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# **Beyond Linearity: Exploring the Curvilinear Association Between Conscientiousness and Well-Being through Instrument Sensitivity**

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### Abstract

**Background:** Recent research has begun to challenge the traditional view of conscientiousness as solely beneficial, suggesting a potential reverse-U-shaped relationship with subjective well-being (SWB). Yet, while some studies have found this curvilinear association, overall findings remain inconsistent. This study proposes the limited conceptualization and measurement of conscientiousness within conventional five-factor model (FFM) personality scales as a contributing factor to the inconsistencies. I compare a conventional FFM (IPIP-120) and a more comprehensive instrument (PID-5) to assess their ability to detect curvilinearity in the conscientiousness-SWB relationship.

**Method:** The study involved comparing linear and curvilinear structural equation models ( $N = 541$ ) and the significance of linear and curvilinear paths estimated for conscientiousness measured with either the conventional or comprehensive instrument in predicting SWB.

**Results:** The comprehensive instrument did not improve fit of the curvilinear model between conscientiousness and SWB compared to the conventional instrument, suggesting sufficiency of the conventional instrument in describing the nature of this relationship.

**Discussion:** Results did not identify a curvilinear relationship between conscientiousness and SWB, and this pattern held even with a more comprehensive instrument. Still, the study highlights the potential utility of a more comprehensive instrument for measuring conscientiousness. Future research employing such instruments could further refine our understanding of the conscientiousness-SWB link.

**Conclusion:** Clarifying the nature and effects of extreme conscientiousness within the context of maladaptive personality is crucial to address the field's current inconsistencies.

*Keywords:* conscientiousness, subjective well-being, nonlinear relationships, personality, instrument sensitivity

**Thank you!**

While this research utilized a pre-existing dataset, the contribution of the original data collectors is acknowledged with gratitude. I would also like to express my sincere appreciation to my supervisor, Petri Kajonius, for their invaluable guidance and support throughout this project. Finally, I extend my heartfelt thanks to my family and friends for their encouragement and understanding.

### **Beyond Linearity: Exploring the Curvilinear Association between Conscientiousness and Well-Being through Instrument Sensitivity**

Conscientiousness is generally esteemed as a highly desirable facet of one's personality. Characterized by adherence to social norms, impulse control, goal-directedness, planning, and delayed gratification (Roberts et al., 2009), it is unsurprising that conscientiousness is associated with positive life outcomes. Among these life outcomes, including many health-related (e.g., Kotov et al., 2010; Takahashi et al., 2013) and performance-related (e.g., Barrick & Mount, 1991; Corker et al., 2012) indicators, conscientiousness has been positively associated with subjective well-being (SWB; Dyrenforth et al., 2010). In addition to the relationships between conscientiousness and the aforementioned outcomes being positive, research has portrayed these relationships as predominantly linear (Friedman et al., 2010). That is, there is a prevailing understanding that increasing conscientiousness should invariably result in better outcomes. In pursuit of these outcomes, studies have posited possibilities aimed at augmenting conscientiousness among individuals (e.g., Javaras et al., 2019), which may potentially induce excessively elevated levels. However, recent research has begun to debate the potential downsides of excessive conscientiousness (e.g., Carter et al., 2016, 2018; Nickel et al., 2019; Widiger & Crego, 2019), necessitating a more nuanced understanding of this factor and the ramifications of interventions targeting its augmentation. Given prior inconsistencies in the research regarding the nature of extreme conscientiousness, the present study set out to investigate the presence of a reverse-U-shaped curvilinear pattern within the conscientiousness–SWB relationship.

Originally outlined within management literature, this paradoxical phenomenon can be elucidated through the too-much-of-a-good-thing (TMGT) effect (Pierce & Aguinis, 2013). According to this theory, a generally advantageous predictor variable exhibits an inflection point, beyond which its relationship with the desirable outcome ceases to be linear and positive. Regarding conscientiousness, traits traditionally perceived as favourable, like orderliness and self-discipline, are suggested to transform into maladaptive forms when expressed at extreme levels, resulting in attributes such as fastidiousness and doggedness (Samuel et al., 2012). These attributes, resembling obsessive-compulsive (OC) tendencies (Samuel & Widiger, 2008), have been used to justify the notion that exceedingly conscientious individuals may experience challenges, which undermine the typically positive influence of conscientiousness on favourable life outcomes (Carter et al., 2016). In as much, studies have shown that OC tendencies are indeed associated with adverse effects on well-

being indicators (Eisen et al., 2006). Accordingly, the once linear and positive relationship between conscientiousness and a favourable outcome takes a downturn, following a reverse-U-shaped curvilinear pattern. However, alongside the disparities in theoretical accounts regarding the link between conscientiousness and maladaptive tendencies (e.g., Carter et al., 2016; Nickel et al., 2019), discord about the curvilinear nature between conscientiousness and positive life outcomes, including SWB, prevails.

Various factors contribute to these inconsistent findings, including the potential misattribution of traits characteristic of neuroticism, such as perfectionism, as extreme high conscientiousness (i.e., the misattribution hypothesis; Nickel et al., 2019), the widespread reliance on conventional scoring techniques (Carter et al., 2014, 2018), and the limited measurement capability of standard personality assessments to comprehensively encompass the entire extent of the trait dimensions (Carter et al., 2018). However, while previous studies have investigated the influence of both the misattribution hypothesis (Samuel et al., 2023) and alternative scoring methods (Carter et al., 2016; Nickel et al., 2019) on the association between heightened conscientiousness and SWB, there is a notable gap in the literature concerning the examination of how limitations in commonly used personality assessments may impact the detection of curvilinear patterns within this relationship. Specifically, the constrained capability of widely employed five-factor model (FFM) personality tests to fully encompass the breadth of trait dimensions could hinder the identification of inflection points within a specific scale (Carter et al., 2018). By addressing these factors, this study aims to offer additional insights into the conflicting findings observed in prior research and promote a more comprehensive understanding of conscientiousness as a whole. Consequently, this study seeks to address the following research question: *How does a more comprehensive conscientiousness instrument compare to a conventional FFM instrument in detecting curvilinearity in the relationship between conscientiousness and SWB?*

### **Is It Possible to Be Too Conscientious?**

A widely discussed hypothesis suggests that personality disorders described in the American Psychiatric Association's (APA) Diagnostic and Statistical Manual of Mental Disorders (DSM; APA, 2013) and World Health Organization's (WHO) International Classification of Diseases (ICD; WHO, 1992) may represent extreme or maladaptive expressions of the FFM of personality (Widiger & Costa, 1994). This notion was recognized both in the DSM-V (APA, 2013) and ICD-11 (WHO, 2019), both of which introduced a dimensional trait model for personality disorders, reflecting the transition of general FFM

personality traits into maladaptive variants characteristic of personality disorders. In DSM-V, the domains of negative affectivity, detachment, psychoticism, antagonism, and disinhibition are proposed as maladaptive variants of the FFM domains (APA, 2013). In ICD-11, a similar trait model is proposed, comprising negative affectivity, detachment, dissociality, disinhibition, and anankastia, aligning conceptually with the FFM traits (Tyrer et al., 2015; Mulder et al., 2016). Regarding conscientiousness, empirical evidence has shown that the disinhibition domain in both DSM-V and ICD-11 corresponds to extremely low conscientiousness (Mulder et al., 2016; Oltmanns & Widiger, 2019), with compulsivity situated at the opposite end of the spectrum (APA, 2013). While DSM-V collapsed disinhibition and compulsivity onto the same dimension (APA, 2013), ICD-11 kept them separate, labelling compulsivity as anankastia (WHO, 2019). This was seemingly done in the name of simplicity, rather than as an opposition to their linkage, as factor analyses of the ICD-11 model have consistently demonstrated that disinhibition and anankastia load onto the same bipolar dimension (Carnovale et al., 2020). Supporting the conceptual alignment (Mulder et al., 2016), empirical research has shown that FFM conscientiousness correlates positively with anankastia (i.e., compulsivity) and negatively with disinhibition (Oltmanns & Widiger, 2019). From a unidimensional lens, disinhibition, signifying extremely low conscientiousness, occupies the polar opposite on the spectrum to compulsivity, which reflects extremely high conscientiousness. Accordingly, research shows that compulsivity content reflective of obsessive-compulsive personality disorder (OCPD) can be conceptualized as heightened conscientiousness.

### ***The Link Between Conscientiousness and OCPD***

Naturally, within the perspective of the dimensional model, the applicability of the TMGT effect to conscientiousness primarily arises from its connection with OC tendencies. In the DSM-V (APA, 2013), the fundamental feature of OCPD is described as “a pervasive pattern of preoccupation with orderliness, perfectionism, and mental and inter-personal control, at the expense of flexibility, openness and efficiency” (p. 678). Such a description bears resemblance to a normative personality domain centred around the control and regulation of behaviour, also termed as constraint, compulsivity, or conscientiousness (Widiger & Simonsen, 2005). Indeed, the FFM domain conscientiousness is characterized through dutifulness, self-control, deliberation, and order (McCrae & Costa, 2003), with the people scoring high on this trait being described as stringent, reliable, industrious, punctual, and disciplined (Roberts et al., 2009). Accordingly, it is reasonable to assume that people

displaying extremely high conscientiousness would be excessively perfectionistic, fastidious, and dogged as well as overly preoccupied with organization, rules, and details (Widiger et al., 2002). Thus, it is suggested that the facets of conscientiousness directly align with OC traits, such as linking competence with perfectionism and orderliness with fastidiousness (Samuel et al., 2012). Yet, while the link between conscientiousness and OCPD seems reasonable lexically, empirical investigations into the connection have not obtained consistent results.

Several extensive meta-analyses have deemed the inconsistency to depend on instrumentation of both OCPD as well as conscientiousness. Regarding OCPD, in one meta-analysis (Saulsman & Page, 2004), while the mean weighted effect size between conscientiousness and OCPD was found to be  $r = .23$  ( $p < .001$ ) across scales, the effect size rose to  $r = .52$  ( $p < .001$ ) using the Millon Clinical Multiaxial Inventories (MCMI) I, II, and III (Millon, 1983, 1987, 1994) yet dropped to only  $r = .03$  ( $p > .05$ ) when all other instruments were considered (e.g., Personality Diagnostic Questionnaire [PDQ], Minnesota Multiphasic Personality Inventory [MMPI]). A similar result was obtained in another meta-analysis, in which the weighted mean effect size between conscientiousness and OCPD was  $r = .24$  across the instruments, yet varied noticeably between them (Samuel & Widiger, 2008). While the MCMI-III obtained strong relationships with all conscientiousness facets (i.e., all above  $r = .38$ ), the PDQ-4 (Hyler, 1994) averaged only  $r = .01$ . This is undoubtedly troubling as MCMI-III has also demonstrated poor convergence with other measures of OCPD (Widiger & Boyd, 2009), indicating that most of the evidence supporting the association between conscientiousness and OCPD comes from a measurement of OCPD that exhibits a negative correlation with other assessments of the same construct. However, the strong association between conscientiousness and OCPD is not exclusive to MCMI-III entirely, as the OCPD scale of the Schedule for Nonadaptive and Adaptive Personality (SNAP; Clark, 1993) has obtained a correlation of  $r = .21$ . This is largely due to the disparate conceptualizations of OCPD across the scales: contrasting MCMI-III, scales like MMPI-2 (Butcher et al., 1989) and PDQ-4 conceptualize OCPD primarily in terms of neuroticism (Samuel & Widiger, 2010).

While the different conceptualizations of OCPD may as well be at fault for affecting the inconsistent findings regarding its association with conscientiousness, there may also be limitations to the current standard of conscientiousness instruments. Majority of the studies investigating this relationship have relied upon the NEO Personality Inventory–Revised (NEO-PI-R; Costa & McCrae, 1992), which is the most common measure of FFM and has a large body of validity evidence (McCrae & Costa, 2008). Nevertheless, NEO-PI-R was

developed to assess normative personality, which may not be capable of capturing the extreme high end of conscientiousness and its association with maladaptive tendencies, like that akin to OCPD. An investigation into the instrument revealed that 90% of the conscientiousness items were geared towards assessing adaptive rather than maladaptive functioning (Haigler & Widiger, 2001), which may partially account for the disparate results regarding the conscientiousness–OCPD connection. Moreover, while the traditional standard has been to conceptualize only the low end of the FFM traits as “maladaptive” personality, a growing body of research has started to explore the existence of maladaptivity at both ends of these traits (e.g., Carter et al., 2018; Widiger & Crego, 2019). However, what hinders the investigation of such a thesis is the limited breadth of the FFM trait domains in our conventional personality instruments that only cover the low and adaptive levels of these traits, the last of which is currently largely considered as the high end of the trait continua (Carter et al., 2018).

### ***Limited Measurement Scope of Conscientiousness***

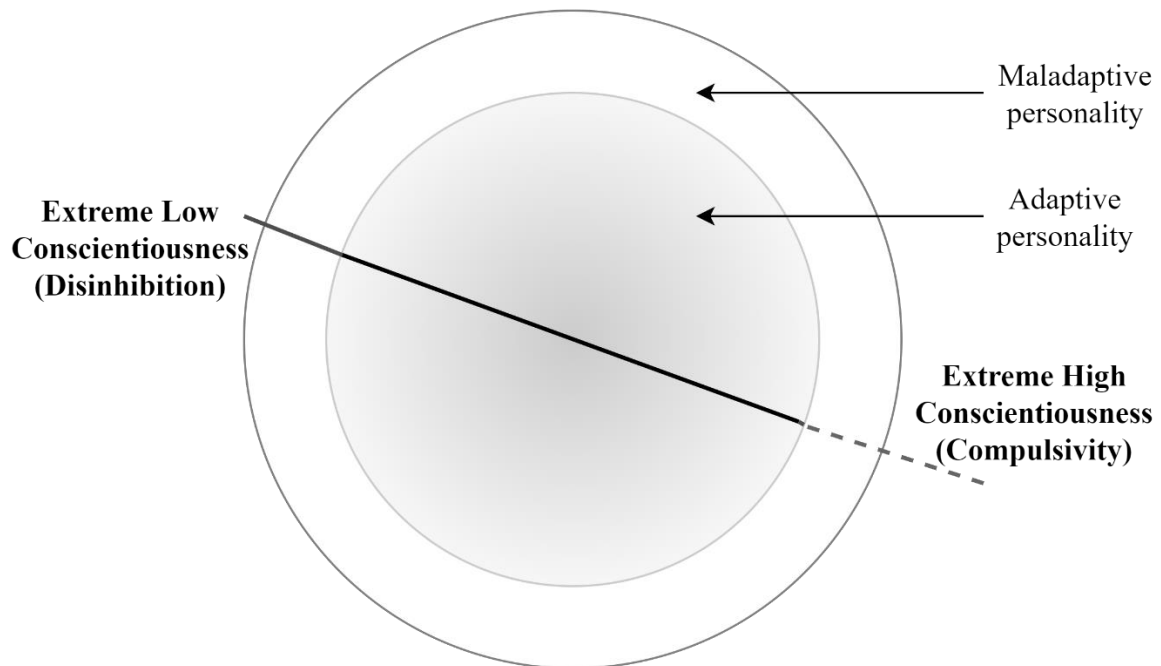
Though higher levels of adaptive traits have been associated with positive outcomes thus far, an analysis of data from a lexical study by Coker and colleagues (2002) found a number of negative descriptors to link with these desirable traits (Widiger et al., 2017) – such as deceivable for high agreeableness and stringent for high conscientiousness. This indicates towards an extended *circumplex conception of personality*, in which adaptive functioning lays in the middle and maladaptivity is found on the edges. Figure 1 depicts this conception and how it parallels the dimensional model of personality disorders as applicable to FFM conscientiousness. Adaptive functioning, according to this model, would equal to a moderate level of all FFM traits, while maladaptive functioning is associated with both extremely low and extremely high standing on these personality traits. However, the extremely high traits levels are not currently explicitly included in the standard personality taxonomies and which we are not reliably measuring as a result. Even as DSM-V and ICD-11 introduced the dimensional model of personality disorders as an alternative model, accentuating the transformation of FFM personality traits into maladaptive variants, they did so largely from a unipolar perspective to maladaptive personality structure (Carter et al., 2018; Widiger & Crego, 2019). That is, the traits associated with personality disorders were intended to identify pathology exclusively at one end of these dimensions, typically the lower end. The one exception is the anankastia domain in the ICD-11 model, which, as explained previously, taps into maladaptively high conscientiousness content. Accordingly, the current instruments



largely allow us to measure only a limited extent of the entire trait dimension, which would explain the profound inconsistencies within the field in detecting curvilinear associations between conscientiousness and positive life outcomes.

### Figure 1

*Conscientiousness in the Extended Circumplex Conception Framework.*



*Note.* Model adapted from Carter et al., 2018. Dashed line represents conscientiousness levels that are not explicitly addressed in existing FFM personality taxonomies.

### The Association Between Conscientiousness and Well-being

Given existing research challenging the assumption of linearity between conscientiousness and performance outcomes (e.g., Carter et al., 2014; Le et al., 2011; Pierce & Aguinis, 2013), more recent developments have begun to question this association with respect to well-being specifically. One such study indeed revealed a curvilinear relationship between conscientiousness and SWB (Carter et al., 2016), with facets more closely associated with their OC variants, such as cautiousness with ruminative deliberation, exhibiting greater contribution to decreased well-being. One strength of this study was the use of a more comprehensive scale called the Five Factor Obsessive Compulsive Inventory (FFOCI; Samuel et al., 2012), which demonstrates a capacity to effectively capture both adaptive and maladaptive ranges of conscientiousness within a single scale. That is, what is typically considered the upper limit of conscientiousness in conventional personality assessments falls within the moderate range of conscientiousness in FFOCI. Accordingly, at lower to moderate

levels, increases in the competence, dutifulness, self-discipline, and cautiousness facets were linked to reduced negative effect. Conversely, for those with higher levels of these facets, increases were associated with heightened negative effect. Such a finding, strengthened by a comprehensive scale and appropriate psychometric methods, provides support for the emerging narrative suggesting potential harm associated with excessive conscientiousness.

In response to this narrative, an extensive investigation was conducted utilizing four large samples from previous studies (Health and Retirement Study, Knowledge Networks, Midlife in the United States; Nickel et al., 2019). Employing sophisticated psychometric modelling, this study aimed to reveal any non-linear relationships between conscientiousness and indicators of well-being. Despite these efforts, the analysis failed to identify significant curvilinear effects between the two main variables. The few curvilinear relationships that they did uncover (e.g., between conscientiousness and positive affect) failed to substantially deviate from linearity or display a realistic inflection point within the borders of the scale or among the observed range of participant values. However, identifying inflection points beyond the scale underscores the one key weakness in the mentioned study – namely, the use of instruments that are constricted in capturing maladaptively high levels of conscientiousness (Chernyshenko Conscientiousness Scale [CCS]; Chernyshenko, 2003; Hill & Roberts, 2011; Midlife Development Inventory [MIDI] personality scales; Lachman & Weaver, 1997). Furthermore, the study suffered from a limited representation of participants scoring extremely high on conscientiousness, resulting in insufficient statistical power to detect potential curvilinear effects. Nevertheless, the authors proposed a critical consideration to the debate: the possible misattribution of neuroticism-like traits and tendencies as extreme conscientiousness.

### ***Methodological Factors Impacting the Conscientiousness-SWB Relationship***

In addition to the proposal of a limited extent of trait dimension coverage in our current personality taxonomies that may hinder the detection of curvilinearity between conscientiousness and SWB, other factors that may impact the findings include the potential oversaturation of high conscientiousness traits with neuroticism as well as the widespread use of traditional scoring methods. As previously noted, it has been suggested that what might be perceived as extreme conscientiousness, such as perfectionism or workaholism, may actually be heavily influenced by neuroticism (the misattribution hypothesis; Nickel et al., 2019). In this view, it is not extreme conscientiousness alone that the inflection point applies to, but to a combined effect of neuroticism and conscientiousness. Indeed, a study among a non-clinical

sample revealed a measure of high conscientiousness, conceptualized through low disinhibition, to load onto the same factor with negative affectivity (Bach et al., 2018), indicative of neuroticism, thus supporting the misattribution hypothesis. However, contrasting this finding, a recent study found that the more maladaptive measures were, in fact, less overlapping with neuroticism compared to adaptive measures of conscientiousness (Samuel et al., 2023). The observed curvilinearity between conscientiousness and SWB, the authors argue, is still attributable to conscientiousness, and conscientiousness alone. These results further deepen the disarray of findings regarding the high polar end of conscientiousness and its discrimination from other impacting features.

Furthermore, self-report personality assessments are often scored according to the conventional dominance response model, which posits a positive association between an individual's trait level and their agreement with trait-descriptive statements. That is, if people respond according to the dominance assumption, individuals high in conscientiousness would strongly endorse items reflecting conscientiousness. This assumption, inherent in both the Classical Test Theory (CTT) and the Graded Response Model (GRM), may introduce measurement error, particularly at the polar ends, which may obfuscate the results regarding curvilinearity (Carter et al., 2014). More so, the classical total sum-score model characteristic of CTT, where individual item scores are simply added together to create a total score, has been argued to *hide* a curvilinear pattern in self-report data (Carter et al., 2014). As a solution, item-response-theory (IRT) models, specifically those incorporating the ideal point assumption (i.e., the Generalized Graded Unfolding Model [GGUM]; Roberts et al., 2000), have been suggested for scoring. While the IRT models have a refined sensitivity in capturing individual response patterns (e.g., Jabrayilov et al., 2016), the ideal point assumption posits that individuals vary not only in the level of a trait but also in their *ideal level* of that trait (Chernyshenko et al., 2007). That is, while dominance models assume that high-scoring individuals consistently select the highest response category (e.g., "strongly agree") across *all items*, ideal point models assume that these individuals should strongly endorse items reflecting high conscientiousness, but they may only moderately agree (e.g., "agree" or "neither agree nor disagree") with items reflecting moderate conscientiousness. This distinction becomes crucial when analysing self-report data from instruments containing moderate items, where dominance scoring might result in highly conscientious respondents receiving lower total scores than those at less extreme levels. Indeed, previous studies comparing CTT, GRM, and GGUM have revealed a sequential improvement in their ability to

detect curvilinear effects in self-report data (Carter et al., 2014, 2016). Moreover, tested within the same dataset, CTT methods detected only half of the curvilinear effects compared to the GGUM approach, suggesting a methodological constraint in the traditional use of CTT scoring for identifying non-linear relationships (Carter et al., 2014).

### **The Present Study**

The present research sought to examine the relationship between conscientiousness and SWB by comparing instruments that vary in their ability to detect extreme levels of conscientiousness. This had the primary goal of assessing whether the hypothesized limited breadth of the conscientiousness domain in conventional FFM instruments could play a role in the disparate findings regarding the curvilinear nature between conscientiousness and SWB. In order to isolate the influence of the different instruments in detecting a curvilinear pattern between conscientiousness and SWB, the analysis of the relationship indirectly addressed the methodological limitations present in prior research (i.e., scoring approaches, confounding variables). Specifically, more robust psychometric scoring techniques appropriate for detecting curvilinearity in self-report data were employed and the influence of confounding variables on extreme conscientiousness was accounted for. Accordingly, the study sought to accomplish two objectives: (a) to test for the presence of a curvilinear relationship between conscientiousness and SWB; and (b) to investigate the influence of instrument sensitivity to extreme conscientiousness levels in detecting curvilinearity in the conscientiousness–SWB relationship.

## **Method**

### **Participants and Procedure**

The present study employed a quantitative research design utilizing a pre-existing dataset (see Nielsen & Kajonius, 2024). The sample consisted of Swedish-speaking individuals who, after giving informed consent, participated in the research by completing an online personality questionnaire. The data collected from the questionnaire was voluntary and anonymous. Of the total 549 observations in the dataset, eight participants were excluded from the analyses due to substantial amounts of missing data. Among these observations, seven were entirely devoid of data, while one observation exhibited over 50% missingness specifically in one of the employed instruments, resulting in overall missingness of 23.22%. The remaining missing data, constituting 0.29% of the entire dataset, was addressed through multiple imputation ( $m = 5$ ), a method known for its effectiveness in retaining efficiency and accuracy (Woods et al., 2023). Subsequent correlational analyses revealed near perfect

agreement ( $r = \sim 1$ ) between the items with and without imputed data, which assures that the integrity of the data and the study's objectives remained unaffected.

The final analysis involved an investigation of a Swedish community sample:  $N = 541$ , of whom 59% identified as female ( $n = 319$ ), 40% as male ( $n = 217$ ), and 1% as unidentified ( $n = 5$ ). The age of the sample ranged from 14 to 65 ( $M = 38.5$ ,  $SD = 12.3$ ). As the study utilized secondary data collected anonymously and voluntarily with participants' informed consent, ethical review was not required. The study approach was primarily descriptive and correlational, aiming to discern relationships and patterns within the available data.

## **Instruments**

### ***FFM Conscientiousness***

Conventional FFM conscientiousness was assessed using the International Personality Item Pool (IPIP-120; Johnson, 2014), which comprises five factors and 30 facets. Domain conscientiousness was captured with 24 items across six facets, including self-efficacy, orderliness, dutifulness, achievement-striving, self-discipline, and cautiousness. Examples of these items include statements like "I always complete tasks" and "I break rules" (reverse-coded). Each item is assessed on a scale ranging from 0 = *very inaccurate* to 4 = *very accurate*.

### ***Comprehensive Conscientiousness***

Comprehensive conscientiousness was evaluated using the reversed disinhibition domain from the Personality Inventory for DSM-V (PID-5; Krueger et al., 2012), encompassing reversed irresponsibility, impulsivity, and distractibility facets, given their primary contribution to the domain (APA, 2013). The selection of this measure was grounded in the proposition that the lower pole of this domain is associated with content reflecting compulsivity (APA, 2013), which has been demonstrated to signify elevated levels of conscientiousness (Oltmanns & Widiger, 2019; Samuel et al., 2023). The higher pole, encompassing the disinhibition domain, has been demonstrated to align with extremely low conscientiousness (Mulder et al., 2016; Oltmanns & Widiger, 2019). While initially suggested to maintain separate, the disinhibition and compulsivity factors were collapsed into a single dimension for parsimony (Krueger et al., 2012), where lower scores reflected the compulsivity domain, and higher scores reflected the disinhibition domain. To simplify the analysis, the present study adopted a reverse-scoring approach for the disinhibition items, so that higher scores reflected increasing compulsivity. Therefore, this approach assumes that the reversed disinhibition scale effectively captures both extreme ends of the conscientiousness

spectrum, with lower scores (disinhibition) reflecting low conscientiousness and higher scores (compulsivity) reflecting high conscientiousness. An example of an item is “I’m often pretty careless with things” (reverse-coded). Each item is assessed on a scale ranging from 0 = *very inaccurate* to 3 = *very accurate*.

### ***Subjective Well-being***

The assessment of well-being involved the development of a well-being estimate, which was derived from a subset of items reflecting neuroticism and extraversion. A recent comprehensive meta-analysis investigating the relationship between personality and SWB found neuroticism ( $r = -.46$ ) and extraversion ( $r = .37$ ) to have the most significant impact on SWB among the FFM structure (Anglim et al., 2020). Among these domains, the depression ( $r = -.64$ ), vulnerability ( $r = -.50$ ), friendliness ( $r = .47$ ), and cheerfulness ( $r = .47$ ) facets exhibited the strongest associations with SWB (Anglim et al., 2020). However, based on the conducted confirmatory factor analysis (CFA) on the given dataset, the facets showing the highest convergence were friendliness, cheerfulness, (reversed) depression, and (reversed) anger, rather than (reversed) vulnerability. Therefore, the development of a well-being estimate involved the use of the items of these four facets, with the neuroticism facets reversed: anger, depression, friendliness, and cheerfulness. According to the meta-analysis, the facet of anger corresponds mostly to negative affect ( $r = .54$ ), depression to self-acceptance ( $r = -.83$ ) and environmental mastery ( $r = -.76$ ), friendliness to positive relations ( $r = .69$ ), and cheerfulness to positive relations ( $r = .59$ ) and self-acceptance ( $r = .55$ ; Anglim et al., 2020). Example items from the neuroticism and extraversion domains that were employed to assess well-being included “I am often depressed” (reverse-coded) and “I look at the bright side of life”. Appendix A provides an overview of the SWB estimate items and their correspondence to items in two classic SWB scales.

### **Instrument Scoring Methods**

Two scoring methods – the traditional CTT as well as the IRT-based GRM – were employed to calibrate the estimates of the sum-scored and latent variables, respectively. While the GGUM approach is deemed the most optimal for detecting curvilinearity in self-report data (Cao et al., 2018; Carter et al., 2015, as cited in Carter et al., 2016), it necessitates a relatively large sample size to produce meaningful parameter estimates (i.e.,  $N > 750$ ; Roberts et al., 2002), which the present study did not reach. Nonetheless, the IRT-based GRM has been posited as a viable alternative since, in most instances, it exhibits reasonably satisfactory performance and demonstrates greater accuracy compared to CTT sum scores

(Carter et al., 2015, as cited in Carter et al., 2016). Moreover, it appears that dominance IRT models may provide a more effective analysis of data responses from instruments constructed in accordance with the dominance model (Cao et al., 2018), which are the types of instruments utilized in the present study. Accordingly, the primary focus of this study was on the results derived from analyses conducted using the GRM approach.

The statistical analyses were conducted on two distinct datasets: one scored in accordance with CTT principles and the other scored in line with IRT principles. Under CTT, the trait variables were derived by aggregating and averaging the item scores. For instance, FFM conscientiousness items were summed to form facet trait scores, which were then averaged to obtain a trait factor score. In contrast, IRT-based latent variables were generated by evaluating items' discrimination and threshold parameters through GRM analyses. Utilizing both CTT and IRT scoring strengthens this study's contribution to research employing more robust methods for detecting curvilinearity in self-report data, thereby refining understanding of the conscientiousness–SWB relationship.

### **Control Variables**

Neuroticism was utilized as a control variable in order to isolate the influence of conscientiousness on well-being. Studies have shown a significant association between SWB and neuroticism, most considerably with negative affect (Diener et al., 1999). This simultaneously served to assess the misattribution hypothesis, which suggests that heightened conscientiousness can begin to resemble aspects of neuroticism (Nickel et al., 2019), thus leading to a misinterpretation of how conscientiousness alone affects SWB. In light of such findings, employing a statistical control for neuroticism was deemed necessary. For a further investigation of the misattribution hypothesis, see Appendix B. Furthermore, analyses were conducted while also controlling for extraversion alongside neuroticism, given its established association with well-being and with positive affect particularly (Diener et al., 1999). In all cases, only the items from the neuroticism and extraversion domains that were not part of the well-being assessment were utilized as controls to mitigate variance overlap. As a result, neuroticism comprised the anxiety, self-consciousness, immoderation, and vulnerability facets, while extraversion comprised the gregariousness, assertiveness, activity, and excitement-seeking facets, each with four items per facet. Analyses were also performed without any control variables to assess variations in model fit and significance.

## Statistical Analyses

Statistical analyses were conducted using R and Jamovi. Before any analyses, the data underwent cleaning and organization in R using the dplyr package (Wickham et al., 2023), while missing data were handled using the mice package (van Buuren & Groothuis-Oudshoorn, 2011). GRM scoring and overall data plotting were performed using the mirt (Chalmers, 2012) and ggplot2 packages (Wickham, 2016), respectively. Given the differences in the indicators of score quality between CTT and IRT-based GRM, separate preliminary psychometric analyses were conducted for each scoring method prior to the primary statistical analyses. Like CFA models, the quality of IRT-based scores is evaluated through the examination of model-data fit statistics, with TLI<sup>1</sup> values higher than .90 (Byrne, 1994) and SRMR and RMSEA values less than .08 demonstrating acceptable-to-good fit (Awang, 2012). CTT-based scores were evaluated through scale means, standard deviations, skewness, and coefficient alphas, with skewness values between -2 and +2 (Byrne, 2010) and coefficient alphas exceeding .70 (Cicchetti, 1994) considered generally acceptable.

The research question was addressed by employing structural equation modelling (SEM) in the Jamovi software to examine the relationship between SWB and conscientiousness measured with either the conventional FFM instrument or a more comprehensive instrument. The linear and curvilinear models were estimated using facet-level scores as indicators of the general constructs. Specifically, two paths – linear and curvilinear – were estimated for each model using a nested model comparison approach, wherein the linear term was added before the curvilinear term. The models were constructed in a sequential manner, progressing from simpler to more complex structures. The initial model examined the prediction of SWB by FFM conscientiousness, without controlling for neuroticism or extraversion. Subsequent models incorporated increasing complexity by introducing either neuroticism alone or both neuroticism and extraversion as controls, in addition to utilizing the more comprehensive conscientiousness measure. The most complex model examined SWB by comprehensive conscientiousness alongside both neuroticism and extraversion. To facilitate comparisons across models using different scoring methods (GRM, CTT), control variables (none, neuroticism, both), and conscientiousness instruments (FFM,

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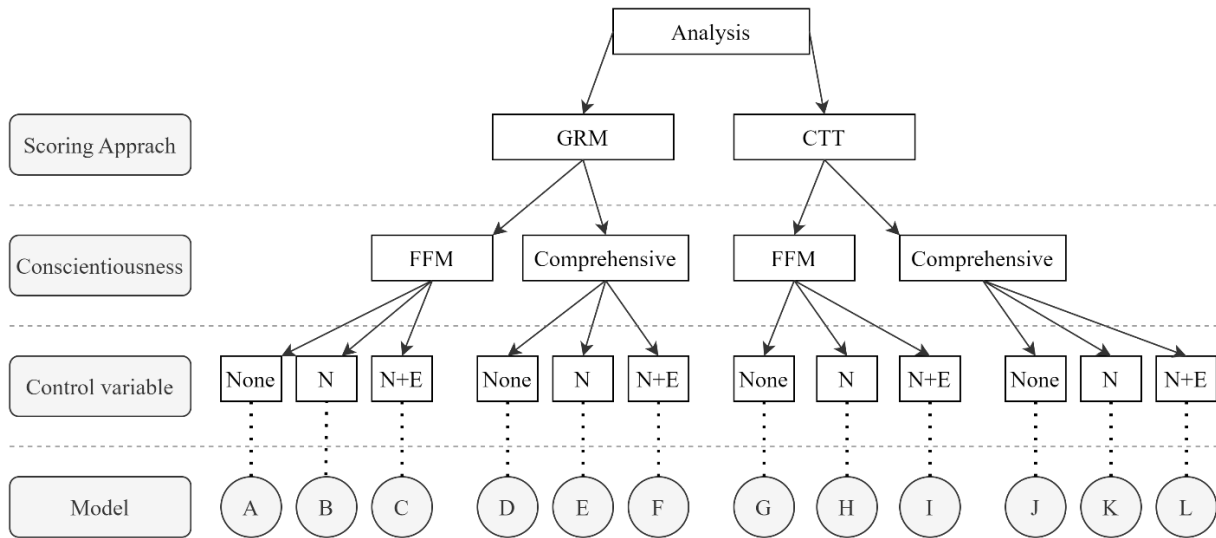
<sup>1</sup> TLI (Tucker-Lewis Index) assesses how well a model fits the data compared to a baseline model that assumes no relationship between variables. SRMR (Standardized Root Mean Square Residual) reflects the average difference between the observed data and the model's predictions. RMSEA (Root Mean Square Error of Approximation) estimates the average error per degree of freedom in the model.



comprehensive), I designated them alphabetically from Model A to L (see Figure 2). The sequence for model testing followed the order presented in the flowchart.

**Figure 2**

*Flowchart Illustrating the Conducted SEM Analyses on the Different Models Predicting SWB.*



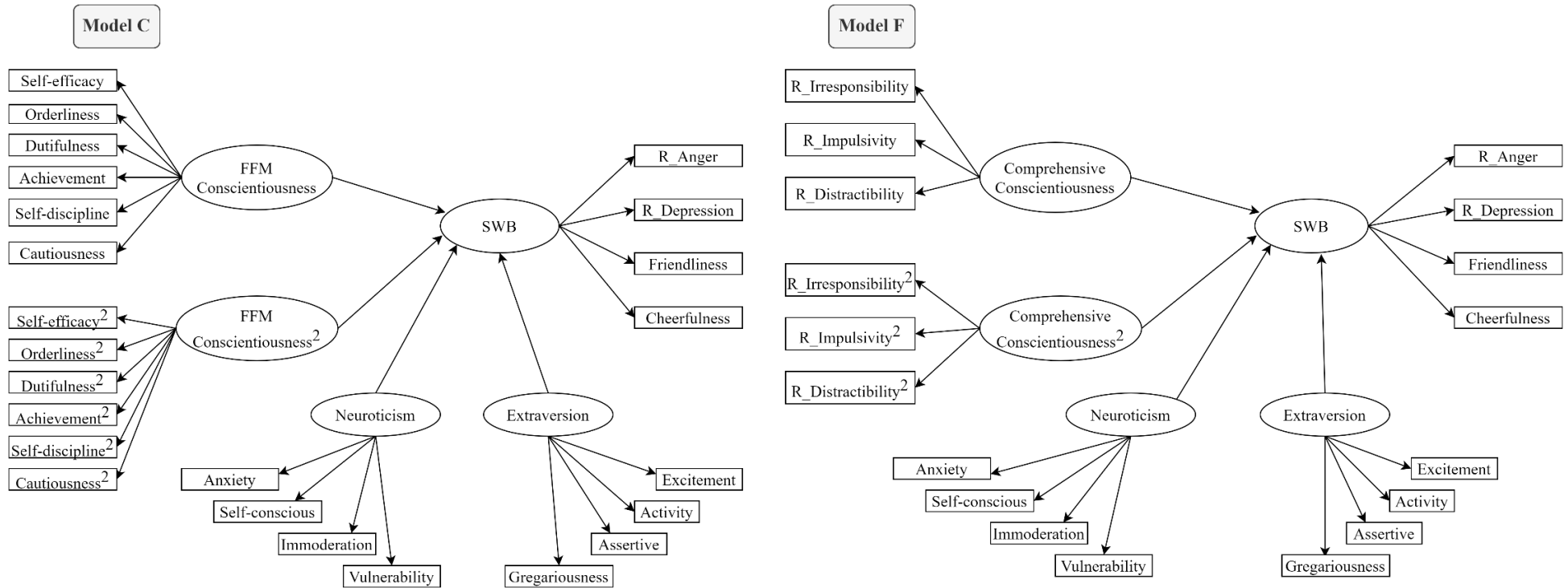
*Note.* SEM = structural equation modelling; SWB = subjective well-being; GRM = Graded response model; CTT = Classical test theory; FFM = five-factor model; N = neuroticism; E = extraversion. Example: Model A employed GRM-scored data to examine the prediction of SWB by FFM conscientiousness, without any control variables. The structural equation models of the primary comparison of interest, Models C and F, are presented in Figure 3.

By employing different scoring approaches and controlling for relevant covariates throughout, the study aimed to minimize bias and provide a clearer picture of the direct association between conscientiousness and SWB. Objective (a) was fulfilled by estimating both a linear and curvilinear path for each model using a nested model comparison approach, which allowed for an assessment of curvilinearity in the conscientiousness–SWB association. For both linear and curvilinear terms of a given model, model fit indices (TLI, SRMR, RMSEA) as well as significance of change in the variance explained ( $\Delta R^2$ ) was assessed. If the model fit indices indicated superior performance of the curvilinear model compared to the linear model, coupled with a notable increase in the explained variance, it was concluded that the relationship exhibits significant curvilinearity. Objective (b) was fulfilled by contrasting model fit indices, SEM path coefficients, and overall explained variance ( $R^2$ ) of structurally identical models that differed only in their measure of conscientiousness (FFM vs. comprehensive), which allowed for an isolated assessment of whether the instrument's

capacity to capture broader conscientiousness levels plays a role in detecting curvilinearity in the conscientiousness–SWB relationship. The primary comparison of interest focused on two of the most complex structural equation models in the GRM-scored dataset: models C and F (see Figure 3). These models incorporated conscientiousness – FFM or comprehensive, respectively – alongside the two control variables to predict SWB.

**Figure 3**

*Structural Equation Models Relating FFM (Model C) and Comprehensive (Model F) Conscientiousness and SWB.*



*Note.* FFM = five-factor model; SWB = subjective well-being; R\_ = reversed facets; ...<sup>2</sup> = squared term (non-linear). The linear and curvilinear models were estimated using facet-level scores as indicators of the general constructs. Models C and F present the primary comparison of interest in the present study.

### Results

The descriptive statistics of both scoring approaches are presented in Table 1. The model-data fit statistics of IRT-based scores showed satisfactory score quality of 52% ( $n = 11$ ) of the facets. Similarly, although only 52% ( $n = 11$ ) of the CTT-scored facets demonstrated internal consistency exceeding  $\alpha = .70$ , all five constructs exhibited reliability coefficients above this threshold, indicating overall consistency on a broader scale. The overall data quality using both scoring approaches was deemed acceptable.

**Table 1**

*Descriptive Statistics and Model-Data Fit of Measurement Models by Scoring Approach.*

	GRM					CTT			
	<i>M</i>	<i>SD</i>	TLI	SRMR	RMSEA	<i>M</i>	<i>SD</i>	<i>Skew</i>	$\alpha$
<b>FFM</b>									
<b>Conscientiousness</b>	-.00	0.95	.579	.089	.111	3.16	0.40	-0.65	.86
Self-efficacy	-.00	0.89	.956	.019	.095	3.36	0.54	-0.99	.80
Orderliness	-.00	0.91	.963	.020	.095	3.05	0.78	-0.87	.81
Dutifulness	.00	0.80	.786	.040	.174	3.66	0.44	-1.71	.67
Achievement	.00	0.84	.779	.037	.137	3.22	0.55	-0.52	.63
Self-discipline	.00	0.87	.765	.046	.187	3.11	0.61	-0.63	.73
Cautiousness	.00	0.85	.759	.047	.141	2.57	0.62	-0.11	.60
<b>Comprehensive</b>									
<b>Conscientiousness</b>	-.00	0.86	.754	.057	.080	2.57	0.31	-1.07	.73
R_Irresponsibility	.00	0.64	.998	.014	.009	2.88	0.24	-2.29	.46
R_Impulsivity	.00	0.83	.986	.016	.029	2.31	0.47	-0.51	.58
R_Distractibility	-.00	0.81	1.01	.009	.000	2.53	0.49	-1.18	.68
<b>Neuroticism</b>	-.00	0.93	.800	.059	.077	1.05	0.48	0.57	.80
Anxiety	.00	0.90	.959	.020	.090	1.02	0.72	0.84	.79
Self-conscious	-.00	0.84	1.00	.014	.000	1.16	0.70	0.39	.51
Immoderation	-.00	0.82	.963	.020	.045	1.25	0.63	0.36	.52
Vulnerability	-.00	0.82	1.02	.005	.000	0.77	0.53	0.67	.56
<b>Extraversion</b>	-.00	0.92	.530	.092	.128	2.52	0.49	-0.39	.81
Gregariousness	-.00	0.86	.984	.014	.044	2.65	0.74	-0.47	.72
Assertive	.00	0.90	.991	.015	.039	2.64	0.61	-0.27	.72
Activity	.00	0.88	.975	.019	.042	2.35	0.64	-0.21	.56
Excitement	-.00	0.92	.916	.030	.129	2.45	0.78	-0.08	.78
<b>SWB</b>	-.00	0.95	.656	.085	.137	3.21	0.49	-0.88	.88
R_Anger	-.00	0.90	1.01	.003	.000	3.12	0.67	-0.81	.73
R_Depression	-.00	0.90	.997	.013	.030	3.40	0.62	-1.36	.81
Friendliness	-.00	0.86	.875	.033	.130	3.17	0.64	-0.84	.73
Cheerfulness	.00	0.89	.948	.022	.099	3.14	0.59	-0.82	.78

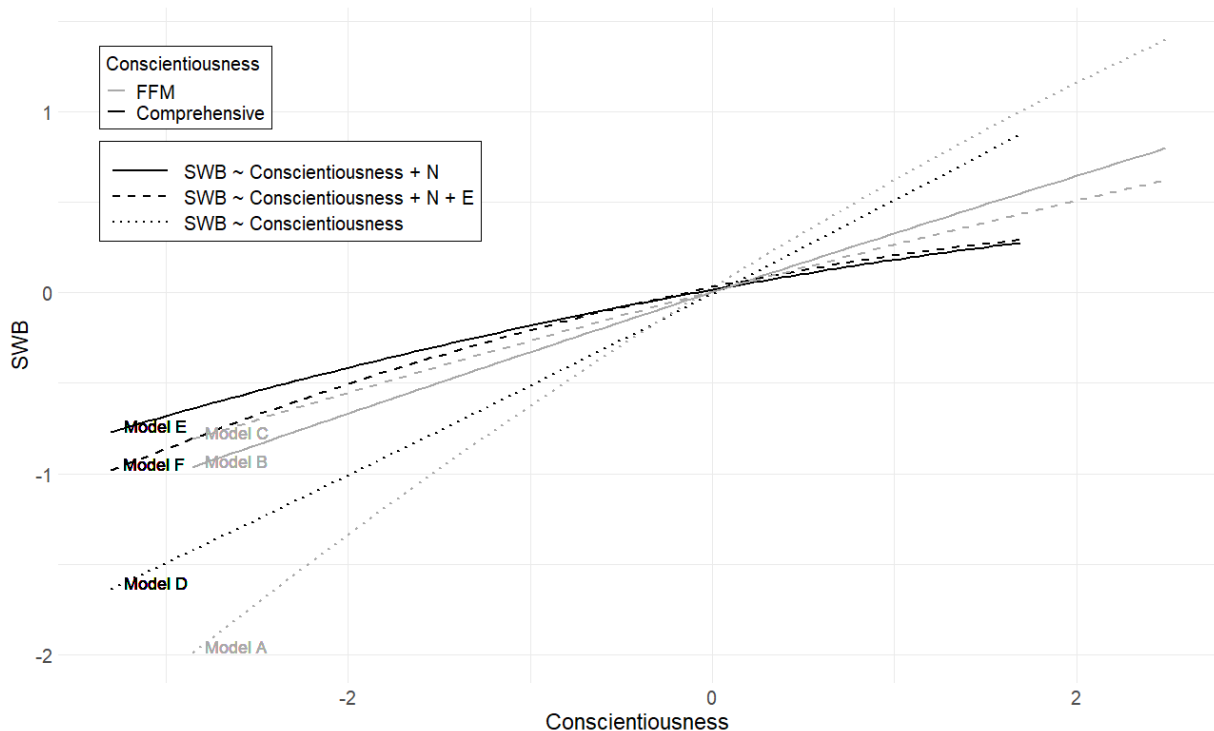
*Note.* R\_ = reversed facets. SWB = subjective well-being.

### Objective (a): Assessment of Curvilinear Fit

To assess the fit of a curvilinear model over a linear model in the conscientiousness–SWB relationship, SEM analyses were conducted using a nested model comparison approach. Figure 4 displays the six GRM-scored models examining the curvilinear relationship between conscientiousness and SWB. While neither instrument produced a visually prominent inflection point in the relationship between the two principal variables, a noticeable curvilinear trend is present in Model E and F. Notably, both models include the employment of the more comprehensive instrument. However, this is not substantiated by the findings of GRM-scored data presented in Table 2, which revealed a generally poorer fit for curvilinear models compared to linear models across the spectrum, from the simplest (Model A) to the most complex (Model F). The sole exception was Model C, where adding the curvilinear term to the linear model produced a marginal improvement in fit ( $\Delta\text{RMSEA} = -.006$ ). Visually, Model C does not present a curvilinear trend. Despite exhibiting the highest explained variance ( $R^2 = 0.672$ ), the curvilinear model in Model C did not demonstrate a statistically significant improvement from the linear model ( $\Delta R^2 = .004, p > 0.05$ ).

**Figure 4**

*Curvilinear Fit of Standardized GRM-scored Models Relating Conscientiousness and SWB.*



*Note.* GRM = Graded response model; SWB = subjective well-being; FFM = five-factor model; FFM Conscientiousness = IPIP-120; Comprehensive conscientiousness = PID-5; N = neuroticism; E = extraversion.

**Table 2**

*Model-Data Fit Analyses for the Linear and Curvilinear Structural Equation Models Relating GRM-scored Conscientiousness and SWB.*

Model	Conscientiousness			$\chi^2$	<i>df</i>	TLI	SRMR	RMSEA	$\Delta$ RMSEA	$\gamma_L$	$\gamma_C$	$\gamma_N$	$\gamma_E$	$R^2$	$\Delta R^2$
<b>A</b>	FFM	None	Linear	156	34	.919	.047	.082		<b>.75</b>				.424	
			Curvilinear	702	101	.743	.086	.105	.023	<b>.73</b>	<b>-.11</b>				.433
<b>B</b>	N		Linear	463	74	.851	.059	.099		<b>.18</b>		<b>-.76</b>		.601	
			Curvilinear	1040	164	.747	.081	.099	.000	<b>.18</b>	-.05	<b>-.75</b>			.604
<b>C</b>	N+E		Linear	874	129	.790	.074	.103		<b>.14</b>		<b>-.42</b>	<b>.52</b>	.669	
			Curvilinear	1477	242	.718	.083	.097	-.006	<b>.13</b>	-.06	<b>-.41</b>	<b>.52</b>		.672
<b>D</b>	Comprehensive	None	Linear	71.1	13	.913	.044	.091		<b>.69</b>				.310	
			Curvilinear	429	32	.725	.120	.151	.060	.03	<b>-.29</b>				.316
<b>E</b>	N		Linear	278	41	.857	.056	.103		.05		<b>-.86</b>		.545	
			Curvilinear	710	71	.742	.123	.129	.026	.08	-.05	<b>-.85</b>			.546
<b>F</b>	N+E		Linear	662	84	.744	.076	.113		<b>.16</b>		<b>-.39</b>	<b>.55</b>	.649	
			Curvilinear	1112	125	.709	.115	.121	.008	.06	<b>-.08</b>	<b>-.47</b>	<b>.54</b>		.650

*Note.* GRM = Graded response model; SWB = subjective well-being; FFM = five-factor model; None = no controls, N = controlling for neuroticism, N+E = controlling for neuroticism and extraversion. The SEM path coefficients for the linear ( $\gamma_L$ ) and the curvilinear ( $\gamma_C$ ) estimates between conscientiousness and SWB, as well as the path coefficients for the relationships of neuroticism ( $\gamma_N$ ) and extraversion ( $\gamma_E$ ) with SWB are standardized. Coefficient values in bold indicate statistical significance at  $p < .05$ . The CTT models G to L are presented in Appendix C.

This pattern mirrored the CTT-scored models (see Appendix C), where Model I, structurally identical to Model C, displayed the highest explained variance through its curvilinear term ( $R^2 = .676$ ). However, similar to Model C, Model I's curvilinearity did not yield a statistically significant improvement in fit compared to the linear model ( $\Delta R^2 = .008$ ,  $p > 0.05$ ). However, in contrast to GRM-scored models, where a curvilinear trend could be more easily visually identified, the CTT-scored models depicted no discernible curvilinear patterns in any of the models (Appendix D). Therefore, the results of the present investigation did not provide statistically significant evidence to favour the curvilinear model over the linear one in explaining the relationship between SWB and conscientiousness.

### **Objective (b): Comparison of Curvilinear Fit by Instrument**

Using a measure of comprehensive conscientiousness over FFM conscientiousness resulted in a decreased amount of variance accounted for in SWB overall, indicating an inferior capability to predict SWB scores compared to the FFM conscientiousness instrument. More often than not, the model-data fit indices weakened when using a more comprehensive measurement of conscientiousness for both linear and curvilinear model estimates. Across instruments, absolute fit indices indicated improvement for the curvilinear model only in Model C ( $\Delta RMSEA = -.006$ ), which notably utilized a more constrained instrument to measure conscientiousness. In direct comparison to Model C, Model F exhibited a weaker performance of the curvilinear model relative to the linear model ( $\Delta RMSEA = .008$ ). The results of the present investigation did not provide evidence to indicate a role of instrument sensitivity in obfuscating the results regarding the detection of curvilinearity in the conscientiousness–SWB relationship.

Nevertheless, evaluation of the linear and curvilinear SEM path coefficients between the FFM and comprehensive conscientiousness instruments depicted the significance of the curvilinear path over the linear one in the models of comprehensive conscientiousness exclusively. While it might be expected that a comprehensive instrument might be better suited to detect subtle changes in the shape of the relationship, this could also reflect the limitation of the constrained measure in failing to capture conscientiousness levels relevant to the inflection point. Comparing the principal models, Model F (comprehensive conscientiousness) demonstrated the significance of the curvilinear term over the linear one when the curvilinear term was added to the model ( $\gamma_L = .06$ ,  $p > .05$ ;  $\gamma_C = -.08$ ,  $p < .05$ ), while Model C (FFM conscientiousness) retained the significance of the linear term in both cases ( $\gamma_L = .13$ ,  $p < .05$ ;  $\gamma_C = -.06$ ;  $p < .05$ ). See Appendix E for the GRM-scored structural

equation models of Model C and Model F with path coefficients. Moreover, this pattern is discernible in both GRM- and CTT-scored data. Accordingly, although this study did not find evidence to support the idea that a more comprehensive instrument is necessarily better at detecting a curved relationship between conscientiousness and SWB, there may still be advantages to using one.

### Discussion

The current study investigated the significance of instrument sensitivity to the extreme high end of conscientiousness in detecting curvilinearity between conscientiousness and SWB. The findings suggested that employing a more comprehensive measure of conscientiousness over the conventional FFM instrument did not yield a statistically significant improvement in the fit of the curvilinear model compared to the linear model. This suggests that, regardless of instrument sensitivity, a simpler linear model may be sufficient to capture the relationship between conscientiousness and SWB. However, a trend emerged across both CTT and GRM scoring approaches: the curvilinear estimate, relative to the linear estimate, demonstrated significance when employing the comprehensive conscientiousness measure exclusively. This suggests that the lack of a significant curvilinear effect with the conventional FFM measure might be attributable to its limitations in effectively capturing the higher ranges of conscientiousness. This is in alignment with the theoretical underpinnings of the extended circumplex conception of personality (Carter et al., 2018), which calls for the validation of a broader personality space in both theory and practice, as well as the evidence supporting maladaptivity at both poles of the personality traits (Widiger & Crego, 2019). Nevertheless, the current findings did not find support for the notion that a scale's differential capacity to capture a broader range of the conscientiousness spectrum might contribute to the inconsistencies observed in prior research regarding curvilinearity between conscientiousness and SWB.

Addressing objective (a) of the present study, the variance explained in SWB did not differ significantly between the linear and curvilinear models, which suggests that the curvilinear model might not offer a substantial advantage in predicting SWB compared to a simpler model. Indeed, visual inspection of the relationship between the principal variables across six GRM-scored models did not reveal a prominent downward turn in the relationship (Figure 4). While Model E and F presented a subtle curve in the conscientiousness–SWB relationship visually, this did not translate to a significant change from the linear model. Similarly, although Model C demonstrated an improvement in model fit of the curvilinear



model over the linear model, the improvement was not prominent enough to substantiate the superiority of the curvilinear model. Overall, the findings across different models agree that a parsimonious linear model may adequately capture the relationship between conscientiousness and SWB. This aligns with previous research (Nickel et al., 2019), suggesting a potentially subtle inflection point in the conscientiousness–SWB relationship that does not translate to a significant improvement in the explained variance of the outcome variable. Accordingly, the present study did not find ample evidence to support a curvilinear relationship between conscientiousness and SWB, nor did it lend significant support to the TMGT effect as applicable to conscientiousness.

However, in addressing objective (b), the study revealed a potential influence of instrument sensitivity in detecting significant curvilinearity between conscientiousness and SWB. This is evident from the path coefficient comparisons between Models C and F, which shared the same model structure but utilized different conscientiousness scales. Between the two primary models, only Model F presented a significant curvilinear path estimate, and the subsequent loss of significance for the linear path estimate upon inclusion of the curvilinear term. This suggests that the instrument capable of capturing broader conscientiousness levels was more adept in identifying a curve in the conscientiousness–SWB relationship. This could reflect a simple characteristic of a more comprehensive instrument, which would be able to capture more subtle shifts in the pattern the relationship. However, an alternative explanation lies in the potential limitations of the more constrained conventional measure, which might lack sensitivity to conscientiousness levels relevant at the inflection point, leading to a missed transition and a seemingly linear relationship. Given the different scales used in prior research that depicted contradictory findings regarding inflection points in the primary relationship (e.g., Carter et al., 2016; Nickel et al., 2019), employment of a scale that is more sensitive to a broader conscientiousness spectrum may partially explain the presence of discrepancies in those findings. Yet, while the instruments differed in their ability to detect a significant curvilinear effect, this study found no compelling evidence for a curvilinear relationship between conscientiousness and SWB compared to a simpler linear model, regardless of instrument sensitivity. Nonetheless, although the inconsistencies observed in prior research may not be simply attributable to limitations in conventional FFM personality scales, there is merit in acknowledging the informational value of a measure with a broader spectrum of personality captured.

Furthermore, the findings demonstrated the benefits of employing psychometrically appropriate scoring methods that suit the investigation of non-linear patterns in self-report data as well as accounting for necessary control variables to isolate the impact of conscientiousness across all levels on SWB. While exploring the influence of these methodological considerations was not the primary focus of this study, it served to solidify the foundation of the statistical methods used. This strengthened approach improved on the limitations identified in previous research and led to a more accurate examination of the core relationship between the main variables. First, using the comprehensive conscientiousness measure led to the nullification of the significance of the linear estimate upon adding the curvilinear estimate into the model in GRM scoring exclusively. This aligns with previous research findings stating that IRT scoring approaches might be more refined in detecting non-linear relationships in self-report data (Carter et al., 2014, 2016). Second, controlling for both neuroticism and extraversion in Model F (comprehensive conscientiousness), as well as in Model L (the structurally identical CTT model), did not eliminate the significant curvilinear effect of conscientiousness on SWB. However, when controlling for neuroticism only, the curvilinear estimate of conscientiousness in Model B (FFM conscientiousness) and Model E (comprehensive conscientiousness) did *not* show a significant impact, instead highlighting the considerable negative influence of neuroticism on SWB over conscientiousness. In contrast, the investigation of the misattribution hypothesis in Appendix B demonstrated the lack of a connection or even the direct opposition between high conscientiousness and neuroticism, which does not support the notion of construct drift. Therefore, although neuroticism alone might indeed have a greater negative impact on SWB than extremely high conscientiousness, the findings do not indicate that the inflection point in the conscientiousness–SWB association, although tenuous, would be significantly oversaturated by neuroticism.

### **Limitations**

In exploring and evaluating the limitations that the present study faced, four specific recommendations for future research can be derived. The first two limitations regard the sample and the sampling technique in general, whereas the last two address the constraints of the instruments in preventing an appropriate measurement of the key variables. As for the sample overall, the present study relied on a pre-existing dataset of a motivated online convenience sample of Swedish-speaking individuals, which may not represent the patterns between personality and well-being among a more general population. A sample consisting of participants with more diverse backgrounds may increase the informational value of the

conducted research by enhancing the ability to capture the generally prevailing conscientiousness–SWB relationship. Additionally, the number of participants that scored high on the comprehensive conscientiousness measure was limited, potentially resulting in restricted power to detect a curvilinear effect, if there was one. As the findings between the SWB estimate and comprehensive conscientiousness suggested a significant fit of the curvilinear estimate over the linear estimate, yet no notable change in the variance accounted for, there may indeed be a pattern at play that the given study was unable to adequately discern. Employing a purposive sampling technique to achieve a flat distribution of conscientiousness scores (e.g., see Samuel et al., 2023), thereby increasing the relative representation of individuals with extreme scores, could be pivotal in overcoming this limitation. Overall, employing a purposive sampling technique that ensures the inclusion of individuals with different backgrounds as well as the adequate representation of individuals across all levels of conscientiousness, especially those with exceptionally high scores, could present an instrumental opportunity in the advancement of understanding trait conscientiousness and its place within the maladaptive personality structure.

Regarding instrumentation, the potential constraints as well as strengths of the employed scales are discussed. The present study utilized the conceptualization of extremely high conscientiousness as the high polar end of the reversed PID-5 disinhibition domain. While the compulsivity domain was intentionally excluded from the diagnostic manual because its content was deemed to be adequately covered within the lower end of the disinhibition domain (APA, 2013), certain elements may have been overlooked in this reversal. Therefore, employing an assessment according to a model such as the anankastia domain of the ICD-11, given the strong conceptual and empirical alignment with high conscientiousness (Mulder et al., 2016), may offer greater insight into capturing all necessary nuances of the construct. What is more, utilizing a single measure that encompasses both the conventional FFM and extremely high conscientiousness, such as the FFOCI or Five Factor Form (FFF; Rojas & Widiger, 2014), should prove to be the most efficient in tracking the association between conscientiousness and SWB across all levels. Additionally, while meta-analytic studies have demonstrated a significant association between SWB and personality, especially with neuroticism and extraversion (e.g., Anglim et al., 2020), the use of a concrete and validated SWB instrument that captures the many different aspects of the construct may prove to be a useful endeavour over and above that of deriving it from two personality traits. Nevertheless, it is essential to acknowledge the stability of SWB over time, hypothesized to

be largely due to the stability and heritability of personality traits (Lucas, 2018), indicating that the use of a specialized SWB instrument may not considerably differ from that derived from personality measurements. Accordingly, in exploring the association between conscientiousness and SWB, employing a unified normative-to-extreme measure of conscientiousness as well as a reliable and validated measure of well-being may prove beneficial to capturing the constructs while lessening their direct overlap.

Furthermore, while not inherently a limitation, the sample size prevented the employment of the GGUM scoring approach, considered optimal for revealing participants' response patterns in self-report data and potentially uncovering previously obscured curvilinearity. Nevertheless, the ideal point scoring approach demonstrates superiority over the GRM solely when the employed scale is constructed in accordance with the ideal point model (Cao et al., 2018). Given that the current study utilized scales developed within the framework of the dominance response model, the use of the dominance IRT approach was likely as appropriate as GGUM would have been, if not more. However, future research would be wise to incorporate the GGUM scoring approach provided that adequate sample size ( $N > 750$ ; Roberts et al., 2002) and appropriate scales – comprehensive and in accordance with the ideal point model – are available.

### **Future Directions**

Future research would benefit from a more in-depth analysis of the potential limited conceptualization of the currently common personality taxonomies. While several extensive studies have been conducted in support of the bipolarity of adaptive and maladaptive personality structure (e.g., Carter et al., 2018; Samuel et al., 2023; Widiger & Crego, 2019) and a handful of comprehensive measures have been developed as a result (e.g., FFF; FFOCI; Too Little Too Much, Vergauwe & De Fruyt, 2017), the overarching conceptualization of maladaptive personality is still understood simply as the opposite of healthy and adaptive personality (e.g., APA, 2013). As it is generally more beneficial to be more persistent, orderly, and disciplined than fickle, disorderly, and undisciplined, it is unsurprising that most existing measures of conscientiousness, and other FFM traits, are largely unipolar regarding maladaptivity (Widiger & Crego, 2019). Yet, beyond the several lexical studies that connect the normative traits to their high maladaptive forms (e.g., Coker et al., 2002), there are numerous empirical investigations that evidence the loading of normative adaptive traits and their high maladaptive variants onto the same factor (e.g., conscientiousness and workaholism; Markon et al., 2005). This suggests that there is a range of personality that the

existing measures and models of (maladaptive) personality are not explicitly and consistently covering, necessitating both theory and practice to extend the trait dimension continua and investigate the high end of the trait levels as well as their consequences. In addition, developing such an extensive instrument in accordance with the ideal point model would facilitate a more inclusive assessment of personality and enable quality exploration of non-linear patterns in its relationship with outcome variables.

### **Conclusion**

The present study extended prior research on the exploration of curvilinearity in the relationship between conscientiousness and well-being by assessing the impact of instruments with different extents of conscientiousness levels captured. Overall, the study did not find compelling evidence for a curvilinear relationship between conscientiousness and SWB, regardless of instrument sensitivity. Although only the more comprehensive conscientiousness instrument depicted significant superiority of the curvilinear path over the linear path, it did not substantially improve explained variance of the outcome variable. This suggests that the parsimonious conventional personality instrument may suffice to adequately assess the relationship between conscientiousness and well-being. Nonetheless, future research efforts stand to benefit from incorporating personality measures that capture a broader spectrum of traits, enabling the exploration of personality extremes and their role in maladaptive personality structure.

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**Appendix A**

*Items Included in the Well-being Estimate of the Present Study and Their Correspondence to Classic SWB Scales.*

<b>Facet</b>	<b>BBC</b>	<b>PANAS</b>
<b>N2: Anger</b>		
I get angry easily*	–	Hostile
I get irritated easily*	–	Irritable
I lose my temper*	–	Hostile
I am not easily annoyed	–	Irritable*
<b>N3: Depression</b>		
I often feel down*	Do you feel able to enjoy life?	Upset
I dislike myself*	Do you feel happy with yourself as a person?	Ashamed
I am often depressed*	Do you feel depressed or anxious?	Upset, Distressed
I feel comfortable with myself	Are you confident in your own opinions and beliefs? Are you happy with your looks and appearance?	Ashamed*
<b>E1: Friendliness</b>		
I make friends easily	Are you happy with your personal and family life?	Enthusiastic
I feel comfortable around people	Are you comfortable about way you relate connect with others?	Interested, Inspired
I avoid contact with others*	Are you comfortable about way you relate connect with others?	Enthusiastic*
I keep others at a distance*	Are you comfortable about way you relate connect with others?	Interested*, Excited*
<b>E6: Cheerfulness</b>		
I radiate joy	–	Excited, Inspired
I have a lot of fun	Do you feel able to enjoy life?	Excited, Active
I love life	Do you feel able to enjoy life?	Excited, Inspired
I look at the bright side of life	Do you feel optimistic about the future?	Inspired, Enthusiastic

*Note.* SWB = subjective well-being; \* = reversed items. BBC = BBC Subjective Well-being Scale (Kinderman et al., 2011); PANAS = Positive and Negative Affect Schedule (Watson et al., 1988).

## Appendix B

As the misattribution hypothesis has been proposed as a potential confounding factor in the conscientiousness–SWB relationship (Nickel et al., 2019), it was essential to further assess the impact of this notion to strengthen the investigation of the primary relationship in the present study. The additional investigation involved the use of the regression discontinuity design (RDD; Thistlewaite & Campbell, 1960), which involves splitting the data at a distinct threshold in the independent variable in order to compare the outcomes between those above and below. The objective was to explore whether the relationship between conscientiousness and neuroticism differs above and below the threshold, revealing if the two become more intertwined at higher levels of conscientiousness.

In the present analysis, RDD was utilized to examine the association between conscientiousness and neuroticism at low and high levels of both conventional FFM and comprehensive conscientiousness. This aimed to detect whether extreme high levels of conscientiousness, compared to lower levels, exhibit a stronger co-occurrence with neuroticism, potentially suggesting a blurring of the personality traits at the high end of the conscientiousness spectrum. The thresholds for defining low and high conscientiousness groups were determined as the range of scores below the mean of either FFM or comprehensive conscientiousness for the low group and the range of scores above the mean of FFM and comprehensive conscientiousness for the high group. This categorization resulted in four distinct groups: low FFM conscientiousness, high FFM conscientiousness, low comprehensive conscientiousness, and high comprehensive conscientiousness. Through the analysis of correlation coefficients between conscientiousness and neuroticism across these categories, differences in the neuroticism saturation at varying levels of conscientiousness were examined, elucidating whether neurotic traits could indeed be misattributed as high conscientiousness. While not the central focus of this study, an analysis exploring the correlations between neuroticism and SWB across conscientiousness levels was conducted to validate the isolated effect of conscientiousness on well-being.

Application of RDD to the assessment of the relationship between conscientiousness and neuroticism depicted a stronger negative correlation between FFM conscientiousness and SWB in a low conscientiousness group ( $r = -.37, p < .001$ ) than in a high conscientiousness group ( $r = -.30, p < .001$ ). This suggests the association between conscientiousness and neuroticism *lessened* in the group that scored high on FFM conscientiousness. Moreover, an independent samples t-test found the lower neuroticism level in the high FFM



conscientiousness group to differ significantly from the higher neuroticism level in the low FFM conscientiousness group,  $t(458.28) = -11.81, p < .001$ . That is, individuals scoring higher on FFM conscientiousness scored significantly lower on neuroticism than those who scored low on FFM conscientiousness. In addition, higher levels of conscientiousness appeared to be less associated with neuroticism overall. However, this effect was reversed when assessing the comprehensive conscientiousness instrument scores – the association between conscientiousness and neuroticism was steeper in the group that scored high on the comprehensive conscientiousness measure ( $r = -.35, p < .001$ ) compared to the low group ( $r = -.32, p < .001$ ). Similarly, an independent samples t-test found the lower neuroticism level in the high comprehensive conscientiousness group to differ significantly from the higher neuroticism level in the low comprehensive conscientiousness group,  $t(401.06) = -10.44, p < .001$ . While these analyses were conducted with standardized CTT data, these patterns were similar for GRM-scored data. Therefore, while increasing conscientiousness to moderately high levels resulted in a decreased association with neuroticism entirely, increasing conscientiousness beyond that demonstrated an increase in the strength of the association that opposed neuroticism.

Therefore, the consistent negative correlations between conscientiousness and neuroticism across several conscientiousness levels refuted construct drift. While the discriminant validity between neuroticism and FFM conscientiousness was enhanced in the high-scoring group, implying a reduced relation between the two traits, the negative correlation strengthened in the high-scoring comprehensive conscientiousness group. While this by itself does not imply a weaker discriminant validity between the two traits, the amplified inverse relationship between neuroticism and comprehensive conscientiousness underscores the opposite and independent domains that these traits represent. This pattern suggests that, while high FFM conscientiousness presents a lack of a connection to neuroticism, the high end of comprehensive conscientiousness exhibits a direct opposition to it, thereby presenting no evidence for a potential synergistic combination of conscientiousness–neuroticism producing the proposed TMGT effect. It appears that there remains a discernible pure aspect to extremely high conscientiousness that may surpass an optimal threshold.

## Appendix C

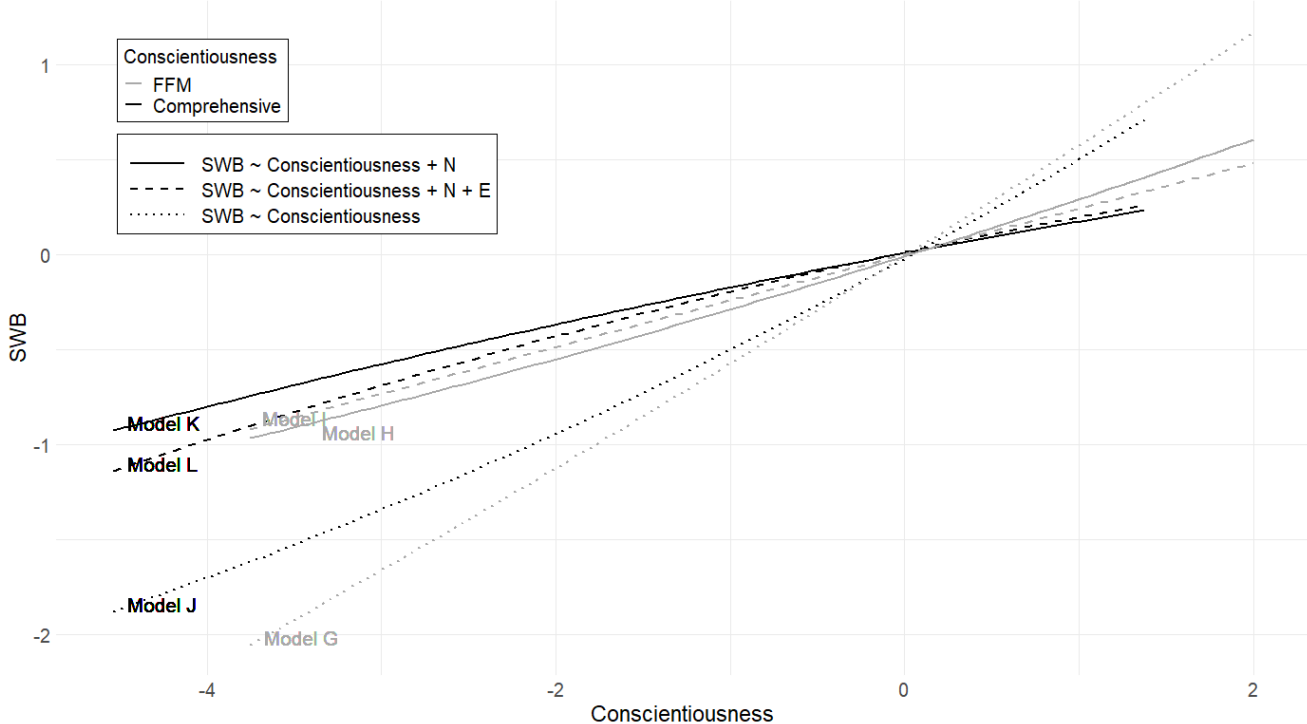
*Model-Data Fit Analyses for the Linear and Curvilinear Structural Equation Models Relating CTT-scored Conscientiousness and SWB.*

Model	Conscientiousness			$\chi^2$	<i>df</i>	TLI	SRMR	RMSEA	$\Delta$ RMSEA	$\gamma_L$	$\gamma_C$	$\gamma_N$	$\gamma_E$	$R^2$	$\Delta R^2$
<b>G</b>	FFM	None	Linear	183	34	.894	.053	.090		<b>.76</b>				.427	
			Curvilinear	10017	101	.202	.426	.426	.336	<b>.32</b>	<b>.38</b>				.436
<b>H</b>	N		Linear	506	74	.820	.066	.104		<b>.33</b>		<b>-.60</b>		.589	
			Curvilinear	10389	164	.253	.118	.339	.235	<b>.13</b>	<b>.17</b>	<b>-.63</b>			.597
<b>I</b>	N+E		Linear	947	129	.755	.082	.108		<b>.16</b>		<b>-.29</b>	<b>.64</b>	.668	
			Curvilinear	10864	242	.282	.116	.285	.177	<b>.05</b>	<b>.09</b>	<b>-.31</b>	<b>.64</b>		.676
<b>J</b>	Comprehensive	None	Linear	80.6	13	.899	.049	.098		<b>.67</b>				.309	
			Curvilinear	621	32	.620	.128	.185	.087	.04	<b>-.32</b>				.313
<b>K</b>	N		Linear	318	41	.824	.064	.112		<b>.15</b>		<b>-.73</b>		.515	
			Curvilinear	922	71	.660	.125	.149	.037	<b>.13</b>	-.07	<b>-.77</b>			.515
<b>L</b>	N+E		Linear	699	84	.750	.082	.116		<b>.18</b>		<b>-.25</b>	<b>.69</b>	.647	
			Curvilinear	1324	125	.649	.117	.133	.017	.05	<b>-.09</b>	<b>-.35</b>	<b>.67</b>		.647

*Note.* CTT = Classical test theory; SWB = subjective well-being; None = no controls, N = controlling for neuroticism, N+E = controlling for neuroticism and extraversion. The SEM path coefficients for the linear ( $\gamma_L$ ) and the curvilinear ( $\gamma_C$ ) estimates between conscientiousness and SWB, as well as the path coefficients for the relationships of neuroticism ( $\gamma_N$ ) and extraversion ( $\gamma_E$ ) with SWB are standardized. Coefficient values in bold indicate statistical significance at  $p < .05$ .

Appendix D

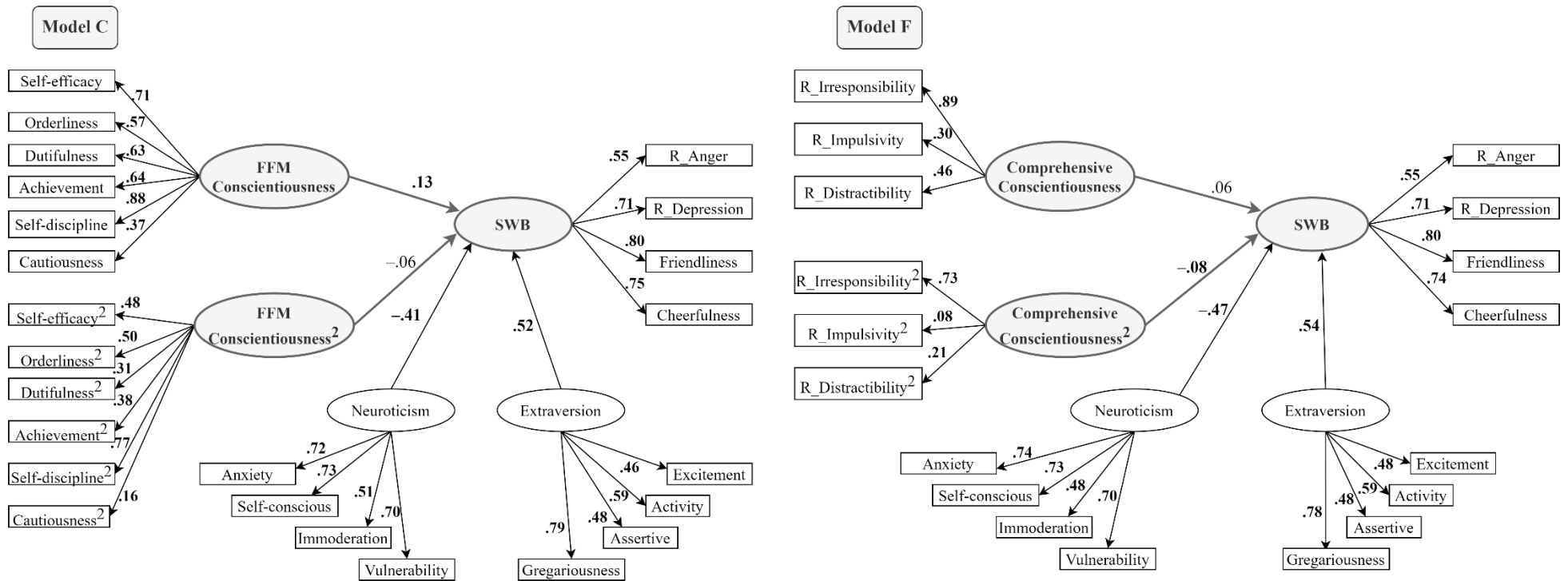
Curvilinear Fit of Standardized CTT-scored Models Relating Conscientiousness and SWB.



Note. CTT = Classical test theory; SWB = subjective well-being; FFM = five-factor model; FFM Conscientiousness = IPIP-120; Comprehensive conscientiousness = PID-5; N = neuroticism; E = extraversion.

**Appendix E**

*Path Coefficients of the Structural Equation Models Relating Conscientiousness – FFM (Model C) and Comprehensive (Model F) – and SWB.*



*Note.* FFM = five-factor model; SWB = subjective well-being; R\_ = reversed facets; ...<sup>2</sup> = squared term (non-linear). The linear and curvilinear models were estimated using facet-level scores as indicators of the general constructs. Models C and F present the primary comparison of interest in the present study. Coefficient values in bold indicate statistical significance at  $p < .05$ .