, $\Delta df = 4$; $p < .05$), and the reversed causal model (M_4 vs. M_3; $\Delta\chi^2 = 18.86$, $\Delta df = 4$; $p < .01$). In addition, reciprocal model M_4 showed the best fit in terms of CFI, TLI, and RMSEA. The model with cross-lagged relationships between T1 job demands and job resources and T2 recovery opportunities as well as between T1 recovery and T2 job demands and resources (M_4) explains our data best.

Figure 1 presents all significant standardized cross-lagged effects observed in M_4 (reciprocal causation). Specifically, it was found that T1 workload ($\beta = -.09$, $p < .05$), autonomy ($\beta = .12$, $p < .01$), and feedback ($\beta = -.11$, $p < .01$) predicted T2 recovery opportunities. Note that the relationship of T1 feedback and T2 recovery opportunities was negative, which is not in the expected direction. An inspection of correlation matrix reveals that the correlation between T1 feedback and T2 recovery opportunities is essentially zero, which suggests that the resulting significant path might be a statistical artifact known as the suppressor effect (Maassen & Bakker, 2001; Tzelgov & Henik, 1991). Therefore, this relationship should

Table 2. Goodness-of-fit indices and models comparisons (N = 502)

Factor model	$\chi^2(df)$	p	CFI	TLI	RMSEA	Comparison	$\Delta\chi^2$	Δdf
M_1 Baseline or stability model	100.1 (38)	.000	.924	.868	.057			
M_2 Normal causation model	77.10 (34)	.000	.947	.897	.050	M_1–M_2	23.00**	4
M_3 Reversed causation model	85.45 (34)	.000	.937	.878	.055	M_1–M_3	14.65**	4
M_4 Reciprocal causation model	66.59 (30)	.000	.955	.901	.049	M_1–M_4	33.51**	8
						M_2–M_4	10.51*	4
						M_3–M_4	18.86**	4

Note. *p < .05. **p < .01.

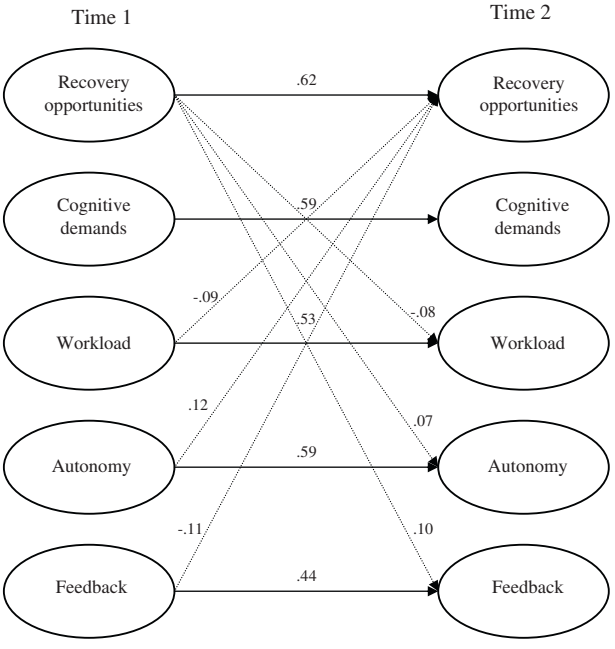

Figure 1. Reciprocal model of work characteristics and recovery opportunities. Standardized coefficients greater than .10 are significant at p < .01; the rest of the values are significant at < .05.

not be taken as a substantive effect. Taken together, as only one of the two job demands and one of the two job resources of T1 were significantly related to T2 recovery opportunities, Hypotheses 1a and 1b were partially supported. Further, as predicted, T1 recovery opportunities were negatively related to T2 workload (β = −.08, p < .05), and positively related to T2 autonomy (β = .07, p < .05) and T2 feedback (β = .10, p < .05), which provides partial support for Hypotheses 2a and 2b. Finally, strong support was found for Hypothesis 3, since six out of eight predicted reciprocal effects were significant (75%).

Discussion

The main purpose of the present study was to examine whether job demands and job resources predict later recovery opportunities and vice versa. By doing so, this study takes a step toward a better understanding about the direction of the relationships between work characteristics and recovery over time. Based on COR theory (Hobfoll, 1998), ERI model (Meijman & Mulder, 1998), and JD-R model (Demerouti et al., 2001), we hypothesized to find reciprocal, lagged effects among the variables.

Results of structural equation modeling analyses showed that the reciprocal model, where mutual relationships between work characteristics and recovery were included, provided a better fit to the data than the alternative causality models. Overall, the findings largely supported our hypotheses. After controlling for gender and age, results revealed that workload and feedback had a negative lagged effect on recovery opportunities, whereas autonomy had a positive causal impact on recovery. These findings are in line with earlier studies which demonstrated the effects of job demands and resources on recovery (Sonnentag & Kruel, 2006; Sonnentag & Zijlstra, 2006). Additionally, our findings are also in agreement with longitudinal studies using time lag of 2 years (De Croon, Sluiter, Blonk, Broersen, & Frings-Dresen, 2004).

Moreover, these findings are in line with the results reported by Meijman, Mulder, van Dormolen, and Cremer (1992) who demonstrated that intensity of work is an important predictor of need for recovery. The current results complement previous findings on the short-term effects of work variables on recovery (Demerouti et al., 2009), by applying a longer time lag which may offer new insights into the recovery process. We have to take into account that recovery processes are inherently dynamic, since they change over time and its different components mutually influence each other.

There were also several reverse significant paths from recovery opportunities to job demands and job resources. Specifically, it was found that recovery opportunities at T1 predicted negatively T2 workload and positively T2 autonomy and feedback. As it has been argued above, when employees have low opportunities to recover, it is more likely that they evaluate their work environment less favorably. In addition, employees may intervene in the perception of their environment based on the energy level. For instance, individuals who do not achieve proper recovery may present less energy at the beginning of the working day, which will interfere with their performance at work, creating additional demands.

Our findings regarding the reciprocal effects between work characteristics and recovery are in line with earlier research. For instance, Demerouti et al. (2007) found a

positive reciprocal relationship between home-work interference and need for recovery. These long-term reciprocal relationships are consistent with COR theory and its "*gain spiral*" (Hobfoll, 1998, 2001). One of the corollaries of this theory is that those individuals who possess greater resources are less vulnerable to resource loss and more capable of resource gain. Moreover, such increases in individuals' resources may create an upward positive spiral, which, in turn, is likely to further increase or gain other resources. Our results can be explained using several mechanisms proposed by Hobfoll (1998) in COR theory. For example, low workload and high autonomy may lead to a better organization of work tasks, which will make it easier for workers to take distance from work during leisure time, making it possible to replenish lost resources. In other words, favorable working conditions may have a trigger effect on later recovery opportunities because employees have more time to engage in recovery activities (like exercise, sport, hobbies) and do not ruminate about problems at work.

In addition, recovery opportunities may have a favorable impact on later job working conditions because employees who feel recovered have more energy to cope with job demands and gain new resources (Sonnentag, Binnewies, et al., 2008). In this sense, as it has been underlined by Hobfoll and Shirom (2000), the gain spiral has its own positive benefits, because through the building up of resources more resources are available to invest again. In our study, having the opportunity to recover may help employees to cope with new workload and to gain resources that are useful to better organize their job tasks. Thus, recovery may operate in several ways. It may provide opportunities for cessation or replenishment of lost resources, as well as to gain new resources (Davidson et al., 2010).

Limitations and Future Research

The current study has limitations that are important mentioning. One limitation is that we collected exclusively self-report data, which may increase the possibility of common-method variance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). However, our two-wave panel study design clearly diminishes the risk of bias due to CMV (Schaubroeck, Ganster, & Fox, 1992). Additionally, confirmatory factor analysis showed that a single factor fit poorly to the data. Thus, we are confident that common-method bias did not play a significant role in our study. However, future research could replicate these results with different designs, for example, by including multiple source data (e.g., coworker's reports of the work environment).

A second limitation concerns causality. Although we have applied a two-wave full cross-lagged panel design which controls for stabilities and synchronous relationships, when exploring causal relations the use of multi-wave designs has been recommended (Dormann & Zapf, 1999). Regarding the time lag, we followed the recommendation of De Lange, Taris, Kompier, Houtman, and Bongers (2004), who suggested that a 1-year time lag is appropriate for demonstrating causal relationships in work contexts. Nevertheless, more research is needed to explore how job demands and job resources relate over time with recovery with shorter and longer time lags.

Third, another possible limitation is that unmeasured variables may influence the relationships under study. Although we tried to rule out third variable explanations by controlling for potential confounders (gender and age) in all the analyses, there are other noncontrolled variables that may offer alternative explanations. For example, people with fewer children may have more opportunities to recover. Similarly, highly educated people may have more means to recovery (e.g., due to higher income) and to blow off steam at home.[1] However, it is important to underline the difficulty of excluding alternative explanations, since the number of potential third variables that may have influence is potentially infinite (Hellgren & Sverke, 2003).

A fourth concern is related to sample's characteristics. This study is based on employees from one single organization, which limits the possibility of generalizability of our results. Thus, more research is needed in other contexts and organizations in order to further estimate the generalizability of our findings. Finally, regarding the SEM results, there are two issues that need to be commented. First, the cross-lagged effects found in our model were relatively small. However, according to Zapf et al. (1996), small effects are to be expected in longitudinal research. Second, we found a suppressor effect in the relationship between T1 feedback and T2 recovery opportunities. As it has been pointed out by Maassen and Bakker (2001), this kind of effect is often found in SEM analysis with longitudinal data, due to the high stability coefficients between variables. Nevertheless, all other effects were in accordance with predictions and the correlation matrix, which suggest that our findings were not biased by suppression.

Study Implications

Despite these limitations, the present findings may have important implications for both future research and practice. First, from a theoretical point of view, the reciprocal causal effects found in this study indicate the need of extending the traditional causal models of recovery to more dynamic approaches. As it has been shown in our study, not only do working conditions influence recovery opportunities, but recovery opportunities also influence the perception of work characteristics. Future research should explore whether these reciprocal relationships are present in the association between recovery and different outcomes, such as work engagement or fatigue. Second, from a practical point of view, employers may increase the probability of achieving employee recovery by reducing job demands and enhancing job resources. According to our findings, workload appears as a crucial factor hindering recovery whereas autonomy facilitates it, so where possible employers should adjust the number of tasks

[1] We thank an anonymous reviewer for suggesting these arguments.

and promote independence while carrying out these tasks. Finally, our results suggest that recovery opportunities help individuals to cope with job demands and to create new resources. These findings suggest that organizations should provide employees with facilities to recover and promote the development of leisure activities to help them disengage from the daily strains of work (Sonnentag, 2003; Sonnentag & Zijlstra, 2006). In this way, it is more likely that a positive upward spiral appears within organizations.

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Alfredo Rodriguez-Muñoz

Department of Social Psychology
Complutense University of Madrid
Campus de Somosaguas
28223 Madrid
Spain
Tel./Fax +34 91 394-2935
E-mail alfredo.rodriguez@psi.ucm.es

