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"What's next?" Individual differences in expected repercussions of the COVID-19 pandemic

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ABSTRACT

The effects of the COVID-19 pandemic on the future are hardly predictable, and people differ in terms of expected repercussions on their future. This study investigated individual differences in the pandemic's expected repercussions, with particular attention to a Balanced Time Perspective (BTP). BTP reflects an individual profile with optimal temporal orientations, it is positively associated with mental health, and it has proven to promote successful coping with unexpected crises. We analyzed data from 3991 adults from 18 to 85 years old participating in an online survey conducted during the Italian lockdown. Participants provided information on BTP, affective states, financial resources, and expectations for the future. Multi-group path analysis was used to test the hypothesized model and to explore gender differences. Results showed that people with a more BTP had fewer negative beliefs about COVID-19's consequences on their future life. BTP affected expected repercussions also indirectly, via affects and beliefs. Finally, gender emerged as a significant moderator of some of the relationships highlighted. The present study contributes to the understanding of the psychological reactions to the current health emergency by confirming its impact on several life domains besides health, not only in the present but also in the anticipated future.

1. Introduction

COVID-19 pandemic hit everybody's daily routine. In a sudden shift, people's habits had been changed, from workplace to school, from family interactions to leisure activities. Remarkably, the pandemic affects both the present and the future: changes have been so pervasive that they will not end with the health crisis. People are undoubtedly aware of the long-lasting effects of the COVID-19 emergency, yet they likely differ in their beliefs about the pandemic's backlashes. The current health emergency has changed people's views of the future, questioning the common assumption on a predictable, reliable future, and increasing the feeling of uncertainty. This may lead to severe mental health consequences, such as increased anxiety, stress, and depression (Holman & Grisham, 2020). And indeed, there is now large evidence that COVID-19 is negatively impacting on people's mental health across the world (Cannito et al., 2020; Di Crosta et al., 2020; Fontanesi et al., 2020; Torales, O'Higgins, Castaldelli-Maia, & Ventriglio, 2020). While a growing body of research focused on people attitudes and beliefs about the pandemic in the here and now (Abdelhafiz et al., 2020; Geldsetzer, 2020), there are sparse studies examining people's expectations for the future, and how much individuals anticipate harsh times due to COVID-19. In the economic field, evidence suggested people are expecting difficulties in household, national and global finance (Barrafrem, Västfjäll, & Tinghög, 2020). Another study showed that pessimism in the forecast was not adequately explained by either socio-demographic (e.g., education, political position), or psychological (e.g., science knowledge, rationalism) variables (Kirkegaard, Taji, & Gerritsen, 2020). These exploratory findings are intriguing and encourage further examination of people's future expectations about COVID-19 consequences.

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1.1. Balanced time perspective

As the current emergency is objectively unpredictable, in building expectations for the future people can only partly rely on their experience or knowledge. Rather, individuals are likely to refer to more general views of themselves and their life (Trzebiński, Cabański, & Czarnecka, 2020). Hence, a potential predictor of expected repercussions is Time Perspective (TP). TP refers to "the totality of the individual's views of his psychological future and psychological past" (Lewin, 1951, p. 75), and it help to build a coherent identity and sense of life (Zimbardo & Boyd, 2008). TP can be considered as a personality trait, relatively stable (Stolarski, Wiberg, & Osin, 2015), and with profound consequences for human functioning, impacting on actions, judgments, and emotions (Stolarski, Fieulaine, & Zimbardo, 2018). Zimbardo and Boyd (1999) identified five temporal frames: past-positive, past-negative, present-hedonistic, present-fatalistic, and future (see Stolarski, Fieulaine, & van Beek, 2015 for a comprehensive review), recently integrated with a sixth temporal dimension, negative future (Carelli, Wiberg, & Wiberg, 2011; Rönnlund, Åström, & Carelli, 2017). Importantly, TP is intrinsically multidimensional, and time-frames should be considered in their mutual interaction, and not as separate dimensions. Zimbardo and Boyd claimed for a balanced TP, that is the most adaptive profile, associated with better outcomes (Zimbardo & Boyd, 1999), and formulated a hypothetical description of a such optimal mix of time perspectives (Zimbardo & Boyd, 2008). Following these suggestions, Stolarski, Bitner, and Zimbardo (2011) introduced the concept of Deviation from a Balanced Time Perspective (DBTP). DBTP is computed as the difference between individual's TP scores and the optimal points identified by Zimbardo and colleagues. This measure indicates how ill-balanced the individual's time perspective is, and has proven to be effective in explaining individual differences in well-being and mental health, as well as in social relationships, self-regulation, and sleep quality (Stolarski et al., 2015; Stolarski, Zajenkowski, Jankowski, & Szymaniak, 2020; Zhang, Howell, & Stolarski, 2013). A recent revision of the DBTP score also integrated the negative-future perspective, hence creating a score that summarized individuals' unbalance on the six temporal dimensions (Rönnlund et al., 2017).

1.2. Psychological and socio-demographic factors

Other variables are likely to play a role in shaping beliefs about the repercussions of the pandemic. On one side, emotions and moods influence how people view the world, impacting on peoples' beliefs, attitudes, and behaviors (Ashby, Isen, & Turken, 1999; Ceccato, Lecce, & Cavallini, 2020; Fairfield, Mammarella, & Di Domenico, 2013; Fairfield, Mammarella, Palumbo, & Di Domenico, 2015; Kim, Lim, & Bhargava, 1998; Palumbo, D'Ascenzo, Quercia, & Tommasi, 2017). Concerning beliefs about the future, negative emotions have been found to predict more negative future events, and the opposite was true for positive emotions (Angie, Connelly, Waples, & Kligyte, 2011). Also, experimental manipulation of affective states influenced judgments of future events (Gherasim, Măirean, & Rusu, 2016). On the other side, subjective expectations about the emergency duration likely shape beliefs about backlashes: People who expect the emergency to end in a short time may anticipate less severe consequences in their future, and vice versa. To our knowledge, expectations about the pandemic duration have been studied only in relation to compliance with social distancing rules, with results confirming that individuals' beliefs impact on their behaviors (Briscese, Lacetera, Macis, & Tonin, 2020).

Finally, socio-demographic characteristics may further explain differences in expected repercussions of COVID-19. First, financial resources easily affect how people imagine their future and how much the pandemic will negatively impact their lives. For instance, people who are feeling uncertain about their economic resources are likely to believe that the pandemic will have a ruinous effect on their life. Second, gender needs to be considered, as recent evidence indicated that women show worse response to the COVID-19 pandemic than men, reporting more anxiety, stress, depression, and lower well-being and quality of life (De Coninck, D'Haenens, & Matthijs, 2020; Rossi et al., 2020). More in general, a consistent body of research indicated that women and men differ in their psychological reactions to traumatic events, from terror attacks to natural disasters (Baum, Rahav, & Sharon, 2014).

1.3. Present study

The purpose of this cross-sectional study was to explore individual differences in expected repercussions of the COVID-19 pandemic, elucidating their potential antecedents. First, we wanted to analyze expected repercussions assuming a comprehensive perspective, hence examining several life dimensions. Second, based on the theoretical framework and empirical findings just presented, we specifically focused on TP and its role as a predictor of expected repercussions. Having a Balanced Time Perspective (BTP) has proven to help in successfully coping with an unexpected crisis (such as the pandemic we are now experiencing) and maintaining positive expectations for the future (Fieulaine & Apostolidis, 2015; Tomich & Tolich, 2019). Along with BTP, we also considered variables that are likely to affect perceived backlashes due to COVID-19: affective states, beliefs about pandemic length, financial resources, and gender. All these variables were entered into a single model, depicted in Fig. 1. This model was tested with a path analysis approach.

Based on the literature, we expected a higher DBTP score would lead to worse backlashes expectations (h1). We hypothesized also indirect effects, via affective states and beliefs. Specifically, we expected that people with higher scores on DBTP would experience more negative feelings, and would expect a longer time for the pandemic to resolve, compared with people having a BTP. In turn, high levels of negative affect and worse length predictions would lead to more severe expected repercussions of the pandemic in the future (h2 and h3). We also hypothesized individuals with a BTP to experience more positive feelings, which in turn would act as a buffer against negative expectations for the future (h4). Regarding socio-demographic factors, we hypothesized perceived financial resources to directly contribute to expected repercussions (h5). Affective states are likely related to both pandemic's length predictions and perceived financial resources, but, as a firm direction for these effects cannot be assumed, we added covariance paths in the model. Finally, we considered gender as a potential moderator for these associations, and to test this effect we adopted a multi-group approach and tested separate models for women and men (h6). To be noted, we also entered age as a covariate in the model, as we want to control for its potential effects on the variables investigated.

2. Materials and methods

2.1. Participants

The sample was composed of 3991 Italian adults from 18 to 85 years old ($M = 35.11$, $SD = 13.63$, women = 68.8%), without self-reported psychiatric illnesses or severe mood disorders. Participants were recruited through word-of-mouth and social media (e.g., Facebook, WhatsApp). Participants varied in their educational level: 0.6% elementary school, 6.8% middle school, 42% high school, 39.9% university degree, and 10.7% higher degree. The Ethical Committee of the Department of Psychological, Health and Territorial Sciences at G. d'Annunzio University of Chieti-Pescara (protocol number: 20004) approved the study, and all participants provided their consent to participate.

2.2. Procedure and measures

Data were collected online, between April 1st and April 20th, 2020,

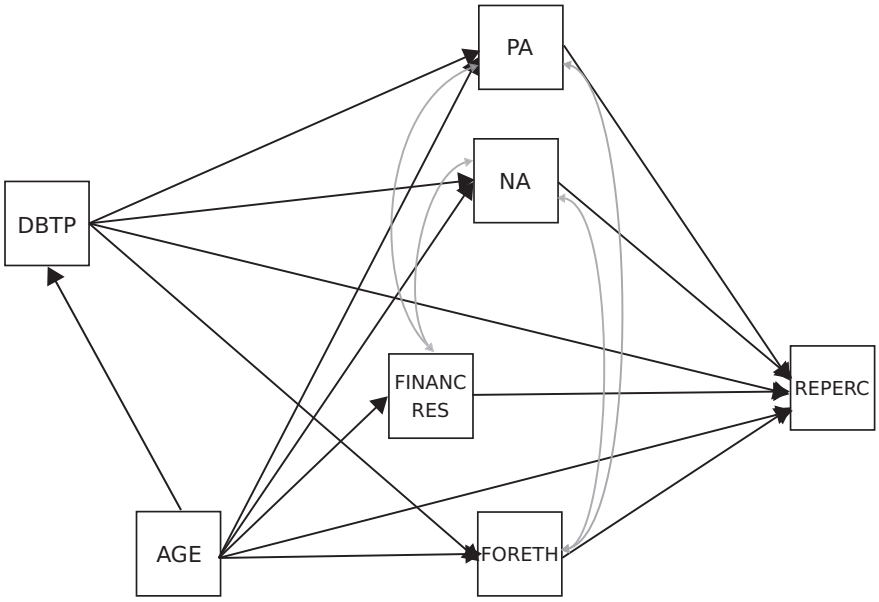

Fig. 1. The hypothesized model explaining the expected repercussions of the COVID-19 emergency.
Note. Black lines are regression paths. Grey lines are covariance paths. DBTP = deviation from balanced temporal perspective; PA = positive affect; NA = negative affect; FINANC RES = perceived financial resources; FORETH = beliefs about pandemic's length; REPERC = expected repercussions of COVID-19 emergency.

with a series of questionnaires implemented in the Qualtrics survey platform. The total survey length was approximately 40 min. The questionnaires dealt with a range of topics related to the COVID-19 emergency, comprising socio-economic and psychological variables. For this study's purposes, we focused on five questionnaires. We also collected information on age, education, and gender.

2.2.1. Expected repercussions of COVID-19

This 4-item questionnaire was specifically created for the COVID-19 pandemic. This scale investigated people's beliefs about the severity of the pandemic's effects on their future, considering four aspects: quality of life, social relationships, traveling, and personal finances. Answers were given on a scale from 0, *not at all*, to 100, *extremely*. We explored the component structure of the questionnaire in a larger Italian sample (n = 4121), using principal component analysis (PCA). The PCA revealed a unidimensional structure, and factor loadings are reported in Table 1. All four items showed satisfactory loadings (i.e., > 0.40; see Howard, 2016), explaining 49% of the variance. The questionnaire also showed satisfactory internal consistency, α = 0.77. We created a total score by averaging the four items, with higher scores reflecting worse expectations for the future.

Table 1
Principal component analysis for the Expected repercussions of COVID-19 questionnaire.

Item	Factor loading
I believe this crisis will negatively affect my quality of life in the future	0.839
I believe this crisis will negatively affect the way I socialize with other people in the future	0.832
I believe this crisis will negatively affect my desire to travel in the future	0.774
I believe this crisis will negatively impact the financial and economic status of my life in the future	0.597

2.2.2. Deviation from balanced time perspective (DBTP)

We administered the Zimbardo Time Perspective Inventory - short form (ZTPI-s), which comprised 18 items, three for each time perspective (Koštpál, Klicperová-Baker, Lukavská, Lukavský, & Klicperova-Baker, 2016). For each time perspective, a total score was computed by averaging the items. DBTP score was computed following Rönnlund and colleagues' formula (Rönnlund et al., 2017):

$$DBTP = \sqrt{(PN - 1.95)^2 + (PP - 4.40)^2 + (PF - 1.50)^2 + (PE - 3.90)^2 + (FP - 4.00)^2 + (FN - 1.80)^2}$$

For each time frame, the optimal score was subtracted to the participant's score. Therefore, DBTP values close to zero indicated an almost perfectly BTP, whereas large values indicated increasing unbalance in TP.

2.2.3. Positive and negative affect schedule - PANAS

The PANAS (Watson, Clark, & Tellegen, 1988) is a widely used questionnaire assessing positive (PA) and negative (NA) affective states. It consists of 20 adjectives describing different feelings (10 for each subscale). We adapted the instructions to analyze feelings during the pandemic, asking participants to indicate how they felt starting from the beginning of the COVID-19 emergency on a 5-point scale (from 1, not at all, to 5, extremely).

2.2.4. Forethought scale

We extracted this scale from the Attitudes toward the COVID-19 questionnaire, described elsewhere (Ceccato et al., 2020). This scale measured people's estimation of the time needed for the pandemic to resolve. It was composed of two items ("In how many months do you

think the situation will improve/be completely resolved?"). Answers ranged from 0 to 36 months. The total score was the average of the two items, so that higher scores reflected longer predictions.

2.2.5. Perceived financial resources

We obtained a subjective measure of people's economic situation by asking participants to indicate how long (in months) they believed they could endure the lockdown situation from a financial perspective. We preferred this measure to annual income information as we were interested in subjective perception more than objective information. Note that perceived financial resources and monthly income were significantly but not strongly correlated, Spearman's rho = 0.27, $p < .001$.

2.3. Analyses plan

We preliminary explored gender differences in the variables under investigation with a series of *t*-tests. Then, we tested the path model depicted in Fig. 1. Note that gender was not considered in this model (Model 1). We adopted a multi-group path analysis approach to examine whether differences in the structural parameters across females and males were statistically significant. To this end, we compared a model in which the regression paths were allowed to vary freely across groups (Model 2), to a nested model in which the paths were constrained to be equal for women and men (Model 3). The fit of the two models was compared using the chi-square difference test. A significant decrement in fit moving from the unconstrained (Model 2) to the constrained (Model 3) model would indicate that the two gender groups' paths are not equal. In this case, every path in the model was constrained to be equal between the two groups one at a time (with all the other paths set free), and each resulting model was compared with the unconstrained model (Model 2) using the chi-square difference test. This procedure allowed us to identify which paths were significantly different across gender groups and should not be constrained to be equal (for a similar approch, see Siedlecki, Falzarano, & Salthouse, 2019).

Mediation analyses were performed using a bias-corrected bootstrapping approach ($n = 10{,}000$) to obtain 99% confidence intervals for the indirect effects.

Given the non-normal distribution of some of our dataset variables, we estimated models using a robust maximum likelihood (MLR) estimation with a mean-adjusted χ^2 test statistic. Therefore, for model comparison, we used the Satorra-Bentler scaled chi-square difference test (Satorra & Bentler, 2001).

The fit indices used to estimate the fit of the models were the χ^2 statistic, comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). We used the following suggested cut-offs to evaluate our models' suitability: a relative chi-square (i.e., χ^2/df) lower than 3, CFI > 0.95, RMSEA <0.06, with the 90% confidence interval's LL < 0.05 and UL limit <0.10, and SRMR <0.08 (Brown, 2015; Carmines & McIver, 1981; Kline, 2011).

T-tests were conducted in SPSS 19 (IBM Corp. Released, 2010). Path analyses were conducted in Mplus Version 7 (Muthén & Muthén, 2012).

Table 2
Means (standard deviations) and t-test for women and men in investigated variables.

	Men	Women	*t* (3989)	*p*
DBTP	2.65 (0.90)	2.78 (0.91)	−4.19	<.000
Financial resources	12.00 (9.07)	10.30 (8.53)	5.72	<.000
Positive affect	27.08 (5.96)	25.76 (5.69)	6.69	<.000
Negative affect	20.14 (6.65)	24.41 (7.19)	−17.80	<.000
Forethought	10.17 (7.14)	10.47 (7.41)	−1.17	.243
Repercussions of COVID-19	46.37 (20.72)	52.29 (20.00)	−8.58	<.000

DBTP = deviation from balanced temporal perspective.

3. Results

T-tests analyses revealed significant gender differences in all variables, but the forethought scale (means, standard deviations, and statistics are reported in Table 2). Overall, women showed worse psychological characteristics than men, reporting lower PA, and higher DBTP, NA, and expected repercussions of COVID-19. Also, financial resources were lower for women compared to men.

Results from path analysis indicated that the hypothesized model (Model 1) showed a satisfactory fit to the data (see Table 3). Findings indicated that DBTP predicted expected repercussions of COVID-19 both directly and indirectly, via PA, NA, and forethought (see Fig. 2 and Table 4). As hypothesized, higher DBTP scores predicted higher NA, lower PA, and longer expected time for the emergency to resolve. Interestingly, people with higher NA also expected a longer time for the pandemic to resolve, whereas PA was not associated with forethought. Financial resources also had a significant, independent, negative effect on expected repercussions, so that limited resources predicted more severe repercussions. All these relationships were controlled for the effect of age. Overall, the model explained 27% of the variance in the expected repercussions of COVID-19.

Then, we entered gender as a grouping variable and compared the baseline model in which parameters were freely estimated (Model 2), to a nested model where parameters were constrained to be equal across gender (Model 3). Model fit information is shown in Table 3. Both models provided sufficient fit to the data. Crucially, the χ^2 difference test indicated that constraining the parameters to be equal resulted in a significant decrease in model fit, $\Delta\chi^2(18) = 48.06$, $p < .001$, suggesting that cross-group invariance cannot be assumed. That is, gender has a moderation effect on (some) path coefficients. We examined which path coefficients should be allowed to vary across groups and results indicated that, only for women, higher PA predicted lower repercussions, whereas this relationship was not significant for men. Also, women and men differed in the strength of the association between DBTP and forethought, with men showing a stronger link (unstandardized estimate = 1.12) than women (unstandardized estimate = 0.57). Gender also moderated the effect of age on DBTP, NA, and financial resources. The final model is presented in Fig. 3.

4. Discussion and conclusions

To answer the call for research into the time perspective framework in the context of COVID-19 (Holman & Grisham, 2020), in this study we assessed the role of individuals' BTP on expectation for the future, in the context of the current health emergency. Notably, we explored people's anticipated repercussions of the pandemic considering distinct areas of life, from social relationships to the desire to travel. Our results confirmed that people with a more BTP had fewer negative beliefs about COVID-19's future consequences (h1). Past studies showed that having a BTP allows to integrate traumatic events into a coherent framework, promoting mental health and well-being (Holman, 2015; Tomich & Tolich, 2019). Current results extended this finding to the COVID-19 context, complementing well recent related studies. For instance, Trzebiński and colleagues found that basic hope in life enhanced life satisfaction and meaningfulness, which reduced anxiety and stress related to the current pandemic (Trzebiński et al., 2020). We speculate that BTP may be theoretically entered in such a model, as an antecedent of hope in life, and expected repercussions may contribute to anxiety and stress.

Furthermore, our study elucidated the mechanisms by which a BTP affects expectations for the future, revealing both direct and indirect effects. Mediation analyses confirmed that DBTP predicted affective

Table 3
Fit indices of the tested models.

Model	χ^2	*p*	χ^2 / *df*	CFI	RMSEA	90% CI	SRMR
1 - No gender	29.94	< .001	9.98	0.989	0.047	0.033–0.064	0.016
2 - Multi-group free	44.23	< .001	7.37	0.984	0.057	0.042–0.073	0.019
3 - Multi-group all constrained	91.95	< .001	3.83	0.971	0.038	0.030–0.046	0.028
4 - Multi-group final	61.45	< .001	3.23	0.982	0.033	0.024–0.043	0.022

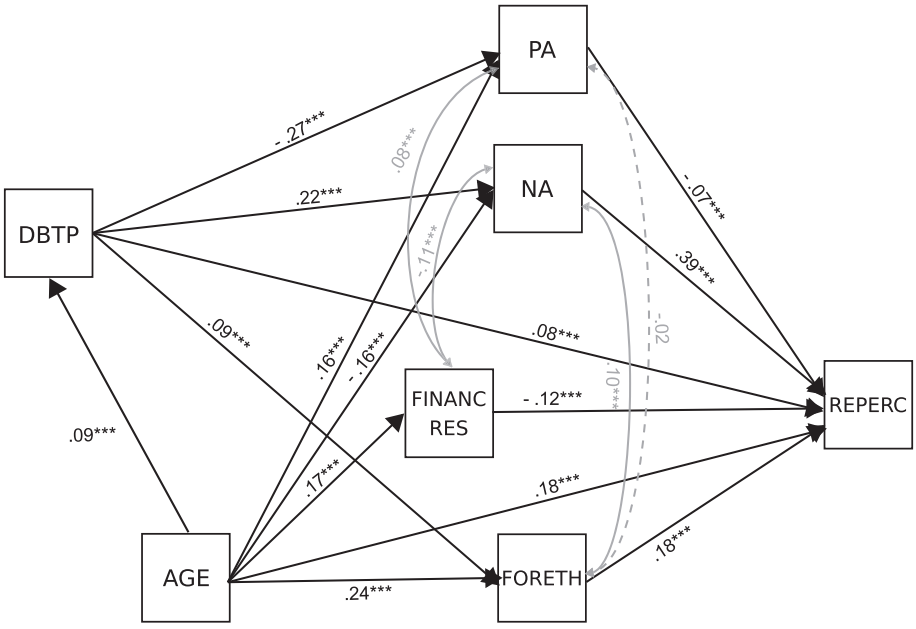

Fig. 2. Standardized estimates for Model 1.
Note. Black lines are regression paths. Grey lines are covariance paths. Dashed line represents paths with $p > .10$, solid line represents paths with $p < .05$.
DBTP = deviation from balanced temporal perspective; PA = positive affect; NA = negative affect; FINANC RES = perceived financial resources; FORETH = beliefs about pandemic's length; REPERC = expected repercussions of COVID-19 emergency.
*** p < .001.

Table 4
Bootstrapped 99% confidence intervals of the unstandardized estimates for the effects of DBTP on repercussions (Model 1). Confidence intervals not including zero indicate significant effects.

	Lower limit (LL)	Upper limit (UP)
Total direct effect	0.91	2.60
Total indirect effect	2.23	3.23
Specific indirect effects		
DBTP > PA > repercussions	0.18	0.65
DBTP > NA > repercussions	1.54	2.36
DBTP > forethought > repercussions	0.21	0.58

DBTP = deviation from balanced temporal perspective; PA = positive affect; NA = negative affect.

experience during the lockdown, leading to higher negative feelings and lower positive emotions. In turn, these affective states shaped expected repercussions in opposite directions (h2 and h4), even if not equally for women and men, as discussed below. Our results are in line with available evidence showing links between TP, feelings, and future expectations (Benzion, Shahrabani, Shavit, & Weiss, 2012; Gherasim et al., 2016; Maiella et al., 2020; Stolarski, Matthews, Postek, Zimbardo, & Bitner, 2014). Also, present findings highlighted that current affective states influence not only concurrent beliefs and behaviors, but also expectations for future. Moreover, we found that DBTP influenced the estimation of pandemic's length, which has an understandable effect on expected repercussions (h3). That is, people with an unbalanced TP believed that the current crisis would last months or even years, and therefore imagined tough negative consequences on their future.

Overall, our findings consolidate the wide literature on the effect of BTP on individuals' attitudes and feelings, suggesting that a balanced time profile is a protective factor that reduces negative views of the future, potentially helping to successfully cope with the COVID-19 emergency.

Interestingly, we found gender playing a moderating role (h6): Women and men showed partly different mechanisms underlying expected repercussions. Such a distinction between women and men's reactions to the COVID-19 pandemic is not without precedents, with recent studies indicating that women showed worse responses to the COVID-19 pandemic than men (Pieh, Budimir, & Probst, 2020). On a general note, research suggested that women often show a disadvantage in mental health, potentially related to gender differences in the appraisals of stressors (Mayor, 2015) and in emotion regulation strategies (Schick, Weiss, Contractor, Suazo, & Spillane, 2020). In line with this literature, we found that women showed a worse profile than men in almost all the constructs we investigated. Starting from these differences, we compared men and women in terms of potential predictors of backlashes due to COVID-19, and we found intriguing differences among the two gender groups. Namely, PA was relevant in explaining expected repercussion only for women, whereas NA had a similar effect across gender. This result suggests that reducing NA may be a useful intervention for both men and women, whereas increasing PA may be fruitful only for women. Moreover, while a more BTP led to shorter emergency length predictions for both gender categories, this effect was doubled for men.

Finally, a corollary finding concerns perceived financial resources, which emerged as an independent predictor of expected repercussions (h5). This result corroborates the view that people are experiencing the pandemic not only as a health issue, but also as a social and economic concern. Researchers discussed the impact of COVID-19 on the individual and global economic situation (Barua, 2020) and our results showed that people believing to have limited financial resources were the most worried about the future. Interestingly, related research indicated that people with low socio-economic status are at greater risk for

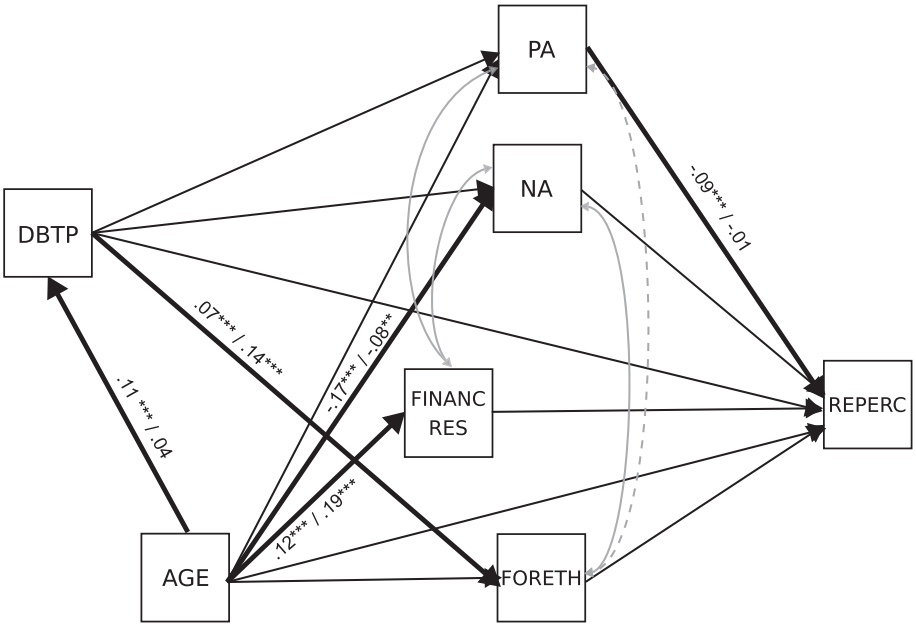

Fig. 3. The final model showing the moderating role of gender.
Note. Bold lines indicate that the difference in the path coefficient was statistically significant between the two gender groups. Standardized coefficients are reported for women/men. DBTP = deviation from balanced temporal perspective; PA = positive affect; NA = negative affect; FINANC RES = perceived financial resources; FORETH = beliefs about pandemic's length; REPERC = expected repercussions of COVID-19 emergency.
** $p < .01$, *** $p < .001$.

mental health issues (Pieh et al., 2020), thus deserving particular attention during the pandemic.

To sum up, the current study examined people's future expectations related to COVID-19 negative effects on daily life. People across the world are aware that the COVID--19 emergency is far from being concluded. In Poland, 59% of the population stated that "the worst is yet to come" (Trzebiński et al., 2020, p. 4). This high concerning rate reveals how much the population is feeling uncertain about the future and worried about the pandemic's negative consequences (besides the health issue). We found that BTP is an important personality factor explaining people's differences in expected repercussions. Namely, having a BTP promotes positive attitudes toward the future. Also, our results indicated that men and women showed similar overall mechanisms underlying expected repercussions of COVID-19, with some interesting gender differences. From a practical point of view, being aware of these differences can help to shape intervention programs to target populations.

We acknowledge that due to the cross-sectional nature of the research we cannot exclude other directionality of the effects. However, current results are supported by theoretical and empirical evidence on which we built our model. Beyond this caveat, the present study contributes to our understanding of people's psychological and behavioral reactions to the current health emergency. Results confirmed that the COVID-19 pandemic is affecting people's life not just as a health issue, but involving also finance, social relationships, and several life's dimensions, not only in the present, but also in the (expected) future.

CRediT authorship contribution statement

Irene Ceccato: Conceptualization, Formal analysis, Writing – original draft, Writing – review & editing. **Rocco Palumbo:** Conceptualization, Methodology, Writing – review & editing, Supervision. **Adolfo Di Crosta:** Software, Investigation, Writing – review & editing. **Daniela Marchetti:** Conceptualization, Writing – review & editing, Supervision. **Pasquale La Malva:** Software, Investigation, Writing – review & editing. **Roberta Maiella:** Investigation, Writing – review & editing. **Anna Marin:** Software, Investigation. **Nicola Mammarella:** Resources, Supervision. **Maria Cristina Verrocchio:** Resources, Supervision. **Alberto Di Domenico:** Conceptualization, Resources, Supervision, Project administration.

Declaration of competing interest

None.

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