Personality and Work Stress:  
The Role of Five-Factor Model Traits and Cynicism in Perceptions of Work Characteristics  

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Abstract
The role of individual differences in perceptions of stress has long been recognized. Despite this, the models that are used to measure stress at the workplace—the job strain model and the effort-reward imbalance model—were developed to assess strenuous work characteristics and their health effects, regardless of the individual. Because work characteristics are usually measured using self-reports the measures cannot be completely objective. The present study examined the susceptibility of the job strain model and the effort-reward imbalance model to Five-Factor personality traits and cynicism. In addition, this study tested the longitudinal measurement invariance of the effort-reward imbalance scales. This study was part of the ongoing prospective, population-based Young Finns study. The measurements for the present study were carried out in 2001, 2007, and 2012. Five-Factor personality traits were assessed with a questionnaire on the Five-Factor model, and cynicism was assessed with a scale derived from the Minnesota Multiphasic Personality Inventory. Work characteristics were measured with questionnaires on the job strain model and the effort-reward imbalance model.

The results showed that high neuroticism was associated with higher job strain and higher effort-reward imbalance and that high agreeableness was associated with lower job strain and lower effort-reward imbalance. High extraversion, high openness, and high conscientiousness were associated with lower job strain. Furthermore, high conscientiousness was related to lower effort-reward imbalance only in men. High job strain prospectively predicted higher cynicism six years later. The effort-reward imbalance scales achieved strict longitudinal measurement invariance and showed adequate criterion validity.

Although developed to measure the structural work environment, the job strain model and the effort-reward imbalance model seem to be susceptible to Five-Factor personality traits—especially to neuroticism and agreeableness. In addition, high job strain seems to have far reaching consequences on cynical attitudes. Furthermore, the results show that scores on effort-reward imbalance from different time points can reliably be compared with each other. This study shows that organizations and occupational health services should apply a more person-oriented approach to increasing wellbeing at work.
Tiivistelmä


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List of original publications

This thesis is based on the following publications:


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### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>NEO-FFI</td>
<td>Neuroticism, Extraversion, Openness, Five-Factor Inventory</td>
</tr>
<tr>
<td>NEO-PI</td>
<td>Neuroticism, Extraversion, Openness, Personality Inventory</td>
</tr>
<tr>
<td>CFI</td>
<td>Comparative Fit Index</td>
</tr>
<tr>
<td>RMSEA</td>
<td>Root Mean Square Error of Approximation</td>
</tr>
<tr>
<td>BIC</td>
<td>Bayesian Information Criterion</td>
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<tr>
<td>ERI</td>
<td>Effort-reward imbalance</td>
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<td>CI</td>
<td>Confidence Interval</td>
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1 Introduction

1.1 Stress – a physiological and psychological concept

In everyday life, the word stress can mean a multitude of things (Väänänen, Anttila, Turtiainen, & Varje, 2012), for example the stressors that elicit the stress response, the physiological reaction to a stressor or the stress process. The original definition of stress is that its function is to mobilize the body for fight or flight (Cannon, 1915). In modern Western societies, this reaction is abundant, as most of the stressors we encounter do not pose a physical threat. Instead, the very reaction that should protect us from physical harm exposes us to physiological reactions in our body that, if prolonged, affects our health in a negative way (Chandola, Heraclides, & Kumari, 2010).

In the literature, stress has been defined both as a physiological and as a psychological process. Physiological stress refers to the result of any demand on the body and the stress response is considered a necessary adaptive means for survival (Selye, 1956). In contrast, psychological stress has been defined as a mismatch between the demands of the environment and the individual’s resources, so that some individuals are more vulnerable to stress than others (Lazarus & Folkman, 1984). Lazarus (1966) has suggested that stress should not be treated as a variable, but as a rubric for many variables and processes that consist of but are not restricted to stressors, stress reactions, and outcomes.

If prolonged, both physiological and psychological stress may have adverse health consequences—e.g. cardiovascular disease, mortality, and depression—and it has been suggested that psychological stress affects health via physiological pathways (for example by activating the autonomic nervous system), via health behaviour or via different aspects of psychological well-being (e.g. anxiety, depression, and distress) (Bonde, 2008; Chandola et al., 2010; Elovainio et al., 2013; Hjemdahl, Rosengren, & Steptoe, 2011; Kivimäki et al., 2013; Steptoe & Kivimäki, 2012).
1.2 Work stress – theories and methodological issues

It was not until the late 20th century that work stress became an important occupational health issue in the Western societies and was understood as a threat to employees’ health and productivity (Väänänen et al., 2012). The term work stress has been used in the literature to depict strenuous working conditions and their consequences on health and wellbeing. The European Union defines work-related stress as an employee’s experience of not being able to cope with (or control) the demands from the work environment (EU-OSHA, 2009). Work stress, therefore, does not constitute the stress process—from exposure to recovery—but the stressors and reactions to them. Across Europe, the most common causes of work-related stress are job insecurity and workload (EU-OSHA, 2013). In 2005, 22% of the work-force in the 15 EU countries reported experiencing work-related stress (EU-OSHA, 2009). In Finland, 28% of the work-force reported having a mentally strenuous job in 2012 and 8% reported having stress symptoms (Kauppinen et al., 2013). Consequently, a majority of employees consider their work non-strenuous and for some, work promotes well-being (van der Noordt, IJzelenberg, Droomers, & Proper, 2014). However, those who do experience their working environment as being highly strenuous have an increased risk for detrimental health outcomes such as coronary heart disease or depression (Bonde, 2008; Kivimäki et al., 2012; Stansfeld, Shipley, Head, & Fuhrer, 2012; Steptoe & Kivimäki, 2012).

In order to conceptualize work stress and identify psychosocial risk factors at work, several models have been developed. As the measurement of stress at work is not confined to the biological markers of physiological stress (e.g. cortisol levels) but relies mostly on assessing psychological processes linked to the social environment, use of the term stress is often discouraged. Instead, researchers use the terms psychosocial risks at work or stressful work characteristics. The current study focuses on the two most prominent theoretical models on stressful work characteristics, the demand-control model (Karasek, 1979) and the effort-reward imbalance model (Siegrist, 1996). Both models are valid, reliable and they have been used extensively in occupational research to investigate the association between work characteristics and health outcomes (de Lange, Taris, Kompier, Houtman, & Bongers, 2003; Kivimäki et al., 2012; Stansfeld & Candy, 2006; van Veghel, de Jonge, Bosma, & Schaufeli, 2005).
1.2.1 The demand-control model

Karasek’s (1979) demand-control model, or the job strain model, is one of the most frequently used theories on stressful work characteristics. The model defines work stress as two-dimensional: a high level of psychological demands combined with a low level of decision latitude constitutes the highest risk for job strain and stress-related diseases (Belkic, Landsbergis, Schnall, & Baker, 2004; Haeusser, Mojzisch, Niesel, & Schulz-Hardt, 2010; Kivimäki et al., 2012). The demand component refers to workload, while control (decision latitude) refers to the control over pace, use of skills, and decision authority an employee has (Karasek & Theorell, 1990). According to the model, the demands act as a stressor and control can act as a buffer to alleviate the strain caused by the demands (Karasek, 1979). Because stress is not measured directly (but through demand and control) the use of the word job strain instead of work stress, is encouraged when using the job strain model to depict stressful work characteristics (Karasek, 1979).

In order to explore the different effects of the interaction between demands and control on health, their interaction coefficient—job strain—has in the work stress literature been calculated using several different formulations, such as linear (job demands - job control), quotient (job demands / job control), and multiplicative terms (job demands x job control) (Landsbergis, Schnall, Warren, Pickering, & Schwartz, 1994; Schnall & Landsbergis, 1994). If the linear and quotient term show significant associations, the effect of demand and control on job strain are additive (i.e. job strain decreases by increasing control or decreasing demands) but if the multiplicative interaction term is significant, its effect is stronger than the two components’ alone. In addition, the multiplicative interaction implies that control acts as a buffer against high demands (van der Doef & Maes, 1998). The use of continuous variables, such as linear and quotient term, has been recommended (MacCallum, Zhang, Preacher, & Rucker, 2002) and when using a linear term of job strain the contributions of job demands and job control are equally weighed (Landsbergis et al., 1994). It has also been stated that if the main effects for demand and control are found, the implications for job redesign are essentially the same for the different job strain formulations (Karasek, 1989). The job strain model has further been extended with a component of social support, which interacts with demand and control so that the highest job strain, or iso-strain, is caused
by conditions where demands are high but control and social support are low (Johnson & Hall, 1988). The iso-strain model has gained support in the literature, albeit to a lesser extent than the job strain model, indicating that the measurement of social support is not as straightforward as the measurement of demand and control (Haeusser et al., 2010).

1.2.2 The effort-reward imbalance model

A more recent model on stressful work characteristics is the effort-reward imbalance model, in which an individual experiences stress at work if the reciprocity between efforts spent and rewards received is not fulfilled (Siegrist, 1996). Effort is interpreted as the demands and obligations the employee is faced with and reward as the money, esteem, and career opportunities (or job security) the employee subsequently expects, not only from the employer but also from society at large (Siegrist, 1996). According to the extrinsic effort-reward imbalance hypothesis, the combination of high effort and low reward—effort-reward imbalance—increases the risk of poor health independently of the risks associated with the each of the components alone (Siegrist, 1996). The extrinsic effort-reward imbalance hypothesis has been studied extensively and most studies support the notion that the lack of reciprocity between effort and reward is associated with employee health and well-being (Backe, Seidler, Latza, Rossnagel, & Schumann, 2012; Godin, Kittel, Coppieters, & Siegrist, 2005; Niedhammer, Tek, Starke, & Siegrist, 2004; van Vegchel et al., 2005). Effort-reward imbalance has also been linked to health risk behaviours such as alcohol intake or being overweight (Siegrist & Roedel, 2006).

In addition to extrinsic effort and reward, the effort-reward imbalance model also includes intrinsic overcommitment, characterized by high need for approval and excessive work-related commitment (Siegrist, 1996; Siegrist et al., 2004). Two additional hypotheses were developed based on overcommitment: the intrinsic overcommitment hypothesis, where high overcommitment is a psychosocial risk factor even in the absence of effort-reward imbalance, and the interaction hypothesis, where the highest risk on health occurs when all three components (effort, reward, and overcommitment) interact (Siegrist et al., 2004). The intrinsic overcommitment hypothesis has gained some support whereas the interaction hypothesis has been
scarcely studied and the results have been mixed (van Vegchel et al., 2005). According to the effort-reward imbalance model, most detrimental to health is when efforts are high and subsequent rewards are low over a long period of time (Siegrist et al., 2004). This state of prolonged imbalance is likely to occur because of 1) lack of alternatives in the labour market or limited mobility, 2) strategic reasons, such as hope of promotion, or 3) high overcommitment (Siegrist et al., 2004).

Although overlapping to some extent (for example demand and effort correspond quite closely to each other), the job strain model and the effort-reward imbalance model reflect slightly different aspects of the psychosocial working environment (Siegrist et al., 2004; Tsutsumi & Kawakami, 2004). Where the job strain model emphasizes task-level control, the effort-reward imbalance model emphasizes the rewards the employee receives (Siegrist et al., 2004). Control and reward also differ in how they reflect justice at work. Control is thought to be related to procedural justice (Theorell, 2003), whereas reward is thought to reflect distributive justice (Siegrist, 2001). Another characteristic that separates the two models is the personal component overcommitment in the otherwise situational effort-reward imbalance model (Siegrist et al., 2004). In addition, the two models differ in their power of explaining stress in different occupational settings (Calnan, Wadsworth, May, Smith, & Wainwright, 2004). Effort seems to explain more of perceived stress in managers and professionals than in other occupations, while perceived stress in sales and machine operatives is best explained by lack of control (Calnan et al., 2004). Furthermore, the effort-reward imbalance model is thought to be sensitive to changes in the labour market and to reflect the predominant macro-economic labour-market situation whereas the job strain model focuses on workplace characteristics (Siegrist et al., 2004). Due to their similarities and differences, both models seem to be suitable tools for measuring stressful work characteristics in the current global economy characterized by increased insecurity in the labour market.

The surveillance of changes in work-related stress is important because these changes might reflect reactions to organizational restructuring or outcomes of stress interventions (Bourbonnais, Brisson, & Vezina, 2011; Limm et al., 2011). The analysis of change in work characteristics relies on the invariance of the scales used and the invariance of the scales allows researchers to make comparisons between constructs over time, knowing that the operationalization of the construct has not changed (Schmitt
Due to the changing world of work and the sensitivity of the effort-reward imbalance model to these changes in the labour market (Siegrist et al., 2004), assessing its longitudinal measurement invariance is integral. Some previous studies on longitudinal measurement invariance of the effort-reward imbalance scales exist. In a Dutch panel study on 383 (first wave) and 267 (second wave) healthcare workers (80–90% women) with a 1 to 2 years follow-up, the factor loadings of the effort-reward imbalance scales were found not to be invariant over time (de Jonge, van der Linden, Schaufeli, Peter, & Siegrist, 2008). In contrast, a Finnish study on 758 white-collar professionals (14–17% women) showed that the effort-reward imbalance scales were invariant across time (Rantanen, Feldt, Hyvönen, Kinnunen, & Mäkikangas, 2013). The mixed findings may be a result of differences in the samples and further research is needed in order to establish that the scales measure work characteristics in the same way (i.e., the same latent variables) across repeated measurement times.

1.3 Personality

Personality is a relatively stable, individual way of thinking, feeling and behaving (Funder, 2012) and personality psychology has been proposed as the branch of psychology concerned with identifying individual differences (Goldberg, 1981; Norman, 1963). However, for a long time the field of personality research lacked tools to identify personality—there was a need for a taxonomy that could be used to explore, examine, and explain individual differences. The first taxonomy consisted of 16 primary factors and 8 second-order factors, based on peer-ratings of college students (Cattell, 1948) and although this taxonomy was complex, it laid the ground for later trait psychologists (Digman, 1990). Several researchers tried to replicate the factor structure but they all came to the same conclusion: personality can be adequately described by five superordinate dimensions (Fiske, 1949; Norman 1963; Tupes & Kristal, 1961). Each of these dimensions—or traits—contains a large number of more specific personality characteristics and captures the basic concepts of human personality.
1.3.1 The Five-Factor Model of personality

Continuing on the work of early trait psychologists Costa and McCrae (1985) developed a questionnaire to assess the five dimensions that would explain individual differences. The Five-Factor Model of personality has since become one of the most influential taxonomies of personality traits in personality research. It specifies five personality dimensions or traits: neuroticism, extraversion, openness, conscientiousness, and agreeableness (McCrae & Costa, 1987). Neuroticism can be defined as a tendency to worry, feelings of insecurity, and self-consciousness. Individuals high on the neuroticism scale tend to be impulsive, experience more distress than others, and more often resort to self-blame when confronted with negative feelings. Extraversion can be defined as a tendency to be sociable, fun-loving, affectionate, friendly, and warm, and extraverted individuals prefer the company of others to being alone. Openness is characterized by originality, independence, and intellectual curiosity. Persons high on the openness scale are full of ideas and values and may be seen by others as intelligent. Conscientiousness can be described as a tendency to be well-organized, reliable, and persevering, and persons high on the conscientiousness scale are more capable of self-discipline than others and have an innate will to achieve. Lastly, agreeableness can be characterized as a tendency to be sympathetic, and forgiving, and an agreeable person usually trusts others and might therefore be taken advantage of more easily than persons with low agreeableness (McCrae & Costa, 1987). The five dimensions have been shown to be relatively enduring and stable over time, with normative personality change occurring from young to old age (McCrae & Costa, 2003; Rantanen, Metsäpelto, Feldt, Pulkkinen, & Kokko, 2007). However, there is some debate on what drives normative personality change in adulthood—genes or social demands and experiences (McCrae & Costa, 2003; Roberts & Mroczek, 2008; Specht, Egloff, & Schmukle, 2011).

1.3.2 Cynicism

Hostility is a personality construct that is closely related to many concepts of trait psychology, such as neuroticism and agreeableness (Costa, Busch, Zonderman, & Mccrae, 1986; Watson & Clark, 1992). While the Five-Factor Model traits are thought of as major broad traits, hostility is described as a narrower facet or aspect of broader
traits. Cynicism represents the cognitive aspect of hostility and is defined as cynical and mistrustful attitudes and the tendency to interpret other’s actions as offensive (Greenglass & Julkunen, 1989; Smith, 1994). The development of cynical hostility may be determined by both genes and environmental factors (Hakulinen et al., 2012; Merjonen et al., 2011; Rebollo & Boomsma, 2006), including early childhood experiences, low family socioeconomic status, parental Type A behaviour, and Type A behaviour in childhood (Keltikangas-Järvinen & Heinonen, 2003). Cynicism is related to many social problems, such as isolation (Vandervoort, 1999), depression (Nabi et al., 2010), as well as somatic health problems, such as cardiovascular risk (Chida & Steptoe, 2009). Therefore cynicism constitutes a public health risk and studying the underlying factors and consequences is important.

1.4 Individual differences in perceptions of work stress

It has long been recognized that there are individual differences in stress reactivity and stress responses (Lazarus & Folkman, 1984; Lazarus, 1999; Lovallo, 1997). According to the classic theory by Lazarus and Folkman (1984), stress is caused by the interplay between individual characteristics and stress factors, so that some people are more vulnerable to stress than others. One of the most comprehensive individual characteristics behind the stress experience is personality—an individual’s personality may contribute to every stage of the stress process, i.e. exposure to the stressor, appraisal of the stressor, coping, vulnerability to illness and disease, as well as response to stress (Bolger & Zuckerman, 1995; Code & Langan-Fox, 2001).

In order to shed light on the relationship between personality and work characteristics, several models have been proposed; the differential exposure model, the differential reactivity model, the differential exposure-reactivity model, and the outcome model (Bolger & Zuckerman, 1995; Kivimäki, 1996). According to the differential exposure model, personality influences exposure to stressors (Bolger & Zuckerman, 1995). Having a certain personality selects individuals to situations where they are exposed to certain stressors, e.g. work characteristics. The differential reactivity model, however, proposes that personality impacts on stress reactivity; a change in stressors influences wellbeing differently for different personalities (Bolger &
Zuckerman, 1995). The differential exposure-reactivity model combines the two previous models; personality impacts exposure and response to stressors (Bolger & Zuckerman, 1995). In contrast to the other models, the outcome model suggests that stressors influence personality, either directly or through wellbeing (Kivimäki, 1996).

Stress at work has often been examined through the conceptual framework of environmental load, where occupational conditions at work are seen to cause stress. The measures for assessing stressful working conditions—the job strain model and the effort-reward imbalance model—were originally developed to depict structural aspects of work (i.e. objective work characteristics). However, studies examining the effects of the psychosocial working environment on employee health and wellbeing are often based on self-reports. Self-reports, in turn, are vulnerable to individual dispositions, such as personality, that may confound the associations of self-reported environmental stress factors and experienced stress with related health outcomes. Thus, some people may perceive, due to individual characteristics, that their environment is highly stressful, as suggested by the differential exposure model. Population-based prospective studies in Denmark (Ebstrup, Eplov, Pisinger, & Jorgensen, 2011) as well as in Finland (Hintsa et al., 2010a; Hintsanen et al., 2011) have shown that personality and temperament traits predict perceptions of job strain and effort-reward imbalance. In addition, it has been shown that the direction of the association runs from personality to stress, not the other way round (Sutin & Costa, 2010). However, personality has also been found to moderate the association between work characteristics and health (Grant & Langan-Fox, 2007; Moyle, 1995; Vahtera, Kivimäki, Uutela, & Pentti, 2000), which might support the differential reactivity model. The role of personality in perceptions of work characteristics defined by the job strain model and the effort-reward imbalance model is, thus, still not clear.

1.4.1 Five-Factor Model traits and stressful work characteristics

Previous research has found associations between the Five-Factor personality traits and different aspects of work. High neuroticism has been found to be associated with lower work satisfaction, higher risk of burnout, and physical ill health, while the opposite has been found for extraversion, conscientiousness, and agreeableness (Alarcon, Eschleman, & Bowling, 2009; Grant & Langan-Fox, 2007; Judge, Heller, & Mount, 2002; Roberts,
Caspi, & Moffitt, 2003). In a recent study of middle-aged full-time employees conducted in the United States, it was found that low neuroticism, high extraversion, high conscientiousness, and high openness were related to greater decision latitude at work (Sutin & Costa, 2010). However, the study did not find an association between personality and psychological demands, and it did not assess job strain. A study by Grant and Langan-Fox (2007) examined whether the Five-Factor personality traits affect subjective strain at work and found that neuroticism, extraversion, and conscientiousness were related to psychological strain. They did not, however, use the job strain model as a measure of strain.

Despite previous evidence, however, little is known about the associations between the Five-Factor Model traits and stressful work characteristics defined by the job strain model and the effort-reward imbalance model. Some previous studies on conceptually similar temperament traits imply that individual differences in perceptions of stressful work characteristics do exist. For instance, studies on the association of temperament with effort-reward imbalance and job strain have shown that negative emotionality, a temperament trait conceptually close to neuroticism, predicts higher job strain and effort-reward imbalance, whereas sociability, a temperament trait similar to extraversion, predicts lower job strain and effort-reward imbalance (Hintsanen et al., 2011). Studies on the trait negative affectivity, conceptually similar to neuroticism, have also found direct associations with higher work stress (Moyle, 1995; Oliver, Mansell, & Jose, 2010).

1.4.2 Cynicism and job strain

Studies suggest that cynicism is associated with work-related factors, such as unemployment, unstable labour market prospects, and poor career achievement (Caspi, Wright, Moffitt, & Silva, 1998; Hakulinen et al., 2013; Siegler et al., 2003). Although studies on the association of cynicism with job strain are lacking, previous studies on temperament and personality traits conceptually close to cynicism have been shown to predict job strain (Hintsa et al., 2010a; Hintsa, Hintsanen, Jokela, Pulkki-Råback, & Keltikangas-Järvinen, 2010b; Hintsanen et al., 2011). Based on these previous studies it can therefore be assumed that cynicism would be associated with work characteristics conceptualized by the job strain model.
According to the selection model, cynicism increases probability for higher exposure to stress (Kivimäki et al., 2003; Smith, 1994). Because of the tendency of cynical individuals to behave in an antagonistic and aggressive way, cynicism may produce interpersonal conflict and lead to reduced social support, which, in turn, may increase health risks (Smith, 1994). The vulnerability model suggests that cynical individuals are more vulnerable to psychosocial risks than non-cynical (Kivimäki et al., 2003; Smith, 1994). Indeed studies have shown that cynical men experience less justice and social support than non-cynical men (Elovainio, Kivimäki, Kortteinen, & Tuomikoski, 2001; Elovainio, Kivimäki, Vahtera, Virtanen, & Keltikangas-Järvinen, 2003). In addition, cynical individuals perceive their social environment more negatively than others (Smith, 1994) and thus it is reasonable to assume that they make more negative and extreme interpretations about their work environment.

The reverse direction of causality is also possible. Although cynicism is considered to be a relatively stable trait in adulthood, mean level change over time is possible (Hakulinen et al., 2014). According to the social context model adverse conditions, such as psychosocial stress are antecedents of cynicism (Taylor, Repetti, & Seeman, 1997). Previous studies have found that, in women, high workload predicts anger and cynicism, defined as an employee’s hostile attitudes towards work situations (Greenglass, Burke, & Moore, 2003; Greenglass, Burke, & Fiksenbaum, 2001). In addition, psychosocial factors at work can cause burnout, which is often characterized as cynicism, emotional exhaustion, and reduced professional efficacy (Lindblom, Linton, Fedeli, & Bryngelsson, 2006; Schaufeli, Leiter, Maslach, & Jackson, 1996).

1.5 Gaps in previous research

The role of Five-Factor model traits and cynicism in perceptions of stressful work characteristics is unclear. Although the structural work environment is important in perceptions of work characteristics, individual dispositions, such as personality, also play a part in what an individual is exposed to and how he or she perceives the working environment. In order to target stress interventions and prevention appropriately, identifying the role of individual traits, such as Five-Factor personality traits and cynicism in perceptions of work characteristics is of great importance. In addition, the
research literature on the association between work characteristics and cynicism suggests that the relationship might be bidirectional, but there are no prior studies that would have investigated this.

Surveillance of change in work characteristics as a result of intervention or organizational restructuring relies on the longitudinal measurement invariance of the measures used. Previous research on the invariance of the effort-reward imbalance scales is mixed, probably due to differences in the samples and an uneven distribution of gender and occupational groups. Therefore, more research is needed using population-based samples, a wider range of occupational groups, and an even gender distribution. It is also important to examine whether effort-reward imbalance scales have measurement invariance over longer time lags than four years. Examining the susceptibility of the job strain model and the effort-reward imbalance model to personality and establishing measurement invariance of the effort-reward imbalance scales brings information that can be important for a large amount of organizational and intervention studies.
2 Aims of the study

The first aim of the present study was to examine the associations of Five-Factor personality traits with effort-reward imbalance and job strain. The Five-Factor Model of personality defines five personality dimensions: neuroticism, extraversion, openness, conscientiousness, and agreeableness. The second aim of this study was to prospectively examine whether cynicism predicts job strain, or whether the association runs the other way. The third aim of this study was to examine whether the effort-reward imbalance scales are invariant over two measurement points five years apart. In addition, criterion validity of the effort-reward imbalance scales was examined using a single-item questionnaire on general stress. The specific research questions and hypotheses were as follows:

1) Are the Five-Factor personality traits associated with job strain and effort-reward imbalance?
   Hypothesis 1a: high neuroticism is associated with higher effort-reward imbalance, whereas high extraversion, high openness, high conscientiousness, and high agreeableness are associated with lower effort-reward imbalance (Study I).
   Hypothesis 1b: high neuroticism is associated with higher job strain, whereas high extraversion, high openness, high conscientiousness, and high agreeableness are associated with lower job strain (Study II).

2) Does cynicism predict job strain, and is the association bi-directional?
   Hypothesis 2: high cynicism predicts higher job strain and high job strain predicts higher cynicism (Study III).

3) Are the effort-reward imbalance scales measurement invariant over two time-points and do the effort-reward imbalance scales have criterion validity?
   Hypothesis 3a: the effort-reward imbalance scales are invariant over time (Study IV).
   Hypothesis 3b: the effort-reward imbalance scales prospectively predict general stress (Study IV).
The study variables at the different study phases are depicted in Table 1.

**Table 1.** Study variables at different phases of the study

<table>
<thead>
<tr>
<th>Study phase</th>
<th>Study 2001</th>
<th>Study 2007</th>
<th>Study 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I and II</td>
<td></td>
<td>Five-Factor personality traits</td>
<td>ERI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Job strain</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Cynicism</td>
<td>Cynicism</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Job strain</td>
<td>Job strain</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>ERI</td>
<td>ERI</td>
<td></td>
</tr>
<tr>
<td></td>
<td>General stress</td>
<td>General stress</td>
<td></td>
</tr>
</tbody>
</table>

ERI = Effort-reward imbalance
3 Methods

3.1 Participants

3.1.1 Design of the Young Finns study

The sample for the present study was from the Cardiovascular Risk in Young Finns study, or shortly the Young Finns study. The Young Finns study is an ongoing, prospective population-based study, designed to study the risk factors of cardiovascular diseases and their determinants in children and adolescents in Finland (Raitakari et al., 2008; Åkerblom et al., 1991). The study was launched in 1978 and 1979 with two pilot studies, and the first cross-sectional study was conducted in 1980. A total of 4320 participants from six age cohorts (3-, 6-, 9-, 12-, 15-, and 18-year olds) in the population register of the Social Insurance Institution covering the entire geographic area of Finland and nationally representative of various socioeconomic groups were initially invited to the study in 1980. Of the invited, 3596 participants (83.2% response rate) responded in the first study. The follow-ups have been conducted in 1983, 1986, 1989, 1992, 1997, 2001, 2007, and the latest follow-up in 2012.

3.1.2 Sample selection of the present study

The criteria for inclusion in studies I-IV were full-time work, no missing data in the covariates and a maximum of 50% missing data in the study variables. The measurements for study I and II were carried out in 2007, when 2058 participants (57.2% response rate), aged 30 to 45 years, responded to the survey on the psychological variables. In Study I, we included 1370 participants ($M_{age} = 38$ years) with adequate information on Five-Factor personality traits and the components of the effort-reward imbalance model. Attrition analyses showed that compared to the excluded, the included participants in Study I were proportionally more often men than women (72.5% vs. 62.5%, $p < .001$), and that the included participants were slightly older than the excluded participants (37.99 vs. 36.78, $p < .001$). In comparison with the excluded participants, the included participants had lower scores on neuroticism (2.33 vs. 2.53, $p < .001$) and higher scores on extraversion (3.46 vs. 3.38, $p < .01$) in addition
to experiencing higher effort (3.25 vs. 3.09, \( p < .001 \)) and higher reward (3.76 vs. 3.65, \( p < .01 \)). Furthermore, the included participants had higher educational level (2.34 vs. 2.25, \( p = .001 \)) and higher occupational status (2.18 vs. 1.93, \( p < .001 \)) than the excluded participants.

In Study II, we included 1372 participants (\( M_{\text{age}} = 38 \text{ years} \)) with adequate information on Five-Factor personality traits and the components of the job strain model. The attrition analyses showed that as compared to the excluded participants the included participants in Study II were proportionally more often men (44.8\% vs. 33.3\%, \( p < .001 \)) and the included participants were slightly older than the excluded participants (37.99 vs. 36.80, \( p < .001 \)). In comparison with the excluded participants, the included participants had lower scores on neuroticism (2.33 vs. 2.54, \( p < .001 \)) and higher scores on extraversion (3.42 vs. 3.33, \( p = .001 \)). Furthermore, the included participants had higher educational level (2.33 vs. 2.25, \( p < .01 \)) and higher occupational status (2.17 vs. 1.95, \( p < .001 \)) than the excluded participants.

In Study III, measurements were carried out in 2001 (\( N = 2105, 58.5\% \text{ response rate} \)) and 2007 when the participants responded to a survey on cynicism and components of the job strain model. Based on inclusion criteria, we included 757 participants (399 women, 53\%) in the structural equation models on the relationship between cynicism and job strain (\( M_{\text{age}} \text{ in 2001} = 31.5 \text{ years} \)). The attrition analyses showed that there were proportionally more men in the included sample than in the excluded sample (47.3\% vs. 41.7\%, \( p = .009 \)) and that the included participants were somewhat older (32.65 vs. 31.02, \( p < .001 \)) than the excluded. Compared to the excluded, the included participants had higher educational level (2.24 vs. 2.16, \( p = .001 \)) and occupational status (1.99 vs. 1.87, \( p < .001 \)) in 2001. In addition, the included participants reported having fewer children in 2007 than the excluded (1.47 vs. 1.65, \( p = .005 \)) and proportionally fewer of the included had moved during the follow-up compared with the excluded participants (58.6\% vs. 65.4\%, \( p = .001 \)).

In Study IV, the data were collected in 2007 and 2012 (\( N = 1752, 48.7\% \text{ response rate} \)). The number of participants varied according to the analyses; there were 1228 and 1177 participants in the analyses of invariance for effort and reward, respectively (\( M_{\text{age}} = 38 \text{ years} \)). In the regression analyses on the association of effort-reward imbalance
and its components with general stress, there were 1237 (unadjusted model) and 1083 (adjusted for occupational status and educational level) participants.

All participants gave written informed consent, and the study was approved by local ethic committees.

3.2 Measures

The Cronbach’s alphas of the scales used in this study are shown in Table 2.

| Table 2. Cronbach’s alphas for the scales in the study |
|-----------------|--------|--------|--------|
| Studies I and II |        |        |        |
| Neuroticism      | 0.88   |        |        |
| Extraversion     | 0.81   |        |        |
| Openness         | 0.84   |        |        |
| Conscientiousness| 0.72   |        |        |
| Agreeableness    | 0.80   |        |        |
| Study III        |        |        |        |
| Cynicism         | 0.79   | 0.83   |        |
| Studies II and III|       |        |        |
| Demand           | 0.61   | 0.63   |        |
| Control          | 0.86   | 0.87   |        |
| Studies I and IV |        |        |        |
| Effort           | 0.76   | 0.76   |        |
| Reward           | 0.82   | 0.83   |        |
3.2.1 Five-Factor Model personality traits and cynicism (Studies I, II and III)

In Studies I and II, personality was measured in 2007 using the Finnish version of the NEO-FFI (Neuroticism, Extraversion, Openness, Five-Factor Inventory), which was developed by Rantanen et al. (2007). The Finnish version used in this study contains 60 questions that are based on the questions from the original NEO-FFI (Costa & McCrae, 1989) as well as on questions from the Finnish version of the NEO-PI (Personality Inventory). The original NEO-PI version was developed by Costa and McCrae (1985) and translated and standardized by Pulver, Allik, Pulkkinen, and Hämäläinen (1995). Some of the questions in the Finnish PI version are modified in order to better correspond to non-Indo-European languages.

Neuroticism was measured with 12 questions (e.g. “I sometimes feel completely worthless”), extraversion with 12 questions (e.g. “I want to be surrounded by other people”), conscientiousness with 12 questions (e.g. “I work hard in order to accomplish my goals”), openness with 12 questions (e.g. “I am intellectually very curious”), and agreeableness with 12 questions (e.g. “I would rather cooperate than compete with others”). The participants answered the questions on a scale from 1 (does not apply) to 5 (applies well). For those who had less than 50% missing values, a mean score was calculated for each personality trait.

In Study III, cynicism was assessed in 2001 and 2007 with a 7-item cynicism scale derived from the Minnesota Multiphasic Personality Inventory (e.g. “It is safer to trust nobody”) (Comrey, 1957; Comrey, 1958). Cynicism represents the cognitive aspect of hostility (Smith, 1994) and has been identified as the central dimension of hostility (Greenglass & Julkunen, 1989). The answers were given on a scale from 1 (totally disagree) to 5 (totally agree). The longitudinal measurement invariance of the cynicism scale has been shown in the data previously (Hakulinen et al., 2014).

3.2.2 Effort-reward imbalance (Studies I, III and IV)

In Studies I and IV, effort was assessed with the five-item original questionnaire (e.g. “I have constant time pressure due to a heavy work load”) and reward with 11 items from the original scale (Siegrist & Peter, 1996). The reward questionnaire consisted of five items measuring esteem (e.g. “I receive the respect I deserve from my superiors”), four
items measuring job promotion (e.g. “My job promotion prospects are poor”), and two items measuring job security (e.g. “My job security is poor”). The responses for both effort and reward were given on a scale from 1 (does not apply) to 5 (does apply).

Mean scores for effort and reward were calculated for those participants who had a maximum of 50% missing values. Effort-reward imbalance was calculated by dividing the mean scores of the effort component by the mean scores of the reward component (Siegrist et al., 2004). A higher value of the continuous effort-reward imbalance variable indicated a higher imbalance (Siegrist et al., 2004). In Study I, a logarithmic transformation was made to the effort-reward imbalance variable to correct for skewness and kurtosis.

In Study IV, general stress in 2012 was used as an outcome criterion for effort-reward imbalance and its components. General stress was measured in 2007 and 2012 by a one-item questionnaire on stress symptoms from the Occupational Stress Questionnaire (“Stress means a situation in which a person feels tense, restless, nervous or anxious or is unable to sleep at night because his/her mind is troubled all the time. Do you feel this kind of stress these days?”) (Elo, Leppänen, Lindström, & Ropponen, 1992). Response was given on a scale from 1 (not at all) to 5 (very much). The validity of the single-item measure has been shown previously (Elo, Leppänen, & Jahkola, 2003).

### 3.2.3 Job strain (Studies II and III)

In Studies II and III, job demands was measured in 2001 and 2007 using a three-item scale from the Occupational Stress Questionnaire (e.g. “Does your work require you to work fast?”), developed by the Finnish Institute of Occupational Health (Elo et al., 1992). These three items correspond to the items in Karasek’s Job Content Questionnaire (1985). The responses were given on a scale from 1 (never) to 5 (all the time). Job control was in Studies II and III, measured in 2001 and 2007 using 9 items from the Job Content Questionnaire (e.g. “In my work, I am allowed to make a lot of decisions”) (Karasek, 1985). The response scale was from 1 (disagree) to 5 (agree). Mean scores for demand and control were calculated only for those participants with a maximum of 50% missing values.
Job strain in 2007 was in Study II calculated using three different formulations, linear term (job demands - job control), quotient term (job demands / job control), and multiplicative interaction term (job demands x job control). The multiplicative interaction term was formed using centralized values for demands and control. When analyzing the multiplicative term’s association, the main effects of job demands and job control are also controlled for. In Study III, job strain in 2001 and 2007 were calculated using the linear term.

3.2.4 Covariates

In addition to age and gender, the covariates in our study were educational level and occupational status, since they are potential confounders (Brunner et al., 2004). Age was entered as a covariate because recent studies have shown that age is associated with both personality and work characteristics (Anusic, Lucas, & Donnellan, 2012; De Lange et al., 2010; Shultz, Wang, Crimmins, & Fisher, 2010; Soto & John, 2012; Specht et al., 2011). Educational level was classified as (1) low (comprehensive school), (2) intermediate (secondary education), or (3) high (academic; graduated from a polytechnic or a university). Occupational status was based on the Central Statistical Office of Finland: (1) manual, (2) lower non-manual, and (3) upper non-manual. The occupational status of entrepreneurs was determined based on their educational level (low, intermediate, and high education corresponding to manual, lower non-manual, and upper non-manual respectively) and was coded accordingly into occupational status categories. Educational level and occupational status were treated as categorical variables when calculating correlations but dummy-coded in the regression analyses.

To take into account major life events during the follow-up we also included the following covariates in study III: marital status, which was coded (0) single, divorced or widowed and (1) married or co-habiting; number of children (range 0-10); moving to a new address during the follow-up, which was coded (0) no change in address and (1) change in address during the follow-up. The participants’ address information was derived from the Population Registry. In addition, both job strain and cynicism have in several previous studies been shown to predict depressive symptoms later in life (Bonde, 2008; Heponiemi et al., 2006; Nabi et al., 2010; Virtanen et al., 2015). To
examine this effect in Study III, we performed additional mediation analyses, with depression in 2007 as an outcome. Depressive symptoms were measured using Beck’s Depression Inventory II (BDI-II) (α = 0.92) (Beck, Steer, & Brown, 1996). The participants answered the 21 statements on a scale from 1 (totally disagree) to 5 (totally agree).

### 3.3 Statistical analyses

The associations between work characteristics and personality traits in Studies I and II were examined by linear regression analyses. The analyses were performed separately for each Five-Factor trait using two models. In Study I, the first model was adjusted for age and the second model was additionally adjusted for education and occupational status. In Study II, the first model was adjusted for age, gender, education, and occupational status. In the second model all Five-Factor personality traits were entered simultaneously into the analysis. The latter model enabled us to examine the association of a trait with the outcome measures so that the other traits were held constant. The analyses in Study I were performed separately for women and men as there were significant gender interactions for neuroticism in relation to effort (p = .006) and reward (p = .027), for extraversion in relation to reward (p = .001), and for conscientiousness in association with reward (p < .001) and effort-reward imbalance (p = .017). In Study II, gender interactions for neuroticism in relation to job control (p = .002) and job demands (p = .008) were found, but as the results for women and men were very similar on these variables (job control: β = -.240, p < .001 for women and β = -.385, p < .001 for men when adjusted for age; job demands: β = .259, p < .001 for women and β = .119, p < .001 for men when adjusted for age), the genders were combined.

In Study III a cross-lagged structural equation models on the relationship between the latent construct cynicism and the observed variable job strain from both study phases (2001 and 2007) was fitted to the data (Figure 1). The model was adjusted for age, gender, educational level, change in occupational status, change in marital status, having children during the follow up, and moving to another address during the follow-up. The structural equation model allowed for correlation between measurement errors over time. In addition, three items in the cynicism scale had high correlations (r > .50)
in addition to being conceptually similar to each other, and their errors were therefore allowed to correlate within time-points. Additional mediation analysis in Study III, for the association between job strain and depression with cynicism as a mediator (N = 750), was conducted using the sgmediation package in Stata, which utilizes Sobel-Goodman’s test of mediation. To account for the effect of the covariates, we first regressed all the covariates of the study on the job strain variable and the depression variable. The mediation analysis was then performed using the residuals of job strain and depression.

In Study IV, longitudinal measurement invariance was assessed with a series of confirmatory factor analyses differentiating four types of measurement invariance: configural invariance, weak (metric) invariance, strong (scalar) invariance, and strict (residual) variance (see, e.g., Schmitt & Kuljanin, 2008). In order to test the invariance of effort and reward, we tested the two dimensions separately following the theoretical model which states that effort-reward imbalance is a division of effort and reward (Siegrist et al., 2004). Reward was examined in two ways, as a first-order factor (i.e., sum score of all the components) and as a second-order factor consisting of the first-order factors esteem, promotion, and security. Because the same individual items were measured at both time points, their residual variances were allowed to correlate in all models. In the effort scale, two sets of two items had a correlation over 0.4 in addition to being theoretically very similar. Thus, we allowed them to correlate in all models. In the first-order reward scale, 7 items were allowed to correlate as shown in Figure 2. The structural model for reward as a second-order factor is shown in Figure 3. Factor loadings of the effort and reward items in 2007 are shown in Figure 2 (effort and first-order reward) and Figure 3 (second-order reward). The items are labelled according to the original labelling (Siegrist et al., 2004). In addition, the associations of effort-reward imbalance and its components in 2007 with general stress in 2012 were examined by linear regression analysis adjusting for age, gender, occupational status, educational level, and general stress at baseline.

In Studies III and IV, model fit was evaluated based on Comparative Fit Index (CFI) and Root Mean Square Error of Approximation (RMSEA) index. RMSEA is not affected by model complexity and CFI is independent of sample size (Cheung & Rensvold, 2002). CFI values above .95 and RMSEA values below .08 indicate good fit.
Bayesian Information Criterion (BIC) was in Study IV used to compare models: the lower the BIC, the better the model fit.
4 Results

Sample characteristics of the study are shown in Table 3.

4.1 Five-Factor Model personality traits and effort-reward imbalance (Study I)

In Study I, women were slightly older ($p = .049$), had higher occupational status ($p < .001$), and higher educational level ($p = .05$) than men. Women had higher scores on all personality traits ($p < .001$) in addition to experiencing fewer possibilities of promotion ($p = .046$) than men. The results for the linear regression analyses on the association between personality traits and effort-reward imbalance are shown in Table 4. In both genders, high neuroticism was associated with high effort-reward imbalance ($\beta = .416, p < .001$) and high agreeableness with low effort-reward imbalance ($\beta = -.197, p < .001$) when age, educational level, and occupational status were controlled for. Among women, conscientiousness was not related to effort-reward imbalance, whereas high conscientiousness was associated with low effort-reward imbalance in men ($\beta = -.155, p < .001$). There were no associations between extraversion or openness and effort-reward imbalance in either gender.

High neuroticism and high extraversion were associated with high effort while high agreeableness was associated with low effort. In addition, high openness and high conscientiousness were associated with high effort in women. As for the reward component, high neuroticism was related to low reward and high extraversion, conscientiousness, and agreeableness were related to high reward. No associations between openness and reward were found in either gender.
### Table 3. Descriptive statistics of the study variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Study I</th>
<th>Study II</th>
<th>Study III</th>
<th>Study IV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Women</td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
</tr>
<tr>
<td></td>
<td>Mean / SD / Count</td>
<td>Mean / SD / Count</td>
<td>Mean / SD / Count</td>
<td>Mean / SD / Count</td>
</tr>
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<td>Demographics</td>
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<td></td>
</tr>
<tr>
<td>Age -07</td>
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<td>37.68 / 5.00</td>
<td>37.99 / 4.99</td>
<td>32.65 / 4.86</td>
</tr>
<tr>
<td>Educational level -07</td>
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<td></td>
<td></td>
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<tr>
<td>low</td>
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<td>28 / 4.6</td>
<td>53 / 3.9</td>
<td>29 / 3.8</td>
</tr>
<tr>
<td>intermediate</td>
<td>436 / 57.6</td>
<td>373 / 60.8</td>
<td>811 / 59.1</td>
<td>467 / 61.7</td>
</tr>
<tr>
<td>high</td>
<td>296 / 39.1</td>
<td>212 / 34.6</td>
<td>508 / 37.0</td>
<td>261 / 34.5</td>
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<td>Occupational status -07</td>
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<td></td>
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<td>manual</td>
<td>197 / 26.0</td>
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<td>445 / 32.4</td>
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<td>lower non manual</td>
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<td>84 / 13.7</td>
<td>252 / 18.4</td>
<td>137 / 18.1</td>
</tr>
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<td>upper non manual</td>
<td>391 / 51.7</td>
<td>284 / 46.3</td>
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<td>Five-Factor Model traits</td>
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<td>Neuroticism</td>
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<td>Job strain and its components</td>
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<tr>
<td>Job demands -01</td>
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<td>3.26 / 0.81</td>
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</tr>
<tr>
<td>Reward -07</td>
<td>3.75 / 0.61</td>
<td>3.77 / 0.62</td>
<td>3.70 / 0.61</td>
<td></td>
</tr>
<tr>
<td>Reward -12</td>
<td></td>
<td></td>
<td>3.71 / 0.64</td>
<td></td>
</tr>
<tr>
<td>ERI -07</td>
<td>-0.07a / 0.14a</td>
<td>-0.08a / 0.13a</td>
<td>0.89 / 0.28</td>
<td></td>
</tr>
<tr>
<td>ERI -12</td>
<td></td>
<td></td>
<td>0.91 / 0.30</td>
<td></td>
</tr>
<tr>
<td>General stress -07</td>
<td></td>
<td></td>
<td>2.34 / 0.95</td>
<td></td>
</tr>
<tr>
<td>General stress -12</td>
<td></td>
<td></td>
<td>2.39 / 0.94</td>
<td></td>
</tr>
</tbody>
</table>

ERI = Effort-reward imbalance

* Logarithmically transformed
Table 4. Standardized linear regression coefficients for the association between Five-factor model traits and effort-reward imbalance and its components

<table>
<thead>
<tr>
<th></th>
<th>Effort</th>
<th></th>
<th>Reward</th>
<th></th>
<th>Effort-reward imbalance</th>
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<tr>
<td></td>
<td>β</td>
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<td>β</td>
<td>ΔR²</td>
<td>β</td>
<td>ΔR²</td>
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<td>-.44***</td>
<td>.19</td>
<td>.40***</td>
<td>.16</td>
</tr>
<tr>
<td></td>
<td>Model 2</td>
<td>.22***</td>
<td>-.44***</td>
<td>.19</td>
<td>.42***</td>
<td>.17</td>
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<tr>
<td><strong>Extraversion</strong></td>
<td>Model 1</td>
<td>.11**</td>
<td>.28***</td>
<td>.08</td>
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<td>.00</td>
</tr>
<tr>
<td></td>
<td>Model 2</td>
<td>.08*</td>
<td>.27***</td>
<td>.07</td>
<td>-.07</td>
<td>.00</td>
</tr>
<tr>
<td><strong>Openness</strong></td>
<td>Model 1</td>
<td>.13***</td>
<td>.06</td>
<td>.00</td>
<td>.09*</td>
<td>.01</td>
</tr>
<tr>
<td></td>
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<td>.09*</td>
<td>.05</td>
<td>.00</td>
<td>.06</td>
<td>.00</td>
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<tr>
<td><strong>Conscientiousness</strong></td>
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<td>.20***</td>
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<td>-.02</td>
<td>.00</td>
</tr>
<tr>
<td></td>
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<td>.21***</td>
<td>.04</td>
<td>-.03</td>
<td>.00</td>
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<tr>
<td><strong>Agreeableness</strong></td>
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<td>.28***</td>
<td>.07</td>
<td>-.20***</td>
<td>.04</td>
</tr>
<tr>
<td></td>
<td>Model 2</td>
<td>-.14***</td>
<td>.29***</td>
<td>.08</td>
<td>-.28***</td>
<td>.07</td>
</tr>
</tbody>
</table>

* Significant at the 0.05 level (two-tailed)
** Significant at the 0.01 level (two-tailed)
*** Significant at the 0.001 level (two-tailed)

ΔR² is calculated for the personality trait

Men (n=613)

<table>
<thead>
<tr>
<th></th>
<th>Effort</th>
<th></th>
<th>Reward</th>
<th></th>
<th>Effort-reward imbalance</th>
<th></th>
</tr>
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<tbody>
<tr>
<td></td>
<td>β</td>
<td>ΔR²</td>
<td>β</td>
<td>ΔR²</td>
<td>β</td>
<td>ΔR²</td>
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<tr>
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<td>.33***</td>
<td>.11</td>
</tr>
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<td>-.49***</td>
<td>.23</td>
<td>.36***</td>
<td>.12</td>
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<td><strong>Extraversion</strong></td>
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<td>.22***</td>
<td>.43***</td>
<td>.19</td>
<td>-.06</td>
<td>.00</td>
</tr>
<tr>
<td></td>
<td>Model 2</td>
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<td>.40***</td>
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<td><strong>Openness</strong></td>
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<td>.12**</td>
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<td>.03</td>
<td>.00</td>
</tr>
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<td>.05</td>
<td>.00</td>
<td>.02</td>
<td>.00</td>
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<td>.41***</td>
<td>.17</td>
<td>-.15***</td>
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<td>.40***</td>
<td>.17</td>
<td>-.16***</td>
<td>.02</td>
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<td>.32***</td>
<td>.10</td>
<td>-.26***</td>
<td>.07</td>
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<tr>
<td></td>
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<td>-.14***</td>
<td>.29***</td>
<td>.08</td>
<td>-.28***</td>
<td>.07</td>
</tr>
</tbody>
</table>

Model 1 - adjusted for age
Model 2 - adjusted for age, educational level, and occupational status

35
4.2 Five-Factor Model personality traits and job strain (Study II)

The results for linear regression analyses in Study II on the associations of personality traits with job strain are shown in Table 5. When the traits were examined separately and age, gender, educational level, and occupational status were controlled for, high neuroticism was associated with higher job strain (linear term; $\beta = .397, p < .001$). Extraversion ($\beta =-.263, p < .001$), openness ($\beta =-.090, p = .001$), conscientiousness ($\beta =-.196, p < .001$), and agreeableness ($\beta =-.149, p < .001$) were all inversely associated with job strain. Furthermore, high neuroticism and high openness were associated with higher demands while high agreeableness was associated with lower demands. High neuroticism was related to lower control while high extraversion, high openness, high conscientiousness, and high agreeableness were all related to higher control.

In general the associations remained fairly similar when the traits were examined simultaneously, except for the associations of extraversion with demands ($\beta = .149, p < .001$), which was not significant when extraversion was examined separately. In addition the associations of extraversion with job strain, openness with demands, and agreeableness with control, demand, and job strain attenuated to non-significance.

When the personality traits were examined separately, the associations with job strain calculated as quotient term remained fairly similar to the results with the linear term. All other associations remained significant, with the exception of openness. The multiplicative term showed a significant association with extraversion. The other traits’ associations diminished to non-significance. Thus, extraversion is associated with perceptions of job strain both when demand and control are non-independent—i.e. the level of one depends on the level of the other—and when demand and control are treated as independent factors. The other traits are associated with perceptions of job strain only when demand and control are independent of each other—as in the linear term.

Results for the analyses between simultaneously entered personality traits and different formulations of job strain showed that quotient term job strain had a significant association only with neuroticism and that multiplicative interaction term showed a significant association with extraversion and agreeableness. Thus, when the effect of the other traits is controlled for, extraversion and agreeableness are not associated with
perceptions of job strain if demand and control are treated as independent factors, but are associated with job strain when demand and control are dependent of each other.
Table 5. Results of linear regression analyses on Five-Factor Model personality traits, job strain and its components

<table>
<thead>
<tr>
<th></th>
<th>Demands</th>
<th></th>
<th>Control</th>
<th></th>
<th>Strain (Linear term)</th>
<th>Strain (Quotient term)</th>
<th>Strain(^a) (Multiplicative)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>(\Delta R^2 = .08)</td>
<td></td>
<td>(\Delta R^2 = .14)</td>
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<td>(\Delta R^2 = .16)</td>
<td>(\Delta R^2 = .13)</td>
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<tr>
<td>(\beta)</td>
<td>(\Delta R^2)</td>
<td>(\beta)</td>
<td>(\Delta R^2)</td>
<td>(\beta)</td>
<td>(\Delta R^2)</td>
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<td>.15</td>
</tr>
<tr>
<td></td>
<td>Model 2</td>
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<td>.06</td>
<td>-14***</td>
<td>.01</td>
<td>.35***</td>
<td>.08</td>
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<td>Model 1</td>
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<td>.11</td>
<td>-26***</td>
<td>.07</td>
</tr>
<tr>
<td></td>
<td>Model 2</td>
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<td>.01</td>
<td>.21***</td>
<td>.03</td>
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<td>.00</td>
</tr>
<tr>
<td>Openness</td>
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<td>.06*</td>
<td>.00</td>
<td>.17***</td>
<td>.03</td>
<td>-.09***</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>Model 2</td>
<td>.03</td>
<td>0.00</td>
<td>.11***</td>
<td>.01</td>
<td>-.07**</td>
<td>.00</td>
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<tr>
<td>Conscientiousness</td>
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<td>.00</td>
<td>.21***</td>
<td>.04</td>
<td>-.20***</td>
<td>.04</td>
</tr>
<tr>
<td></td>
<td>Model 2</td>
<td>.03</td>
<td>0.00</td>
<td>.10***</td>
<td>.01</td>
<td>-.06*</td>
<td>.00</td>
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<tr>
<td>Agreeableness</td>
<td>Model 1</td>
<td>-.09***</td>
<td>.01</td>
<td>.10***</td>
<td>.01</td>
<td>-.15***</td>
<td>.02</td>
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<tr>
<td></td>
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<td>-.03</td>
<td>0.00</td>
<td>-.03</td>
<td>.00</td>
<td>.01</td>
<td>.00</td>
</tr>
</tbody>
</table>

Values are standardized beta coefficients, their p-values and coefficients of determination.

Model 1: Individually entered traits adjusted for age, gender, occupational status, and educational level

Model 2: Simultaneously entered traits adjusted for age, gender, occupational status, educational level, and personality traits

\(\Delta R^2\) is calculated for the personality trait \(\Delta R^2_m\) is calculated for all the traits in the Five-Factor Model combined

* Additionally adjusted for demands and control

* Significant at the 0.05 level (two-tailed)

** Significant at the 0.01 level (two-tailed)

*** Significant at the 0.001 level (two-tailed)
4.3 Cynicism and job strain (Study III)

Model fit showed that the structural equation model of the association of cynicism with job strain in Study III fitted the data well [$\chi^2$ (df) = 463.18 (231), CFI = .949, RMSEA = .036]. All factor loadings for the items in the cynicism scale were significant at the .001 level and ranged between 0.31 and 0.76. Figure 1 depicts the standardized coefficients of the association between cynicism and job strain. The results revealed that high job strain ($\beta = .08$, $p = .006$) was associated with higher cynicism six years later. The association was independent of age, gender, educational level, change in occupational status, change in marital status, having children, and moving during the follow-up.

The results for the additional Sobel-Goodman mediation analysis showed that cynicism mediated the relationship between job strain in 2001 and depression in 2007 ($p < .001$). The total effect mediated by cynicism was 21.5%.

![Figure 1](image_url)

**Figure 1.** Cross-lagged structural equation model of cynicism and job strain with standardized coefficients. Measurement errors (not shown) are allowed to correlate over time. Adjusted for age, gender, educational level, change in occupational status, change in marital status, having children, and change in address.

* $p < .05$  ** $p < .01$  *** $p < .001$
4.4 Longitudinal measurement invariance of the effort-reward imbalance scales (Study IV)

Table 6 shows a summary of the fit indices for the invariance models in Study IV. The results show that both the effort scale and the reward scale are invariant over the two time points used in our study. For effort, the strict model fit the data best (RMSEA = .048, CFI = .977, BIC = 33418.078). Both RMSEA and BIC values were lower in the strict model than in the strong (RMSEA = .051, BIC = 33448.412) or weak (RMSEA = .054, BIC = 33474.448) model. For first-order reward, all models showed adequate fit but examination of the BIC revealed that the strict model (RMSEA = .056, CFI = .916, BIC = 66166.819) fit the data better than the strong (BIC = 66222.601) or the weak (BIC = 66227.953) model. Likewise, when reward was treated as a second-order factor the strict model had the best fit (RMSEA = .052, CFI = .924, BIC = 66038.978) when comparing the BIC to the strong (BIC = 66101.982) or the weak (BIC = 66097.109) model.

The results for the associations of effort-reward imbalance and its components in 2007 with general stress in 2012 showed that high effort ($\beta = .269, p < .001$) and high effort-reward imbalance ($\beta = .294, p < .001$) were associated with high general stress five years later while high reward ($\beta = -.129, p < .001$) was associated with low general stress five years later. These associations were not attenuated after adjusting for educational level and occupational status. The results indicate that the effort-reward imbalance scales show criterion validity with the general stress measure. Additionally adjusting for baseline general stress decreased the estimates so that only high effort prospectively predicted higher general stress ($\beta = .072, p = .019$).
**Figure 2.** Correlations between conceptually similar items and factor loadings in the effort and reward scales in 2007 (all factor loadings shown were significant at $p < .001$).

**Figure 3.** Factor loadings of items in the second-order reward scale with first-order factors esteem, promotion and security in 2007 (all factor loadings shown were significant at $p < .001$).
Table 6. Summary of goodness-of-fit for the invariance models.

<table>
<thead>
<tr>
<th></th>
<th>$\chi^2$/ df</th>
<th>CFI</th>
<th>RMSEA</th>
<th>BIC</th>
</tr>
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<tbody>
<tr>
<td><strong>Effort</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline model</td>
<td>126.28/25</td>
<td>0.978</td>
<td>0.057</td>
<td>33492.47</td>
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<tr>
<td>Weak</td>
<td>129.60/28</td>
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<td>0.054</td>
<td>33474.45</td>
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<tr>
<td>Strong</td>
<td>139.13/33</td>
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<td>0.051</td>
<td>33448.41</td>
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<tr>
<td>Strict</td>
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<td><strong>Reward - first order</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline model</td>
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<td>0.057</td>
<td>66268.55</td>
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<tr>
<td>Weak</td>
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<td>0.056</td>
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<td>0.052</td>
<td>66038.98</td>
</tr>
</tbody>
</table>

CFI = Comparative Fit Index, RMSEA = Root Mean Square Error of Approximation, BIC = Bayesian Information Criterion
5 Discussion

5.1 Main findings

5.1.1 Five-Factor Model personality traits and work characteristics

In the present study all personality traits of the Five-Factor Model explained differences in perceived job strain while neuroticism, conscientiousness, and agreeableness explained differences in effort-reward imbalance. High neuroticism was associated with higher perceived job strain and effort-reward imbalance, whereas high agreeableness was associated with lower perceived job strain and effort-reward imbalance. In addition, high extraversion and high openness were associated with lower job strain. High conscientiousness was associated with lower job strain in both genders and lower effort-reward imbalance in men. Openness was not associated with effort-reward imbalance in either gender. These associations were largely independent of age, educational level, and occupational status. Thus, the hypotheses set for Studies I and II were supported with the exception of openness. The results indicate that personality traits are associated with the experience of work characteristics.

High neuroticism was in the present study associated with higher effort, lower rewards, higher demands, lower control, and consequently higher effort-reward imbalance and higher job strain. These results are supported by a recent study on Italian police officers in which high neuroticism was associated with higher job strain and higher effort-reward imbalance (Garbarino, Cuomo, Chiorri, & Magnavita, 2013). The findings from the present study are also in line with previous studies that have shown that neuroticism is associated with lower work satisfaction, higher risk of burnout, and lower decision latitude (Alarcon et al., 2009; Grant & Langan-Fox, 2007; Judge et al., 2002; Sutin & Costa, 2010). In addition, the current results support previous findings on temperament traits conceptually similar to neuroticism predicting higher demands, higher effort, lower control, lower rewards, and consequently higher job strain and higher effort-reward imbalance (Hintsa et al., 2010a; Hintsanen et al., 2011). Individuals high on the neuroticism scale might experience their work characteristics as more negative and their decision latitude as limited due to their predisposition to experience more distress. Previous studies have shown that neuroticism is correlated with stress.
reactivity, which can influence an individual’s ability to cope with challenges and predispose him or her to depressed mood (Felsten, 2004). Because of their worrying and self-conscious nature, they might put in a lot of effort at work but due to their insecurities, they might less often get actual rewards (e.g. promotion opportunities), or they may have a subjective experience of not being esteemed at work. Neurotics may also create a negative atmosphere at the workplace and therefore not receive the favourable effects of social support (Goldsmith, 2007).

In addition to being associated with lower perceived job strain, high extraversion was in the present study also associated with higher control, higher effort, and higher reward. These results are in line with previous studies reporting associations of extraversion with higher work satisfaction, lower risk of burnout, and higher decision latitude (Alarcon et al., 2009; Judge et al., 2002; Sutin & Costa, 2010). Temperament traits conceptually close to extraversion have been shown to predict higher control, higher reward, and lower job strain, which is in line with the results of the current study (Hintsa et al., 2010; Hintsanen et al., 2011). Extraverted individuals are described as sociable and friendly (McCrae & Costa, 1987) and might thereby participate in creating a friendly and supportive working environment, which in turn reduces stress (Goldsmith, 2007). In certain jobs extraversion can be a preferred characteristic and employers might therefore reward this behaviour with decision latitude, promotion possibilities, esteem, and job security. There may also be a halo-effect, that is, employers might reward employees for the behaviour the trait induces, although it in fact might not have any effect on work performance. In the present study, extraversion did not show an association with effort-reward imbalance, which might indicate that the characteristics of an extraverted individual are more important for perceiving a balance between job demands and control than for perceiving reciprocity in efforts spent and rewards received.

Openness was not associated with effort-reward imbalance in this study but was associated with higher effort, higher demands, higher control and lower job strain. These results are similar to previous findings showing that openness is associated with higher decision latitude (Sutin & Costa, 2010). Being creative and independent might induce a sense of control over the situation in persons high on the openness scale. A characteristic of individuals high on the openness scale is that others view them as
intelligent (McCrae & Costa, 1987). They might, therefore, be given positions with
greater demands and they may actively seek jobs with higher demands to fulfil their
creativity.

Conscientiousness was in the present study found to be related to higher reward,
higher control, and to lower job strain. Furthermore, conscientiousness was associated
with higher effort in women but with lower effort-reward imbalance only in men. These
results are in line with previous studies linking conscientiousness to high work
satisfaction and greater decision latitude (Judge et al., 2002; Sutin & Costa, 2010).
Conscientiousness is described as a tendency to be well-organized and persevering
(McCrae & Costa, 1987) and these might be characteristics that enhance the feeling of
control and skill discretion. Because conscientiousness has been shown to be associated
with increased performance at the workplace (Barrick & Mount, 1991) employers might
reward well-performing conscientious persons in various ways. In the current study,
high conscientiousness was associated with lower effort-reward imbalance only in men,
and the associations between conscientiousness and rewards were stronger in men as
compared to women, which suggests that women might not be as generously rewarded
for being conscientious as men might be. However, as rewards were assessed with self-
reports, it remains uncertain how closely our measures reflect the actual level of
rewards. The results might also suggest that conscientiousness influences women and
men differently and affects different aspects of work.

Agreeableness was associated with job strain and its components so that individuals
high in agreeableness had low demands, high control and consequently low perceived
job strain. The associations turned to non-significant when the other traits were
controlled for which might indicate that the association between agreeableness and job
strain is a reflection of the influence of the other traits on this association. Furthermore,
high agreeableness was associated with lower effort-reward imbalance, lower effort,
and higher reward. Previous studies have shown that agreeableness is associated with high
work satisfaction and lower risk of burnout (Alarcon et al., 2009; Judge et al., 2002).
The present results are in accordance with these findings. Agreeable individuals are
characterized by flexibility and sympathy (McCrae & Costa, 1987) and might therefore
not experience the demands of the work as being as restrictive as those who are low in
agreeableness. Agreeable individuals might not experience putting in a lot of effort as
they might enjoy their duties and, on the other hand, experience that they receive a lot of positive feedback and rewards in turn. Employers might also reward an agreeable individual for being flexible.

5.1.2 Bi-directional associations of cynicism and job strain

The results on the bi-directional association between cynicism and job strain showed that high job strain at baseline was associated with higher baseline adjusted cynicism six years later. This effect was further examined in the additional mediation analysis, which revealed that cynicism mediated the relationship between job strain and depression. The hypothesis on the bi-directionality was thus not supported by the present study. However, the results bring new information on the relationship between the psychosocial working environment and personality.

In the current study, high job strain was related to an increase in cynicism. This result is in line with previous studies on burnout—a concept characterized by cynicism—showing associations of high workload and high demands with burnout (Greenglass et al., 2001; Lindblom et al., 2006; Schaufeli et al., 1996). The result can also be explained by the social context model, which hypothesizes that cynicism is, in part, a result of an adverse environment and psychosocial stress (Taylor et al., 1997). Indeed, the development of cynicism may be determined by both genes and environmental factors (Hakulinen et al., 2012; Merjonen et al., 2011; Rebollo & Boomsma, 2006), including early childhood experiences, low family socioeconomic status (SES), parental Type A behaviour, and Type A behaviour in childhood (Keltikangas-Järvinen & Heinonen, 2003). Although cynicism is considered to be a relatively stable trait in adulthood, mean level change over time is possible (Hakulinen et al., 2014). Experiencing having little control over a highly demanding job not only induces perceiving work characteristics as stressful but might also elicit antagonistic and mistrustful thoughts and feelings in employees about their jobs.

Cynicism is a personality construct that is closely related to many concepts of trait psychology, such as neuroticism and agreeableness (Costa et al., 1986; Watson & Clark, 1992). Previous research has shown that job strain is associated with temperament and personality traits conceptually similar to cynicism (Hintsa et al., 2010a; Hintsa, et al., 2010b; Hintsanen et al., 2011). The direction of the association has been from
personality to job strain, not the other way round (Sutin & Costa, 2010). In the present study, cynicism was not associated with change in job strain over six years. While the Five-Factor Model traits are thought of as major broad traits, cynicism is described as a narrower facet or aspect of broader traits. According to the bandwidth-fidelity literature (Ashton, 1998), narrow traits tend to relate more strongly to narrow outcomes. The narrow nature of cynicism might make it harder to detect prospective associations with broad constructs like job strain.

Job strain has in several previous studies been shown to predict depression later in life (Bonde, 2008; Virtanen et al., 2015), and cynicism has also been linked to depressive symptoms (Heponiemi et al., 2006; Nabi et al., 2010). Additional analyses were performed to explore whether the findings on the association between job strain and cynicism could be explained by cynicism mediating the association between job strain and depression. The results showed that cynicism mediated a considerable amount (21.5%) of the effect of job strain on depression. High job strain might increase cynical attitudes and mistrustful feelings towards others, which in turn might increase depressive mood. The results might also be explained by previous research on the reporting bias that affects the relationship between job strain and depression, when measured with self-reports (Kolstad et al., 2011). The present results might indicate that cynicism inflates the perceived relationship between job strain and depression and should therefore be taken into account when measuring this association.

5.1.3 Longitudinal measurement invariance of the effort-reward imbalance scales

The results on the longitudinal measurement invariance of the effort-reward imbalance scales showed that both the effort and reward scales of the effort-reward imbalance model achieved strict measurement invariance. Thus, the hypothesis on the invariance of the effort-reward imbalance scales was supported, and this indicates that the effort and reward scales measure the same latent variables over time. Furthermore, it was found that high effort, low reward, and high effort-reward imbalance were associated with higher risk for general stress 5 years later. Therefore, the results indicate that effort-reward imbalance and its components have adequate criterion validity, which supports our hypothesis. Moreover, based on the analyses that controlled for the
baseline general stress, high effort seem to be a valid prospective risk indicator for higher general stress five years later. This goes beyond the scope of what is usually demanded as evidence for adequate criterion validity. These results are in accordance with the effort-reward imbalance model, which states that effort is spent as a part of a contract, where sufficient rewards are expected in return (Siegrist et al., 2004). If the rewards do not match the effort, this lack of reciprocity is considered particularly stressful (Siegrist, 1996). Current findings also support previous studies that have shown associations of effort-reward imbalance with decreased health and wellbeing (Feldt et al., 2013; Hintsanen et al., 2007; van Vegchel et al., 2005).

5.2 Methodological considerations

This is, to our knowledge, the first study to examine the role of Five-Factor Model personality traits and cynicism in perceptions of work characteristics. The sample used in this study was fairly large, population-based, and consisted of varying occupations, thereby being representative of the Finnish working-age population. In addition, the measures used in this study have been validated in several studies, which increase the comparability of our results to other studies. Furthermore, using cross-lagged structural equation modelling when examining cynicism and job strain, allowed for examination of the bi-directional associations over time and testing for causality of the constructs.

The associations of neuroticism and openness with demands, reported in the current study, have not been found in other studies. The present study also reported an association between agreeableness and job control which has not been found previously. The discrepancies in results between previous studies and the present study might be explained by sample size, or other sample related differences such as age differences (the participants in the present study were somewhat younger) and differences in measures of job demands and job control (for example, previous studies only used measures other than the Job Content Questionnaire which is the most commonly used measure of job strain).

The results from the present study gave support for an additive interaction between job demands and job control rather than a multiplicative one. This means that demand and control affect job strain separately, i.e. to maximally decrease job strain one should
increase control and decrease demand. Several formulations of job strain have been accepted in job strain literature (Landsbergis et al., 1994; Schnall & Landsbergis, 1994) and it has been stated that the implications for job redesign are similar for additive and interactive effects (Karasek, 1989). In addition, the linear term has been shown to be the best predictor of stress and health outcomes (Courvoisier & Perneger, 2010). Besides the significant associations between Five-Factor Model traits and the linear term formulation, we also found support for interaction effects in the quotient term formulation. Replicating the results with several formulations of job strain reveals the robustness of our results. The multiplicative interaction term was only significant for one trait in the separately adjusted model and for two traits in the mutually adjusted model. Other studies have also reported non-significant findings for multiplicative interaction, while showing significant main effects (de Lange et al., 2003; Hintsa et al., 2008; Hintsanen et al., 2005). This is, in part, due to the general nature of the demands and control scales used in our study. In order to detect interaction effects, more specificity in the scales is needed (de Jonge, van Vegchel, Shimazu, Schaufeli, & Dormann, 2010).

In general, the personality traits of the Five-Factor Model explained a considerable amount of the variance in the work characteristics. The highest explained variance was obtained for neuroticism, which explained 17.1% of the variance in effort-reward imbalance in women and 12% in men. In addition, neuroticism explained 15.9% of the variance in job strain. The other traits explained less than 10% of the variance in the work characteristics. After mutually adjusting for personality traits, the highest explained variance was found for neuroticism in relation to job strain (7.9%). The rest of the traits individually explained less than 3%. The complete Five-Factor personality model explained 16.2% in the linear term job strain formulation.

In order to examine the association of a trait while simultaneously taking into account the other personality traits, the traits were entered into the analysis simultaneously when examining the association between the Five-Factor traits and job strain in Study II. This way, the association between a specific trait and an outcome measure was not affected by the other traits. The possibility of response bias due to the characteristics of neuroticism, which has been suggested in previous research (Costa Jr. & McCrae, 1990), is controlled for using this method. However, it has been concluded that although
this bias exists and should be taken into account when interpreting the results, the substantive effects of the trait also exist alongside it (Costa Jr. & McCrae, 1990; Oliver et al., 2010; Stansfeld, 2002). Personality includes, however, a combination of all traits and therefore the effect of a single trait on the perception of stress may not reflect the reality. Nevertheless, examining single traits provides us with information on the nature of the trait’s effect on job strain, which is not available when examining the whole personality model.

Some limitations should be taken into account when interpreting our results. First, in our study both personality traits and work characteristics were assessed with self-reports, which constitutes a risk for common method bias. However, it has recently been argued that common method bias is not automatically a source of bias in research that uses self-reports (Conway & Lance, 2010) and that its effect, when it exists in organizational research, is often rather small (Spector, 2006) and may actually decrease the associations, not amplify them (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Furthermore, controlling for the baseline level of cynicism/job strain in study III, controls for the common method bias. Second, Studies I and II were cross-sectional and therefore no conclusions about cause-and-effect relationships or temporal precedence can be made. This raises the question about the direction of the association. According to the corresponsive principle of personality development, personality traits predict particular workplace conditions and these conditions drive normative personality development (Roberts et al., 2003). However, a recent study on the Five-Factor traits and work characteristics has shown that the direction is one-directional, from Five-Factor personality to occupational experiences rather than the other way around (Sutin & Costa, 2010). In addition, results from longitudinal, population-based studies on temperament-based personality traits and stressful work characteristics (Hintsa et al., 2010a; Hintsanen et al., 2011) suggest that personality traits may indeed predict perceptions of stressful work.

Third, the participants had higher educational level and occupational status in addition to having lower scores on neuroticism. One might therefore conclude that neurotics might have a tendency of dropping out of studies like these. These tendencies might affect the associations so that it appears that neuroticism has weaker association with the outcome measure than it has in reality, for example neurotics a weaker association
with higher perceived job strain. However, there were no differences between the included and excluded on job strain or effort-reward imbalance which makes the probability of our sample being highly selective low. Nevertheless our results may reflect individuals with lower neuroticism and higher socioeconomic status slightly better than individuals with higher neuroticism and lower socioeconomic status. In addition, because our sample corresponds to the vast majority of the Finnish population, our results may not be directly generalizable to other ethnic or cultural groups.

Fourth, gender differences were examined only in Study I. We decided to test the genders separately in Study I due to significant gender interaction between some of the study variables. Therefore the research framework differed in Studies I, II and III, which makes the comparability of the results—in regard to gender differences—difficult. In future studies it would be appropriate to base decisions about examining men and women separately on theory rather than on methodology.

Fifth, the current study only included subjective measures of job strain and effort-reward imbalance and in future studies it would be beneficial to include subjective as well as objective measures of work characteristics, as proposed in recent literature (Haeusser et al., 2010). It might also be beneficial for future studies to use the iso-strain model, which also measures social support. The extended model might be able to better mirror the characteristics of personality traits such as extraversion and agreeableness that are thought to increase social support. It would also be appropriate for future studies to use more narrow measures of personality traits, e.g. include the facets of the Five-Factor Model, because they, according to the bandwidth-fidelity literature (Ashton, 1998), tend to relate more strongly to narrow outcomes like demand and control or effort and reward.

Sixth, the Cronbach’s alphas for the job demands scale were 0.61 and 0.63, which can be considered at the lower range of acceptable reliability estimates. However, despite the low alpha, the mean inter-item correlation showed satisfying internal consistency for the scale. In addition, the low alphas may reflect the small number of items in the demand scale. Furthermore, possible job changes during the follow-up were not inquired in our study. In future studies, measuring change in work characteristics systematically in several time points would make the interpretations of the results more reliable.
Seventh, in Study IV the RMSEA and CFI values of the invariance models for the first-order and the second-order reward scales, showed adequate fit, rather than good fit. However, we were able to obtain strict measurement invariance in all scales—effort, first-order reward, and second-order reward—which indicates that the constructs are indeed measurement invariant over time. In addition, the outcome variable for assessing criterion validity in Study IV was measured with only one general stress item. Nevertheless, the single-item measure of stress has been validated and shown to be a sensitive indicator of well-being at work (Elo et al., 2003). In future studies it would be important to also examine the longitudinal measurement invariance of the job strain scales as they are also widely used in longitudinal and intervention studies.

5.3 Theoretical implications

The concept of individual differences in perceptions of the work environment is not a novel one. There was a shift towards a more service-orientated and knowledge-based economy in the 1960’s. It became important to place a human actor in the field of stress research—not only promote physical health but also well-being of the working mind (Väänänen et al., 2012). Lazarus and colleagues (1966; 1984) turned the focus from structural factors at work towards individual sense-making in the stress process. Although the focus was shifted towards the individual, the models that were developed to conceptualize and measure work characteristics (the job strain model and the effort-reward imbalance model) did not fully take into account that there are individual differences in stress reactions, resilience or recovery. Instead, they were developed to capture the work environment and depict strenuous working conditions, regardless of the individual experiencing it. When measured with self-reports, job strain and effort-reward imbalance cannot be completely objective and independent of individual dispositions, such as Five-Factor personality traits. The present study adds to the work stress literature by showing that perceptions of job strain and effort-reward imbalance at work are susceptible to personality traits of the Five-Factor Model and that job strain increases cynicism.

At the general level, the results can be explained by a variety of causes. According to the differential exposure model, individuals with different personality traits place themselves in different situations and are therefore exposed to a varying level of
stressors (Bolger & Zuckerman, 1995). Neurotics might choose occupations where they are exposed to more stressors than extraverts. In addition, the selection hypothesis states that exposure to adverse circumstances during life is not necessarily random; cynicism has been linked to greater risk of depression (Heponiemi et al., 2006; Nabi et al., 2010) which might also be related to higher exposure to stressors (Bonde, 2008; Virtanen et al., 2015). Furthermore, personality is thought to affect the appraisal process; personality influences what is perceived as stressful and what is not (Code & Langan-Fox, 2001). Agreeable individuals might, due to their flexible nature, not experience the demands of the work as being as strenuous as those who are low in agreeableness.

Personality also affects stress reactivity (Felsten, 2004) and thereby determines how strongly and in what way an individual responds to stress. In terms of the differential reactivity model (Bolger & Zuckerman, 1995), neurotics may respond differently to a sudden increase in work load than non-neurotics. According to the psychosocial vulnerability model, cynical individuals are more vulnerable to adverse conditions and benefit less from psychosocial resources than non-cynical (Kivimäki et al., 2003; Smith, 1994). Indeed, cynicism has been found to be associated with more conflicts and less social support as well as less psychophysiological benefit from social support, when available (Lepore, 1995; Smith, Glazer, Ruiz, & Gallo, 2004). Furthermore, personality influences what coping methods an individual uses in order to alleviate or manage stress (e.g. Connor-Smith & Flachsbart, 2007). Conscientious individuals tend to use positive cognitive appraisal and adaptive coping methods (Penley & Tomaka, 2002) and these methods might help buffer the stressor.

According to the social context model, adverse conditions are an antecedent of cynical hostility (Taylor et al., 1997). Stressful circumstances, such as putting in effort but not receiving adequate rewards are hypothesized to lead to cynical perceptions and inadequate coping (Taylor et al., 1997). Indeed, studies on burnout as a result of high workload, give support to this model; burnout is characterized by cynicism and studies show that an employee’s attitudes and behaviour change in a negative way as a result of adverse working conditions (Greenglass et al., 2001; Lindblom et al., 2006; Schaufeli et al., 1996). This is also in accordance with the outcome model, which suggests that stressors influence personality, not the other way around (Kivimäki, 1996).
Some gender differences were found in the association between personality and work characteristics. Low conscientiousness was associated with higher effort-reward imbalance only in men. This suggests that conscientiousness has different roles in the working environment for men and women. Conscientiousness seems to be more important for men when perceiving a balance between efforts spent and rewards received. It may also be that conscientiousness steers men and women into different working environments and they are therefore exposed to different stressors.

It has been debated whether the job strain model and the effort-reward imbalance model complement each other or if they actually depict the same work characteristics (Calnan et al., 2004; Tsutsumi & Kawakami, 2004). The results of the present study show that in terms of Five-Factor personality, the two work stress models differ to some extent. Neuroticism and agreeableness play an important role in both models, whereas extraversion, openness, and conscientiousness seem to be important in measuring job strain caused by high demands combined with low control while not being important for measuring the reciprocal nature of efforts spent and rewards received at work.

5.4 Conclusions and practical implications

The results of this study show that Five-Factor model personality traits are associated with perceptions of work characteristics. In addition, job strain prospectively predicts higher cynicism. Establishing the associations between an employee’s personality and perceptions of the working environment is important in order to recognize the predisposing and protective factors that influence vulnerability to work stress. In addition, recognizing the effect of work on cynical attitudes is also important information for occupational health services. This knowledge can then be utilized to create preventive and intervention programs for reducing stress and restructuring the working environment.

Being aware of individual dispositions influencing the well-being at work also benefits the organization, because disregarding individual differences in perceptions of the work environment can lead to misinterpretations, for example employers might misinterpret the stressfulness of the work as different individuals react to and cope with stressors differently. These misinterpretations can lead to expensive and unnecessary
actions that are aimed at improving the working conditions, whereas a more effective target would sometimes be the person himself.

The present study also showed that the effort-reward imbalance scales are measurement invariant over time and are therefore reliable measures for change in perceptions of work characteristics. Due to the wide use of effort-reward imbalance model to study and depict stressful working conditions, establishing measurement invariance of the scales has implications for a large amount of longitudinal organizational studies. In addition, knowing that changes in the scores reflect true changes in perceptions of stressful work characteristics enables occupational health services to target stress management and intervention appropriately.

In order to make valid conclusions about the effect of the psychosocial work environment on employee health and wellbeing, occupational health services and occupational psychologists should be able to rely on the measures used to conceptualize work characteristics. Measuring work characteristics—job strain and effort-reward imbalance—with self-reports makes them susceptible to individual dispositions such as personality. However, automatically controlling for personality traits in research is not encouraged, because of the information that will be lost as a result (Spector, Zapf, Chen, & Frese, 2000). Perceptions of the environment are dependent of the person perceiving it, and simplifying the environment to merely objective characteristics might bring information that can help in organizing work at the organizational level, but it will not tell occupational health services about the wellbeing of the individuals. Personality traits should instead be used as moderators, in order to capture the effect personality has on the association between work characteristics and well-being. In addition, future studies should examine the interaction between personality and occupation in explaining well-being at work—information on person-job fit could then be used in recruiting, in stress interventions and in organizational restructuring to fit the person to the job.

The structural aspects of the work environment are undeniably important in the experience of stress at work, but our study suggests that personality should also be taken into account. In addition, the working environment can have far reaching consequences on an individual’s attitudes, which in turn can influence health and wellbeing. Researchers and occupational health professionals should be aware that when work
characteristics are measured with the job strain model and the effort-reward imbalance model, the results reflect both the structural work environment and the individual differences that emerge through personality.
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