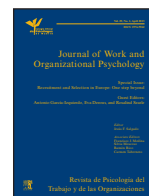# Journal of Work and Organizational Psychology

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Incremental validity of proactive personality over the Big Five for predicting job performance of software engineers in an innovative context

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ABSTRACT

This study examined the incremental validity of proactive personality for predicting overall job performance over the Big Five in the context of an innovative software engineering job. Proactive personality and the Big Five were measured in a sample of 243 engineers and overall job performance was assessed through supervisor ratings in a sub-sample of 95 of these engineers. Results showed that even though proactive personality represents a valid and important predictor of performance it does not show a relevant increment on the prediction yielded by extraversion, openness, conscientiousness, emotional stability and organizational tenure. Implications for the relevancy and practical value of proactive personality for personnel selection are discussed.

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Validez añadida de la personalidad proactiva sobre los «cinco grandes» para predecir el desempeño en el puesto de ingenieros de software en un contexto innovador

RESUMEN

Este estudio examina la validez añadida de la personalidad proactiva sobre los «cinco grandes» para predecir el desempeño en el trabajo en el contexto de un puesto de trabajo de ingeniero de software. La personalidad proactiva y los «cinco grandes» fueron medidos en una muestra de 243 ingenieros y el desempeño global fue evaluado mediante valoraciones del supervisor en una sub-muestra de 95 de estos ingenieros. Los resultados mostraron que aun cuando la personalidad proactiva representa un importante y válido predictor del desempeño no muestra un incremento relevante en la predicción producida por la extraversión, apertura, conciencia, estabilidad emocional y antigüedad en el puesto. Se discuten las implicaciones, la relevancia y el valor práctico de la personalidad proactiva para la selección de personal.

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One of the major objectives of personnel selection research concerns the identification and assessment of the individual characteristics that are relevant for the effective prediction of job performance (Salgado, Viswesvaran, & Ones, 2001; Schmidt & Hunter, 1998). The research efforts conducted under this particular purpose, over the last decades, have firmly demonstrated that personality constructs, as assessed in the five-factor model of personality, represent important predictors of performance behaviours at work (Barrick & Mount, 1991; Barrick, Mount, & Judge, 2001; Chiaburu, Oh, Berry, Li, & Gardner, 2011; Salgado, 1997; 2003; Salgado & De Fruyt, 2005).

Apart from the recognition of the relevancy of the five-factor model for the prediction of job performance and other important work outcomes (e.g., training success, job satisfaction, leadership), and despite the wide acceptance of this model as a comprehensive description of the salient aspects of personality, some authors have claimed that the examination of the determinants of behaviour may also benefit from considering additional personality constructs besides the Big Five (Paunonen & Jackson, 2000). Accordingly, Borman (2004) argued that "the rigid adherence to the Big Five model is probably not wise for our field" (p. 267). Furthermore, other researchers have pointed out that compound personality variables more specifically tailored to the outcome might outperform the criterion-related validity of the primary personality traits (Hough & Schneider, 1996; Viswesvaran, Deller, & Ones, 2007).

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Proactive personality represents one of such personality constructs, which has been receiving growing attention from both organizational researchers and practitioners over the last two decades (Bateman & Crant, 1993; Crant, 2000; Thomas, Whitman, & Viswesvaran, 2010). This construct was initially proposed by Bateman and Crant (1993) and is defined as an individual disposition to take action to enact change and influence the environment. Individuals with a typical proactive personality are relatively unconstrained by situational factors and stay focused on the identification of opportunities to shape their environments in order to achieve their personal objectives (Bateman & Crant, 1993; Crant, 2000). Rather than accepting their roles passively, proactive individuals are characterized as challenging the status quo, trying to improve current circumstances or creating new ones. Conversely, individuals with low scores on the measures of this personality variable tend to be more passive and to accommodate more frequently to current circumstances (Bateman & Crant, 1993; Crant, 2000).

The emphasis that has been posited on this individual disposition is concomitant with the acknowledgment of the importance of individual proactivity for the effectiveness of many modern organizations, which have become more dynamic and decentralized to cope with an increasingly competitive and fast-changing environment (Belschak, Hartog, & Fay, 2010; Grant & Ashford, 2008; Grant, Parker, & Collins, 2009). As a consequence of such organizational transformations, many jobs and occupations have become less formally prescribed and more flexible and autonomous, increasing the need for organizations to select employees prepared to behave proactively or, in other words, inclined to be self-starters and use their initiative to anticipate potential problems, to improve current circumstances and to foster their performance (Crant, 2000; Frese & Fay, 2001; Grant & Ashford, 2008). Taking these new job requirements into account and relying on the assumption that proactive personality represents a key antecedent of individual proactive behaviour, many researchers become particularly interested in the examination of relationships between this personality variable and relevant work criteria, like job performance, leadership, and career success (Belschak & Hartog, 2010; Crant & Bateman, 2000; Seibert, Crant, & Kraimer, 1999; Thompson, 2005; Zhang, Wang, & Shi, 2012).

Interestingly, recent quantitative reviews of the literature on this topic have provided grounds for optimism regarding the usefulness of proactive personality for personnel selection and human resource management by showing that it does indeed represent a valid predictor of job performance and other meaningful individual outcomes, including job satisfaction and several career outcomes (Fuller & Marler, 2009; Thomas et al., 2010). Notwithstanding these promising findings, an important question that still remains relatively underdeveloped in the literature regards the determination of the incremental validity of proactive personality for predicting job performance criteria over other well established individual performance predictors, such as the five factors of personality (Thomas et al., 2010). To the best of our knowledge, most of the previous studies have not controlled for the effects of other predictors of individual differences (Crant, 1995; Greguras & Diefendorff, 2010; Yang, Gong, & Huo, 2011, are exceptions). Nevertheless, the complete evaluation of the applied value of proactive personality cannot be done if its incremental validity is not scrutinized (Schmidt & Hunter, 1998; Van Iddekinge & Ployhart, 2008).

The current study aims to contribute to the literature concerning this particular research topic by examining the incremental validity of proactive personality over the five factors of personality in a sample of Portuguese software engineers. The use of such a sample to investigate this research question represents a further contribution to the proactive personality literature. In fact, as some authors have previously noted, the majority of the samples used to unveil the relationships between proactive personality and work outcomes have been collected in the United States, therefore a replication of the studies with samples pertaining to other countries, cultures and workforces is needed in order to draw conclusions about the validity generalization of this predictor (Kim, Hon, & Crant, 2009; Li, Liang, & Crant, 2010).

In the following section we review the prior research that has important implications for the main objective of the present study.

Proactive personality, Big Five and Job performance

One of the key conceptual assumptions about proactive personality is that the individuals who obtain high scores on this construct are also more likely to obtain high levels of performance, compared with their counterparts, because they seek to actively customize their environment in a way that accentuates their strengths and enhances performance (Bateman & Crant, 1993; Crant, 2000; Seibert et al., 1999). More specifically, it was assumed in the literature that proactive personality can lead to improved job performance by enacting behavioural patterns that are important for the successful accomplishment of work related duties, such as setting high standards concerning their performance levels, anticipating potential problems, identifying new ideas for improving work processes, developing and updating their knowledge and skills, seeking information about work procedures and company politics, and going beyond formal responsibilities (Crant, 2000; Kim et al., 2009; Major, Turner, & Fletcher, 2006; Seibert, Kraimer, & Crant, 2001).

As we have already emphasized, the results of previous empirical studies are congruent with these conceptual assumptions, suggesting that proactive personality correlates in a positive and meaningful way with job performance criteria. Accordingly, Fuller and Marler (2009) reported, on the basis of the first meta-analytic review of proactive personality literature, an estimate of $\rho = .38$ ($k = 14$, $n = 2638$) for the true relationship between this predictor and overall job performance (corrected for unreliability in both the predictor and the criteria, and for range restriction). The results reported by these authors also showed positive relationships between proactive personality and more specific performance dimensions, such as task performance ($\rho = .23$, $k = 8$, $n = 1320$) and contextual performance ($\rho = .41$, $k = 8$, $n = 2116$).

Another relevant meta-analysis with important implications for this research topic was carried out by Thomas et al. (2010) regarding the relationships of emergent proactive constructs with different work outcomes. In a similar vein, the results of this meta-analysis have revealed that proactive personality was positively associated with overall job performance, showing a true-score correlation estimate of $\rho = .26$ ($k = 25$, $n = 5045$) generalized across the analyzed studies (corrected for unreliability in both predictor and criterion measures, but not for range restriction). The authors also found that proactive personality was more strongly related to supervisor ratings of performance ($\rho = .38$, $k = 17$, $n = 3261$) than to objective measures of this criterion ($\rho = .16$, $k = 13$, $n = 2539$).

In spite of these noteworthy developments in the empirical research about the links between proactive personality and job performance, and as we highlighted above, relatively little conclusive evidence has been established concerning the incremental prediction that may be yielded by this individual disposition over other important performance predictors. Of particular relevance to this research topic is the assessment of the incremental validity of proactive personality over the five personality factors, since it has been found that these constructs are meaningfully correlated. To illustrate this aspect it is important to mention the results of the meta-analysis conducted by Fuller and Marler (2009), which revealed that proactive correlated positively with the personality factors of extraversion ($\rho = .41$, $k = 20$, $n = 3565$), conscientiousness ($\rho = .34$, $k = 17$, $n = 3401$), openness ($\rho = .34$, $k = 20$, $n = 4890$), and neuroticism ($\rho = -12$, $k = 12$, $n = 2291$). In addition to this, the reported estimate for the relation between proactive personality and the factor of

agreeableness was close to zero (ρ = .07, k = 12, n = 2063). These values were corrected for unreliability in both variables. More recently, another meta-analytic study carried out by Thomas et al. (2010) provided further support for these relationships by obtaining positive associations between proactive personality and the dimensions of extraversion (ρ = .42, k = 9, n = 1574), conscientiousness (ρ = .39, k = 9, n = 1662), openness (ρ = .38, k = 9, n = 1756), and emotional stability (ρ = .31, k = 8, n = 1563). The findings of this meta-analysis also demonstrated the existence of an almost null and non-generalized relationship between proactive personality and the dimension of agreeableness (ρ = .02, k = 8, n = 881). These values were also corrected for unreliability in both variables.

Notwithstanding the existence of this pattern of inter-correlations between these constructs, there are very few studies that have specifically controlled for personality factors when examining the validity of proactive personality for predicting job performance. One of these studies was carried out by Crant (1995) using a sample of 131 real estate agents. The results of this primary study showed not only that proactive personality was positively related to an objective task-based job performance criterion (r =. 23, p < .01), but also that this predictor added 8% of explained variance in the respective criterion, when controlling for the variance explained by social desirability, job experience, general mental ability, and the personality factors of conscientiousness and extraversion. Another set of results with relevant implications for the incremental validity of proactive personality as predictor of overall performance was obtained in the study of Thomas et al. (2010). The authors observed, through a follow-up regression analysis conducted with the data of their meta-analysis, that proactive personality still accounts for a significant amount of variance in overall performance after controlling for the variance accounted for by conscientiousness on this criterion (ΔR^2 = .03, p < .01).

As illustrated, and despite the relevant contributions that resulted from these studies, none of them have tested the incremental validity of proactive personality for the prediction of performance, by controlling for all the Big Five, or at least for the factors of openness, conscientiousness, extraversion and neuroticism, which have emerged as correlated with this predictor in previous research (Fuller & Marler, 2009; Thomas et al., 2010). Yet, in the absence of this sort of evidence, it is not possible to conclude if the relationship between proactive personality and job performance is due to proactive personality itself, or it s a result of the primary personality factors that are related to it.

In summary, the reviewed literature indicates that proactive personality and the Big Five are valid and meaningful predictors of job performance. In addition, and as we also highlighted, the correlations reported in previous research seem to suggest that proactive personality shares a certain amount of variance with the five factors of personality that cannot be neglected. It also should be noted that these findings are not incongruent with the conceptual assumptions regarding proactive personality, which posited it as a compound personality variable (Crant, 2000; Crant & Bateman, 2000). However, proactive personality is also conceived as a construct that captures a conceptual and empirical variance that is not encompassed in the five-factor model (Bateman & Crant, 1993; Crant, 2000; Thomas et al., 2010). Based on these assumptions, and taking into account the previous meta-analytic results indicating that this variable is a valid predictor of job performance, we hypothesized that it will increment the explained variance in general performance that is accounted for by the Big Five. Accordingly, the existing evidence concerning the incremental validity of proactive personality, albeit limited, seems to point in this hypothesized direction (Crant, 1995; Thomas et al., 2010). Therefore, and by taking these arguments together we hypothesized that:

Proactive personality will show incremental validity over and above the big five for predicting overall job performance.

Method

Organizational context

This study was carried out in a large Portuguese software engineering company, specialized in the delivery of innovative and reliable solutions customized to the client's needs and specific requirements. This organizational setting was particularly appropriate for the implementation of the current study because proactive and innovative behaviours represent a critical core of its employees' job performance. In effect, it is expected and required by the organization that their employees take initiative to improve existent products and service quality, as well as to create new products, to enhance work methods and procedures and to improve well-being in the organization. Therefore, proactive personality, which is conceptualized as a key determinant of proactive and innovative behaviours (e.g. Fuller & Marler, 2009; Seibert et al., 2001; Parker, Williams, & Turner, 2006; Thomas et al., 2010), is likely to represent an important predictor of job performance in this context.

Participants and data collection procedures

The data used to test our research hypothesis were collected from employees and their immediate supervisors, as part of a validation study. In a first data collection phase, the 305 employees of a software engineering company were invited to complete the measures of the Big Five and proactive personality during their regularly scheduled work time. The employees were senior software engineers, project software engineers, manager software engineers, and commercial engineers. Surveys were administered on-line and included a Portuguese version of both measures that were translated from their original form in English into the Portuguese language following the back-translation standard procedure (Brislin, 1986; Brislin, Lonner, & Thordike, 1973). Participants were assured of the confidentiality of their responses and asked to e-mail the completed questionnaires directly to the research team. A total of 243 questionnaires were returned, corresponding to a response rate of 79.7%. The majority of the participants were male (94%) and had a mean age of 30.2 years (SD = 4.14). In addition, the average tenure in the organization was 3.77 years (SD = 2.41), ranging from eight months to twelve years.

After six months of the assessment of the predictors, we collected supervisor ratings of overall performance in a sub-sample of 95 engineers who had participated in the first phase of the study and which pertained exclusively to the job category of software project engineering. We circumscribed the assessment of job performance to this specific job category in order to ensure greater sample homogeneity in terms of job requirements. The size of this sample is similar to the median of the samples in the validity studies published in top journals (Salgado, 1998). The subjects of this sub-sample were predominantly male (94%), with a mean age of 31.2 years (SD = 5.09) and a tenure average of 3.22 (SD = 1.48). Each immediate supervisor rated every employee that directly reported to him or her in the previous six months. These ratings were collected during the execution of the company's performance appraisal system and supervisors were assured that their ratings were to be kept confidential and were used for research purposes only.

Measures

Proactive personality. Proactive personality was measured using the 10-item brief form (Seibert et al., 1999) of Bateman and Crant's original scale. Example items include "I excel at identifying opportunities" and "If I see something I don't like, I fix it". Respondents indicated their levels of agreement with each item as an accurate description of themselves, using a 5-point Likert-type scale (1 = *strongly agree* to 5 = *strongly disagree*). Previous studies have provided

evidence of the psychometric characteristics of this scale (e.g., Claes, Beheydt, & Lemmens, 2005; Seibert et al., 1999; Thompson, 2005). We tested its factor structure using a principal component analysis, which detected a single factor solution that explains 30% of the total variance, with all items showing appropriate loadings on the factor (all above .40). A parallel analysis (Longman, Cota, Holden, & Fekken, 1989) also supported the unidimensionality of the scale. Cronbach's alpha was .73.

Big Five. The five factors of personality were assessed using Saucier's (1994) Mini-Markers, a 40-item shortened form of Goldberg's (1992) 100-item Adjective Checklist that provides unipolar markers for the Big-Five personality factor structure. Sample items are: "Talkative" and "Shy" for Extraversion; "Organized" and "Efficient" for Conscientiousness; "Relaxed" and "Temperamental" for Emotional Stability; "Imaginative" and "Uncreative" for Openness; and "Sympathetic" and "Kind" for Agreeableness. Participants were asked to rate how accurately each adjective described them on a Likert-type scale anchored at 1 = *extremely inaccurate* and 5 = *extremely accurate*. Saucier (1994, 2002) has provided evidence supporting that this scale reproduce the expected five-factor solution with remarkable robustness. The author also reported internal consistency coefficients ranging from .78 for openness and emotional stability to .83 for extraversion and conscientiousness. A principal component analysis conducted with the data of this study showed a five-factor structure that accounts for 47.2% of the total variance, with all items revealing clean loadings (all above .40) on the expected factor. A parallel analysis was conducted and also suggested the retention of a five-factor solution. The Cronbach's alphas for the *Big Five* were .88 for emotional stability, .74 for openness, .76 for conscientiousness, .75 for extraversion, and .65 for agreeableness.

Overall job performance. This measure was assessed by supervisors' ratings on a company 9-item measure of overall performance which resulted from the organization's job analysis procedures. It evaluates core task-based and innovative competencies, such as "detailed software design and coding", "software quality assurance", "suggestion and implementation of innovative ideas". Supervisors are asked to provide ratings on the items of this measure using an 8-point Likert scale anchored at 1 = *unacceptable* and 8 = *outstanding*. It should be underlined that only 7 of these items were applicable to all the software engineers who participated in this study. The remaining two items reflected more complex or specific competencies pertaining to particular subsets of the engineers included in the sample. As a consequence of this particularity, the factor structure of this measure was tested using these seven items only. The results from a principal components analysis uncover a single factor solution that accounts for 60% of the total variance, with all items showing appropriate loadings, ranging from .57 to .92. With respect to the measure reliability estimation, we estimated in a first step the internal consistency of the 9 items using all the subjects for which supervisors' ratings for all the items were available. The obtained Cronbach's alpha was α = .81. In a second step, we estimated the equivalent reliability that should be expected for 7 items or parts using the Spearman-Brown prophecy formula, obtaining a final reliability estimate of .77.

Data analysis strategy

As previously mentioned, the purpose of this study is to investigate the incremental validity of proactive personality for predicting job performance over the Big Five factors. In order to achieve this goal, a set of statistical analyses was conducted. In the first phase, the observed criterion-related validity coefficients of proactive personality and the Big Five were obtained. In order to estimate the correspondent operational validity, the observed validity coefficients were further corrected for both criterion unreliability and predictor direct range restriction. The correction for criterion measurement

error was performed using the inter-rater reliability meta-analytic estimate of .52 for job performance reported independently by Viswesvaran, Ones and Schmidt (1996) for studies conducted in the United States and by Salgado, Anderson, Moscoso, Bertua, and De Fruyt (2003) for European studies. For selection purposes, the relevant estimate is the operational validity coefficient, thus corrections for predictor unreliability were not made because the predictors are always measured with imperfect reliability in applied settings. With regard to the correction for predictor direct range restriction, we used the range restriction ratios (u_x) obtained in the current study for each predictor variable, after comparing the values of standard deviation obtained in the sample used for the measurement of the predictors (N = 243) with the correspondent values observed in the sub-sample used to measure the criterion (N = 95).

In the second phase, which was conducted before testing our research hypothesis, we investigate the extent to which proactive personality was a compound variable of the Big Five in our sample. We assessed this question by estimating the true amount of variance that is shared by proactive personality and the five personality factors. To provide such an estimate we firstly obtained the percentage of observed common variance of these constructs through the calculation of the statistical estimates of the coefficients of cross-validated multiple correlation (R_{cv}) and cross-validated square multiple correlation (R^2_{cv}) . We relied on these particular coefficients because they represent preferable estimates compared with the observed multiple square correlation R^2 or even with the adjusted R^2 (Lautenschlager, 1990; Yin & Fan, 2001). The latter coefficients constitute, in fact, inflated estimates due the capitalization in chance that occurs in multiple regression analysis, a bias effect that grows progressively with the increase in the number of predictors included in the analysis. Browne's (1975) formula was used to estimate the R_{cv}. Previous studies have shown that this formula outperforms alternative statistical procedures that can be implemented for cross-validation estimation (Cattin, 1980; Lautenschlager, 1990; Yin & Fan, 2001). Once these estimates were obtained, and as we intended to examine the percentage of true common variance of proactive personality and the Big Five, we further corrected the observed multiple cross validity coefficient (R_{cv}) for measurement error. In order to perform this correction we firstly calculated a linear composite variable of the Big Five factors which were significantly related to proactive personality in our sample and then estimated its reliability using the formula proposed by Mosier, as recommended by Guilford (1954). In respect to the reliability estimate of proactive personality, the respective Cronbach's alpha (α = .73) obtained in this study was used.

Finally, in the third and last phase, we tested our research hypothesis by examining the incremental validity of proactive personality through a hierarchical regression analysis, following the procedures recommended by Cohen, Cohen, West and Aiken (2003). For the reasons previously discussed, we relied on the on the R^2_{cv} coefficient instead of the R^2 or the adjusted R^2 coefficients, to assess the incremental prediction of proactive personality over the Big Five on overall job performance.

Results

Descriptive statistics, reliability estimates, and intercorrelations among study variables are presented in Table 1. As can be observed, proactive personality represents a positive and significant predictor of overall performance (r = .25, p < .05). For the Big Five the results indicated that the factors of conscientiousness (r = .27, p < .01), emotional stability (r = .25, p < .05) and extraversion (r = .23, p < .05) were positive and significant predictors of this criterion. Organizational tenure (r = .20, p < .05) also emerged as a valid predictor of overall performance in this sample.

Table 1
Means, standard deviations and zero-order correlations between study variables

Variable	N	M	SD	1	2	3	4	5	6	7	8	9	10
1. Sex [a]	243	1.07	.25										
2. Age	243	31.24	5.09	-.03									
3. Tenure	243	3.77	2.41	.05	.26***								
4. Emotional Stability	243	3.54	.73	-.08	.04	.17*	(.88)						
5. Extraversion	243	3.62	.61	.03	.04	-.09	.01	(.75)					
6. Openness	243	3.46	.48	-.14*	-.04	-.04	-.04	.26***	(.74)				
7. Agreeableness	243	3.83	.43	.04	.02	-.01	.19**	.09	.21**	(.65)			
8. Conscientiousness	243	3.94	.51	.06	.07	.17*	.10	.10	.18**	.21**	(.76)		
9. Proactive Personality	243	3.77	.38	-.04	.10	-.04	.05	.44***	.48***	.13*	.24***	(.73)	
10. Overall job performance (z scores)	95	0.02	.87	.03	-.04	.20*	.25*	.23*	.16	-.14	.27**	.25*	(.77)

Note. Reliability estimates are located in the diagonal in parentheses
[a] Males were coded as 1 and females were coded as 2
$^*p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Table 2 displays the validity estimates corrected for criterion unreliability and direct range restriction in the predictors (operational validity). As we have already specified, the obtained range restriction ratios were used for the range restriction validity corrections. More specifically, the following U values (the u_x values are in parentheses) were found for the valid predictors: 1.11 (0.89) for proactive personality, 1.01 (0.99) for emotional stability, 1.06 (0.94) for extraversion, 1.17 (0.85) for conscientiousness and 1.63 (0.61) for tenure.

Table 2
Corrected validity coefficients for measurement error and range restriction

Predictor	r	ρ	CI 95
Tenure	.20	.42	.17 < .42 < .68
Emotional stability	.25	.35	.17 < .35 < .53
Extraversion	.23	.34	.15 < .34 < .52
Conscientiousness	.27	.43	.24 < .43 < .61
Proactive personality	.25	.38	.19 < .38 < .57

Note. $N = 95$; r = uncorrected validity coefficient; ρ = operational validity coefficient (corrected for both criterion unreliability and predictor direct range restriction); CI 95 = 95% confidence interval.

As shown, the corrected coefficient for proactive personality is ρ = .38, whereas emotional stability, extraversion, and conscientiousness had corrected coefficients of ρ = .35, and ρ = .34, and ρ = .43, respectively. It is also relevant to note that none of the respective confidence intervals included zero, suggesting that these variables do indeed represent significant and meaningful predictors of overall performance in the present sample.

In addition, and as the zero-order correlations revealed, proactive personality was associated with the factors of openness (r = .48, $p < .001$), extraversion (r = .44, $p < .001$), conscientiousness (r = .23, $p < .01$) and agreeableness (r = .13, $p < .05$). Moreover, the multiple correlation of the Big Five for explaining proactive personality was $R = .60$: $F(4, 238) = 32.66$, $p > .001$. The results of this analysis also indicated that openness (ρ = .38, $p < .001$), extraversion (ρ = .33, $p < .001$), and conscientiousness (ρ = .14, $p < .05$) contribute significantly to the explanation of variance in proactive personality. Agreeableness (ρ = -.01, ns) did not predict proactive personality in the presence of the other three personality factors. A replication of the previous analysis without agreeableness revealed an identical multiple correlation of $R = .60$: $F(3, 239) = 43.70$, $p > .001$, which corresponds to an estimate of $R_{cv} = .58$, ($p < .001$, $R^2_{cv} = .34$, $N = 243$), showing that

the factors of openness, extraversion and conscientiousness accounted for 34% of the observed variance in proactive personality. Furthermore, the magnitude of the obtained multiple cross-validity coefficient R_{cv} rises from .58 to approximately .84, after the correction for measurement error in both proactive personality and the compound variable formed by openness, extroversion, and conscientiousness (the obtained reliability estimate for this compound using Mosier formula was .65), indicating a percentage of true shared variance of 71% ($R_{cv} = .84$, $R^2_{cv} = .71$) between the constructs under analysis. As indicated by this pattern of results, proactive personality shares a substantial amount of variance with these three personality factors in this sample, though it is not totally covered by them.

Table 3 summarizes the results of the hierarchical regression analysis carried out to test our research hypothesis, which posited that proactive personality would show incremental validity over the five factors for the prediction of job performance. The Big Five factors of emotional stability, extraversion and conscientiousness, which represented valid predictors of overall performance in this study, were entered in the first step of the analysis. As we intended to control for all the personality factors that share variance with proactive personality, openess was also entered in this step of the analysis, even though it was not considered a valid performance predictor in our sample. The obtained results indicate that this set of personality factors accounts for 17% of the variance in overall job performance: adjusted $R^2 = .19$, $F(4, 90) = 6.65$, $p < .001$, $R_{cv}^2 = .17$, $p < .001$. Due to the fact that tenure emerged as a valid predictor of the criterion in the present sample it was entered in the second step of the hierarchical regression. We entered this predictor in the analysis after the Big Five since we assumed a causal order with emotional stability, extraversion conscientiousness and openness as exogenous variables, and tenure and overall performance at consecutively later stages of the causal chain. As shown, adding tenure explains an additional 1% of the variance in the criterion: β = .17, $p = .07$; $\Delta R^2 = .03$, $F(1, 89) = 3.43$, $p = .07$, $\Delta R_{cv}^2 = .01$.

Finally, proactive personality was entered in the third and last step of the analysis to evaluate the amount of variance that it explains in the criterion over and above the considered personality factors and tenure. The results demonstrate that proactive personality explains 1% of the variance: β = .19, $p = .09$; $\Delta R^2 = .02$, $F(1, 88) = 2.81$, $\Delta R_{cv}^2 = .01$, in overall performance beyond the variance explained by emotional stability, extraversion, openness, conscientiousness and tenure. Thus, our research hypothesis, which posited that proactive personality would incrementally predict overall performance over the Big Five, was only barely supported.

Table 3
Results of hierarchical regression analysis showing the incremental validity of proactive personality on overall job performance over the Big five and tenure

Independent variables ΔR_{cv}^2	Overall job performance (z scores)			
	β	R^2	ΔR^2	R_{cv}^2
Step 1	.19***	.17***		
Emotional stability	.33**			
Extraversion	.24*			
Openness	.03			
Conscientiousness	.32**			
Step 2	.22***	.03+	.18***	.01
Tenure	.17+			
Step 3	.23***	.02+	.19***	.01
Proactive Personality	.19+			

Note. *N* = 95. R^2 values are adjusted R^2 values. +*p* < .10, *p* < .05, **p* < .01, ***p* < .001.

Discussion

According to our literature review, few studies have investigated the incremental validity of proactive personality for predicting relevant organizational and individual outcomes. The present study aimed to contribute to this research topic by assessing the incremental prediction of proactive personality on overall job performance over and above the Big Five. The obtained results reveal that proactive personality is a relevant valid predictor of overall performance in our sample of software engineers, displaying an operational validity coefficient of ρ = .38 (*p* < .05), a finding that suggests that this disposition may represent a useful predictor of job performance in highly complex and innovative occupations. Moreover, as these results were obtained in a non-American sample, they also allow us to conclude that proactive personality is related to job performance in other cultures and organizational settings, as prior research has started to show (e.g., Gan & Cheung, 2010; Kim et al., 2009; Li et al., 2010; Zhang et al., 2012).

Nonetheless, the results also show that the incremental prediction produced by proactive personality over emotional stability, extraversion, openness, conscientiousness and organizational tenure was considerably small and marginally significant. In fact, proactive personality only explains 1% of variance in overall performance beyond the latter predictors, a finding that seems to indicate that little is gained, even from an economic utility point of view, from further assessment of proactive personality for selection purposes in combination with the Big Five.

The current study also contributes to the literature by estimating the amount of variance that is shared by proactive personality and the Big Five. More precisely, the obtained estimate of the multiple square cross-validity indicated a percentage of almost 71% of true common variance (the observed R^2_{cv} was .34 and rose to .71 after correction for measurement error) between proactive personality and the factors of extraversion, openness and conscientiousness. This finding suggests that although proactive personality is not completely covered by the Big Five, the degree of overlap that exists between these constructs may be substantial and should not be overlooked when hypothesizing about the potential of proactive personality to meaningfully outperform the prediction displayed by the Big Five for organizational and individual criteria. Yet, additional evidence regarding this particular issue is needed to reach more definite conclusions about the extent to which proactive personality represents more than a composite of Big Five personality traits.

This study has also some limitations. One important limitation concerns the measure of overall performance, that was restricted to the behavioural aspects of task performance and individual innovation that were valued by the company in this study and formally assessed through its performance evaluation system. In spite of the appropriateness of this criterion for investigating the validity and incremental validity of proactive personality, given that previous research has found that proactive personality is a valid predictor of these particular behaviours (e.g. Crant, 1995; Fuller & Marler, 2009; Seibert et al., 2001; Fuller & Marler, 2009; Thompson, 2005), the use of a broader measure of global performance that also includes the dimensions of contextual performance and counterproductive behaviours will provide a more comprehensive examination of the criterion-related validity and incremental validity of proactive personality. Another limitation of the study is concerned with the investigation of the discussed research questions in only one specific job, which limits the generalization of these conclusions to other occupations and organizational settings.

Future research on these issues may benefit from the use of samples pertaining to different organizations and to jobs and occupations with different levels of complexity and with different formal requirements in terms of individual innovation. A more comprehensive understanding of the utility of proactive personality for personnel selection and human resource management may also be reached with the future study of narrower performance criteria, like the dimensions of task and contextual performance and counterproductive behaviour, and with the examination of other relevant, but less studied, criteria in the proactive personality literature like job satisfaction, leadership, and promotability evaluations (Li et al., 2010; De Pater, Van Vianen, Bechtoldt, & Klehe, 2009; Thomas et al., 2010; Zhang et al., 2012).

In conclusion, this study provides evidence that proactive personality represents a valid and important predictor of overall job performance in the context of an innovative job of software engineering, though this construct does not show a relevant increment in the prediction of this criterion that is provided by the Big Five and organizational tenure.

Conflicts of interest

The authors of this article declare no conflicts of interest.

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