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A Longitudinal Investigation of the Changes in Work Motivation and Employees' Psychological Health

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Abstract: Organizations strive to motivate employees to thrive at work. However, employees' motivation is likely to vary over a short period (e.g., a few months) to cope with the routine dynamics of organizations' activities. These motivation dynamics covary with employees' affective, cognitive, and behavioral outcomes in the workplace. Moreover, employees' psychological health, a multidimensional concept focused on the individual's well/ill-being simultaneously, changes over time. Using the integrated theoretical frameworks of self-determination theory (SDT) and the hierarchical model of self-determined motivation (H-SDT), this research sought to examine the motivational changes following the dual-path model. In particular, this work sought to unpack the temporal dynamics in employees' subjective well/ill-beings predicted by the changes in basic needs satisfaction/frustration through autonomous/controlled motivation, while considering the characteristics of people's general causality orientations (trait-level motivation). Over four months, longitudinal field data were collected from the employees in several private small businesses in the consumer product retail industry. Latent growth modeling (LGM) results supported the positive dual relations between the changes in employees' psychological health and basic psychological needs satisfaction/frustration, but neither the changes of autonomous/controlled work motivation nor the indirect change paths via autonomous/controlled work motivation were significant. Finally, we discussed the theoretical and practical implications of the findings. Limitations and possible future research directions to further this line of research on the dynamic of work motivation were also summarized.

Keywords: change in motivation; psychological health; longitudinal study

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1. Introduction

Psychologists have long been working to answer the research question of how humans adapt to different situational and relational demands across different life domains as learning results over time. The source for such changes, a self-regulative mechanism, refers to human motivation and serves as the psychological process that enables humans to interact meaningfully with their environment (Bandura 1991, 2001). Motivation is an essential psychological process that elicits, controls, and sustains behavior (Pinder 2008). Self-determination theory ("SDT"; Deci and Ryan 1985a, 2000; Ryan and Deci 2017), a needs-based motivation theory, offers a multidimensional framework of motivation that incorporates both levels (quantity) and dimensions (quality) of motivation (Deci and Ryan 2000; Ryan and Deci 2017). It proposes that the satisfaction of three basic psychological needs—autonomy, relatedness, and competence—promotes highly self-determined motivation and adaptive results at work (Gagné and Deci 2005; Baard et al. 2004). In addition, the hierarchical model of self-determined motivation ("H-SDT"; Vallerand 1997; Vallerand and Ratelle 2002) suggests that self-determined motivation can act at three reciprocally related conceptual levels: the global, the contextual, and the situational. Furthermore,

the H-SDT model also suggests that determinants and consequences of intrinsic/extrinsic motivation may occur at all three levels of generality and that the changes among different levels are recursive (Vallerand 1997). H-SDT supplements previous research and allows researchers to study the temporal change patterns in motivation (Shipp and Cole 2015) and motivational consequences from multidimensional and multi-level perspectives.

SDT (Deci and Ryan 2000; Gagné and Deci 2005) emphasizes the importance of organismic experiences in humans seeking to satisfy their basic psychological needs while avoiding those that may thwart them. SDT researchers have established research evidence for the cross-cultural validity of the need for autonomy (Chirkov et al. 2003; DeCharms 1968), relatedness (Baumeister and Leary 1995), and competence (Csikszentmihalyi 1988). At the same time, needs-support-seeking behavior (e.g., seeking feedback or recognition, forming meaningful connections, proactive problem solving, and so on) facilitates internalization, a process of motivational changes in self-regulation that is shown over time (Deci and Ryan 2000; Gagné and Deci 2005). Past organizational research implied that satisfying the three basic psychological needs for autonomy, relatedness, and competence resulted in improved subjective well-being (e.g., Boezeman and Ellemers 2009; Milyavskaya and Koestner 2011). On the other hand, needs frustration—something that has been less researched—resulting from thwarting situations (e.g., deprivation of work resources, abusive supervision, minimum volition at work) are demotivating and negatively affect employees' psychological/physical health. Hence, the parallel process (less self-determined regulation) of motivational change—externalization—results from repeated needs frustration over time (Deci and Ryan 2008b; Gagné and Deci 2005).

SDT suggests that needs support/thwarting work contexts should directly affect motivation and result in highly functional/dysfunctional consequences (Ryan and Deci 2017). Therefore, this study seeks to examine how the within-person changes in perceived needs satisfaction and frustration predict changes in employees' well/ill-being through the changes of autonomous and controlled motivation, respectively, following two independent dynamic motivational processes: internalization and externalization. At the same time, whether autonomous or controlled general causality orientations, the global-level motivation trait differences predict the changes in contextual motivation at work and employees' well/ill-being.

Theoretical Framework and Research Hypotheses

Autonomy in the workplace, described as a perception of free will to carry out job-related activities, such as being able to control the specifics of work attempt and its desired outcome (Ryan and Deci 2001), captures the universal spirit of many management "best practices" in organizations, including empowerment, total quality management, autonomous workgroups, and flexible job/work design (Gagné and Bhave 2011). Research suggests high work autonomy predicts job satisfaction, commitment, and performance (Spector 1986). Satisfaction with the basic psychological need for autonomy has also been found to relate to many well-being implications, such as higher work engagement (Baard et al. 2004), less stress and work-family conflict (Thompson and Prottas 2006), and lower burnout (Taris et al. 2002). In addition, the satisfaction of the basic psychological needs for relatedness and competence has also been correlated to one's daily well-being (Reis et al. 2000).

Drawing on the SDT (Deci and Ryan 2000; Ryan and Deci 2017) and a multidimensional conceptualization of psychological health, including employee well-being and ill-being at the same time, this research examines changes in basic needs satisfaction/frustration related to subjective well-being/ill-being via changes in motivation while accounting for the motivational trait, the general causality orientation. The contributions of this research were that it allowed the mapping out of the variations (i.e., changes) of perceived psychological needs satisfaction/frustration as motivational antecedents to be studied, together with the changes in the types of motivation at work and their multidimensional health-related consequences to advance our theoretical understanding of the collective temporal patterns

outside of the lab with no experiment manipulations. Furthermore, this study (see Figure 1 for integrated research model) uses a longitudinal field research design to understand the within-person dynamics of needs satisfaction/frustration, work motivation, and employees' psychological health naturally occurring in the workplace.

Psychological health is a multidimensional concept (Ryan and Deci 2017). Under the SDT framework, it is one's dynamic reflection on both manifestations of wellness and the absence of illness, such as depletion and exhaustion of biological and psychological energy (Martela and Sheldon 2019). At the same time, Deci and Ryan (2008b) also emphasized the importance of including the representation of the fullness and vitality of the organismic function of human beings on top of the subjective experience of positive versus negative affect in the definition of well-being. In other words, a psychologically healthy worker shows awareness, cognitive flexibility, engagement, and integration rather than depletion, defensiveness, rigidity, or segregation (Ryan and Deci 2017). Longitudinal research (Vansteenkiste et al. 2020) also showed that severe and chronic stresses caused by the interplay of physiological and psychological needs thwarting work activities could be detrimental and dysfunctional to one's function at work and long-term career.

Recent research investigating perceived needs supportive and thwarting actions from significant people (e.g., life partners, coaches, teachers, supervisors) implied that needs satisfaction/frustration leads to well-being/ill-being independently (Deci and Ryan 2008b). The reason to separate needs frustration from needs satisfaction is that it involves active thwarting of basic psychological needs rather than simply the absence of satisfaction of basic psychological needs (Vansteenkiste et al. 2020). While patterns have shown that people's well-being levels decrease with lower levels of needs satisfaction, independent ill-being aspects suggest a separate asymmetrical path (Chen et al. 2015). Similar to active disturbance, specific actions/interactions thwart psychological needs captured by people's ill-being in different contexts (Vansteenkiste and Ryan 2013). Empirical evidence also suggests that if basic psychological needs are thwarted, personal goal-striving behavior and affect regulation may have even more severe adverse health outcomes than when such needs are not satisfied (Bartholomew et al. 2011; Deci and Ryan 2008a). Although few studies have examined these distinct paths, Gillet et al. (2012) found that perceived organizational and personal support impacted employees' well-being and ill-being through their perceived satisfaction and frustration of basic psychological needs resulting from work tasks via two distinct paths. However, these effects have not been examined for changes over time. Adopting a dynamic perspective with which to view the two separated paths traveling parallel, we expect that, over time, changes in basic needs satisfaction and frustration will lead to corresponding changes in employee well-being and ill-being independently. This theoretical expectation leads us to make the following hypotheses:

Hypothesis 1. *Changes in employee well-being will be positively predicted by the within-person changes in satisfaction of the basic psychological needs for autonomy, relatedness, and competence over time.*

Hypothesis 2. *Changes in employee ill-being will be positively predicted by the within-person changes in frustration of the basic psychological needs for autonomy, relatedness, and competence over time.*

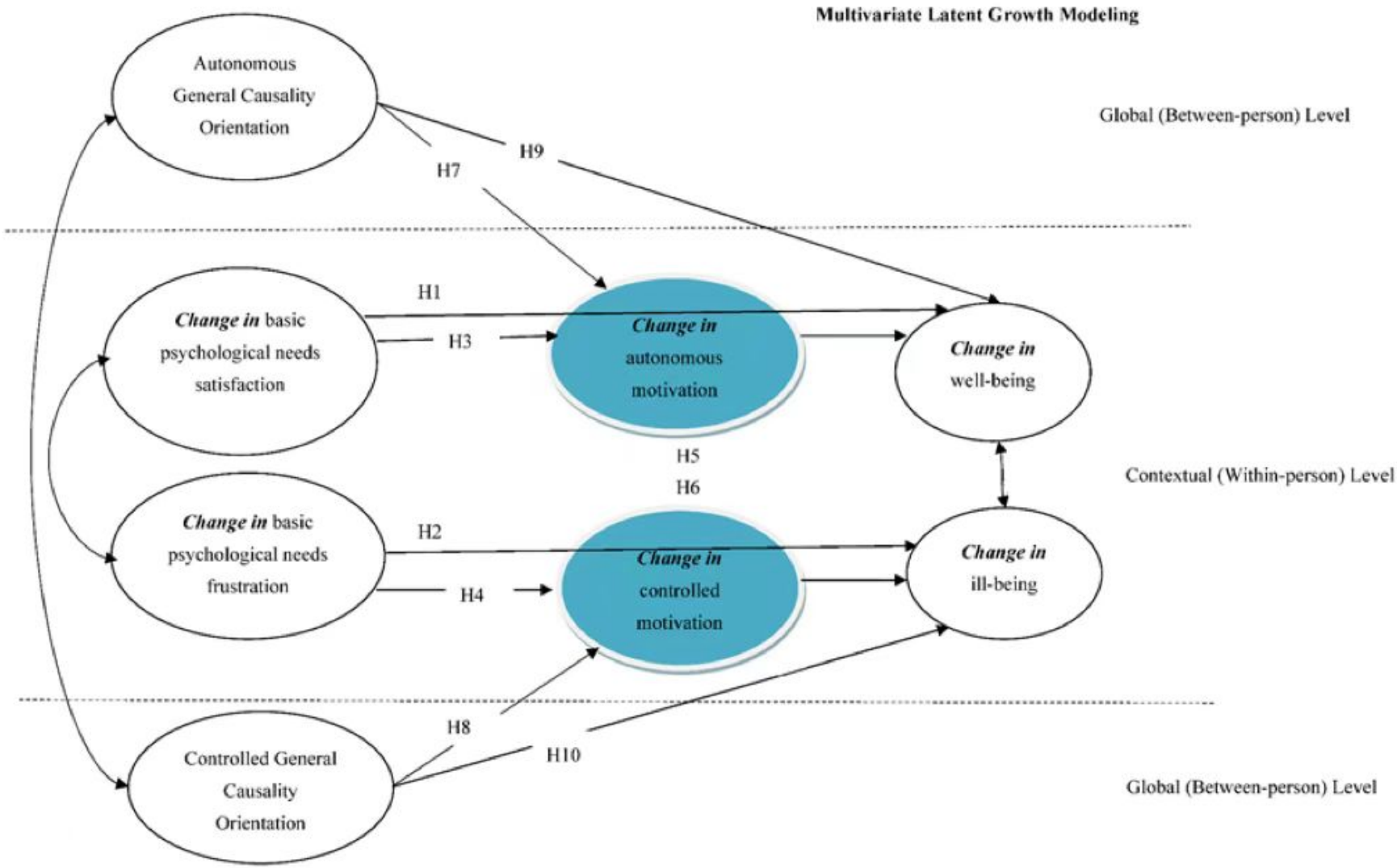

Figure 1. Hypothesized longitudinal research model.

SDT (Deci and Ryan 1985a, 2000) framework suggests that either controlled (e.g., to obtain monetary compensation or to avoid punishment) or autonomous reasons (e.g., to have fun or to realize one's values) may drive people's thoughts and actions. Autonomous motivation includes two forms of self-determined motivation: intrinsic and identified regulation, while controlled motivation includes external regulation and introjected regulation (Deci and Ryan 2000; Gagné and Deci 2005). According to SDT, self-determined regulation (e.g., autonomous motivation) stems from repeated needs satisfaction experiences, which is essential for people to internalize organizational values and self-concord goals over time (Gagné and Deci 2005). Domain-specific research echoes such a statement, as autonomy, relatedness, and competence needs satisfaction is related to a higher level of autonomous motivation in various settings, for example, in sports (Standage et al. 2006), in the workplace (Baard et al. 2004), and in education (Standage et al. 2006).

Recently, Bidee et al. (2016) tested a similar dual-path model using a dynamic approach and experience sampling methodology that included changes in needs satisfaction/frustration and autonomous/controlled motivation over a few days. They found that the growth curves for controlled and autonomous work motivation were the opposite. Surprisingly, their study found no significant positive linear relationships between the change in needs satisfaction/frustration and autonomous/controlled work motivation. Only the initial level of needs satisfaction was positively related to the change in autonomous work motivation. These findings from the study—one of the rare ones that used a longitudinal research design to examine these paths—were not consistent with past empirical findings from cross-sectional studies, suggesting a need for replicating and further research on the dynamic nature of work motivation. In addition, SDT scholars were calling for accumulative empirical evidence on the dynamics of motivation for theoretical advancement (Ryan and Deci 2017). The present study attempted to replicate and extend this line of research on the dynamic nature of motivational change and tried to further test such a temporal relationship with a longer timespan between different measurements (e.g., four months in this study compared to about a week in Bidee et al. 2016) in the for-profit businesses (e.g., compared to the volunteers studied in the Bidee et al. 2016). In this vein, we propose the following hypotheses:

Hypothesis 3. *Changes in autonomous motivation will be predicted by the initial level and within-person changes in satisfaction of the basic psychological needs for autonomy, relatedness, and competence over time.*

Hypothesis 4. *Changes in controlled motivation will be predicted by the initial level and within-person changes in frustration of the basic psychological needs for autonomy, relatedness, and competence over time.*

According to SDT, the satisfaction/frustration of basic psychological needs is the gateway to work motivation and its psychological and behavioral consequences (Ryan and Deci 2017). Furthermore, these psychological mechanisms could form the behavior-regulatory processes of internalization and externalization over time (Gagné and Deci 2005; Bidee et al. 2016). For instance, the satisfaction of the three basic psychological needs has been found to mediate the relationship between perceived supervisor autonomy support and job satisfaction (Adie et al. 2008; Deci et al. 2001). These studies were conducted using mainly cross-sectional research designs and between-person measurements of work motivation.

Nonetheless, a few longitudinal studies using athlete samples support these process-oriented dynamic motivational relationships. For instance, positive relationships have been found among coach autonomy support, needs satisfaction, and athletes' well-being (e.g., Gagné 2003), and similar results were obtained through multi-level empirical investigations (within- vs. between-person) in sports (Reinboth and Duda 2006; Adie et al. 2012). Needs support from coaches also resulted in higher perceived needs satisfaction, leading to higher

autonomous motivation and ultimately predicted end-of-season performance (Smith et al. 2007). Extending this line of research, we proposed that such motivational change processes should occur in the workplace over several months, with changes in needs satisfaction and frustration leading to changes in well-being and ill-being via the changes in autonomous and controlled motivation (e.g., autonomous vs. controlled self-regulatory patterns in the workplace context), respectively.

Hypothesis 5. *Changes in employee well-being are positively predicted by the changes in satisfaction of the three basic psychological needs via the indirect path of changes in autonomous motivation over time.*

Hypothesis 6. *Changes in employee ill-being are positively predicted by the changes in frustration of the three basic psychological needs via the indirect path of changes in controlled motivation over time.*

General causality orientations ("GCOs") describe the "trait-like adaptations" (McAdams and Pals 2006) that unfold people's propensities to orient themselves toward different and varied motivation conditioning situations (Ryan and Deci 2017). There are three types of GCOs: (1) autonomous orientation, in which people approach their environment by treating it as the source of relevant information since they take an interest in both external events and the accompanying inner experiences; (2) controlled orientation, in which people's attention and concerns tend to be oriented only toward external contingencies and controls; and (3) impersonal orientation, which is the degree to which people focus primarily on the obstacles to their goals when they react to their lack of control over outcomes—and this could easily lead to amotivation (Ryan and Deci 2017). Beyond being indicators of the different forms of contextual motivation that one could demonstrate in different life domains, GCOs are trait-level (global-level) constructs focusing on capturing individuals' characteristic differences (Deci and Ryan 1985b). Such individual differences are the persistent results of situational support vs. deprivation that one can experience through long-term learning (Ryan and Deci 2017).

Past empirical evidence supports that higher self-esteem and self-actualization are promoted by higher levels of autonomous causality orientation (Deci and Ryan 1985a). For example, higher individual autonomous causality orientations resulted in higher autonomous motivation to lose weight and better weight loss results from maintenance over time (Williams et al. 1996). Kwan et al. (2011) also showed that positive affect was positively predicted more by autonomous causality orientation than impersonal causality orientation during self-selected exercises in a longitudinal study. In addition, college students with a stronger controlled causality orientation tended to set performance-oriented goals (e.g., similar to controlled self-regulation) and experienced more anxiety when they received failure feedback (Koestner and Zuckerman 1994). Lonky and Reihman (1990) also found that higher controlled causality orientation predicted students' cheating behavior when opportunities were provided. In the present research, we also examined whether controlled causality orientation induces people toward more venerable contextual needs-thwarting factors and, at the same time, whether it results in higher levels of ill-being such as psychological and physical exhaustion as part of the dual-path model.

Under the SDT, employees with higher trait-level autonomous causality orientation will be more ready to pick up situational and relational cues that support basic psychological needs, resulting in more autonomous self-regulation and a higher level of well-being (Gagné and Deci 2005). Guay et al. (2003) showed that global (trait) level causality orientations predicted changes in learning motivation (in the educational domain) over time. Our study aimed to replicate and extend the understanding of the dynamic nature of motivation with possible cross-level change mechanisms in the work domain. Furthermore, we wanted to see whether GCOs trigger changes in employees' work motivation via their perception of needs satisfaction or frustration—in other words, how the GCOs, employees' trait motiva-

tion, resulted from one's long-term learning experience, predict the within-person changes in well/ill-being via the changes in autonomous/controlled self-regulation. However, since the present study is one of the pioneer studies to engage in an explanatory longitudinal investigation of the temporal relationship between GCOs and the dynamics in employees' work motivation and well/ill-being over time, it lacks a known basis to hypothesize the speed (e.g., acceleration or deceleration) of such changes. Thus, we anticipated stable, linear temporal relationships among GCOs, changes in work motivation, and changes in employees' well/ill-being in the spirit of preliminary empirical exploration in this study.

Hypothesis 7. *A linear increase (e.g., even positive changes) in the employees' autonomous work motivation is positively predicted by autonomous GCO over time.*

Hypothesis 8. *A linear increase in employees 'controlled work motivation is positively predicted by the controlled GCO over time.*

Hypothesis 9. *A linear increase in employees' well-being is positively predicted by the autonomous GCO over time.*

Hypothesis 10. *A linear increase in employees' ill-being is positively predicted by the controlled GCO over time.*

2. Methods

2.1. Procedures

The human resources (HR) staff of three small and medium-sized (fewer than 500 permanent employees) private businesses in China sent out invitation emails to their employees containing the link to access an online questionnaire for research participation. Similar procedures were followed three separate times (i.e., times 1 to 3) with a month in between. We also interviewed the CEOs and a representative from the HR department in each organization to understand the general business cycle, ongoing business activities, and recent management interventions. No significant business uncertainties (i.e., potential acquisition and buyout, launching new products/services, significant management reformation, process re-engineering, and so on) were noticed in these organizations during the data collection period. At the end of the data collection period, general business analysis reports and advice on potential management improvement were provided to the management of the participating organizations as a benefit of this research participation.

2.2. Samples

Data were collected from Chinese private businesses in the consumer products retail industry (final sample was N = 110 across T1 to T3; average age = 34 with SD = 7 yrs; 43% of the participants were male; 32% of the participants had a bachelor's degree or higher) before the onset of the global COVID-19 pandemic. Out of 220 permanent employees contacted for participation, 190 (86% of contacted employees) responded to our T1 survey, 166 (87% of T1 survey responders) employees responded to the T2 survey four weeks later, and 110 (69% of T2 survey responders) employees responded to the T3 survey, four to five weeks after the T2 survey. Most of the dropouts from T1 to T3 were due to random reasons for personal and business (e.g., job transfer, resignation, or layoff). Logistic regression analyses were conducted to examine whether participant attrition across three measurement times led to non-random sampling (Goodman and Blum 1996). Results showed that the probabilities of remaining at T2 ($\chi^2 = 14.29$; $df = 10$; $p < 0.16$; n.s.) and T3 ($\chi^2 = 6.04$; $df = 10$; $p < 0.82$; n.s.) from T1 variables (N = 190) were not significant, nor were the probabilities of remaining at T3 ($\chi^2 = 9.76$; $df = 10$; $p < 0.46$; n.s.) from T2 variables (N = 166), which suggested that respondent attrition across three data collection times was statistically random.

2.3. Measurements

All the scales were validated in Chinese in past research, except the modified athlete burn-out questionnaire (ABQ; Raedeke and Smith 2001) and the general causality orientation scale (GCO; Deci and Ryan 1985b). Therefore, we followed the standard translation–back-translation procedure for cross-cultural studies to ensure the translation validity of these measures (Brislin 1980).

Work motivation. The revised motivation at work scale measured the quality and quantity of work motivation (Gagné et al. 2015; Cronbach's α = 0.86, 0.89, 0.83 for T1, T2, and T3, respectively). Participants were asked to use a Likert scale of 1 (not at all for this reason) to 7 (exactly for this reason) to evaluate how likely each statement is to answer the question "why do you put effort into your job?" This scale comprises nineteen items measuring intrinsic motivation (four items), identified regulation (four items), introjected regulation (three items), and external regulation (six items). Examples were: "because I have fun doing my job (intrinsic motivation)."; "because putting effort into this job aligns with my personal values (identified regulation)."; "because otherwise I will feel ashamed of myself (introjected regulation)."; and "because others will reward me financially only if I put enough effort in my job (external regulation)."

Basic needs satisfaction. The satisfaction of basic needs was measured by the satisfaction of basic psychological needs scale for work (Van den Broeck et al. 2010; Cronbach's α = 0.73, 0.70, and 0.73 for T1, T2, and T3, respectively). Respondents were asked to use a Likert scale of 1(strongly disagree) to 5 (strongly agree) to evaluate how they felt about their jobs. This scale comprises sixteen items to measure the satisfaction of basic psychological needs of autonomy (six items), relatedness (six items), and competence (seven items). Example items were: "I feel I can be myself at my job (autonomy)."; "At work, I feel part of a group (relatedness)."; and "I have the feeling that I can even accomplish the most difficult task at work (competence)."

Basic needs frustration. Psychological needs frustration was measured by the scale developed by Bartholomew et al. (2011; Cronbach's α = 0.86, 0.88, and 0.86 for T1, T2, and T3, respectively). Respondents were asked to use a Likert scale of 1 (strongly disagree) to 7 (strongly agree) to evaluate twelve statements describing the thwarting of the three basic psychological needs of autonomy (four items), relatedness (four items), and competence (four items). Example items were: "I feel like I am being pushed to behave in certain ways (autonomy)."; "There are situations where I am made to feel inadequate (competence)."; and "I feel that other people dislike me (relatedness)."

Well-being/ill-being. Well-being measurement included multidimensional measurements of work engagement, measured using the short version of the scale developed by Schaufeli et al. (2006; Cronbach's α = 0.96, 0.97, 0.95 for T1, T2, and T3, respectively). Respondents were provided a Likert scale of 0 (never) to 6 (always, almost every day) to evaluate the frequency of seventeen scale items measuring vigor (six items), absorption (six items), and dedication (six items). Example items are: "My job inspires me (dedication)."; "At work, I feel full of with energy (vigor),"; and "I get carried away when I am working (absorption)."

Ill-being measurements included measures of both emotional and physical exhaustion. In order to incorporate both types of exhaustion, we used a facet of the ABQ (Raedeke and Smith 2001; Cronbach's α = 0.83, 0.87, 0.79 for T1, T2, and T3, respectively), which was adapted to the workplace: it measures the frequency with which employees perceive having deficient energy levels at work. Respondents were asked to use a Likert scale from 1 (almost never) to 5 (almost always) to rate their psychological and physical exhaustion with fifteen items of reduced accomplishment (five items), devaluation (five items), and physical exhaustion (five items). Example items are: "I am not achieving much at work (reduced accomplishment)."; "The effort I spend in doing my work would be better spent doing other things (devaluation)."; and "I am not as into my work as I used to be (physical exhaustion)."

General causality orientation. GCO was measured using the general causality orientation scale, containing twelve vignette questions (Deci and Ryan 1985b). The vignettes describe

different hypothetical sketches, for example: "you have been offered a new position in a company where you have worked for some time. The first question that is likely to come to mind is . . . " with 36 items (Cronbach's α = 0.79, full scale at T1) measuring autonomous GCO (twelve items; Cronbach's α = 0.78), controlled GCO (twelve items; Cronbach's α = 0.75), and impersonal GCO (twelve items; Cronbach's α = 0.75). Respondents are asked to use a Likert scale between 1 (very unlikely) and 7 (very likely) to assess how likely they will come up with the listed statements when asked. Example items include "I wonder if the new work will be interesting (autonomous GCO)."; "Will I make more at this position? (controlled GCO)"; and "What if I cannot live up to the new responsibility? (impersonal GCO)."

2.4. Statistical Analyses

The data were first examined for missing information, and kurtosis and skewness were then verified to ensure the univariate normality of the data distribution. Multi-group confirmatory factor analyses were finally conducted to ensure the equivalence among the T1, T2, and T3 measurements. Lastly, following the suggestions mentioned for longitudinal research design (Ployhart and Vandenberg 2010) and data analyses (Chan and Schmitt 2000; Lance et al. 2000), we carried out latent growth curve modeling ("LGM"; von Soest and Hagtvet 2011) analyses by using Mplus 7.0 (Muthén and Muthén 2012). In order to test the temporal relationships proposed in the integrated research model, we conducted second-order LGM by calculating the latent factor of change using multivariate SEM. Then, correlations and coefficients between latent factors were regressed to test the direct and mediation hypotheses (von Soest and Hagtvet 2011). Please see the results section for details reported.

3. Results

3.1. Descriptive Statistics and Simple Correlations

Descriptive statistics of study variables at within-person and between-person levels are displayed in Table 1, including the independent *t*-test results between the three measurement occasions (T1, T2, and T3). Table 2 summarizes simple correlations between study variables within-person and between-person levels. Simple correlations among reported variables were consistent with the directions of our proposed research hypothesis.

Table 1. Descriptive Statistics for Study Variables.

Study Variables			Min.	Max.	Mean	SD	Variance	Skewness		Kurtosis		Independent *t*-Test		
								Stat	Std. Err.	Stat	Std. Err.	T1 vs. T2	T1 vs. T3	T2 vs. T3
Basic Needs Satisfaction	Autonomy	T1	3	7	4.31	0.93	0.86	0.15	0.23	−0.20	0.46	A	A	A
		T2	3	7	4.41	0.73	0.53	0.38	0.23	0.95	0.46			
		T3	2	7	4.38	0.76	0.57	0.35	0.23	1.31	0.46			
	Competence	T1	3	7	5.44	0.86	0.74	−0.34	0.23	−0.29	0.46	A	A	A
		T2	4	7	5.24	0.82	0.66	−0.02	0.23	−0.67	0.46			
		T3	4	7	5.27	0.89	0.80	0.02	0.23	−0.88	0.46			
	Relatedness	T1	3	7	4.96	0.63	0.39	0.13	0.23	0.62	0.46	B	B	A
		T2	4	6	4.80	0.54	0.29	−0.15	0.23	−0.53	0.46			
		T3	3	6	4.78	0.58	0.34	−0.24	0.23	−0.32	0.46			
Basic Needs Frustration	Autonomy	T1	1	7	3.54	1.12	1.26	−0.07	0.23	0.34	0.46	A	A	A
		T2	1	6	3.59	1.07	1.14	−0.40	0.23	0.12	0.46			
		T3	1	6	3.45	1.08	1.17	−0.27	0.23	0.13	0.46			
	Competence	T1	1	7	4.24	1.06	1.13	−0.48	0.23	1.02	0.46	B	B	A
		T2	1	6	3.93	0.86	0.75	−0.45	0.23	0.79	0.46			
		T3	2	6	3.78	0.98	0.95	−0.04	0.23	−0.31	0.46			
	Relatedness	T1	1	7	2.93	1.09	1.19	0.15	0.23	1.15	0.46	A	A	A
		T2	1	6	2.92	0.99	0.98	0.10	0.23	−0.09	0.46			
		T3	1	7	2.67	1.03	1.07	1.11	0.23	−0.31	0.46			
Motivation at Work	Autonomous Motivation	T1	1	7	4.77	1.01	1.03	−0.92	0.23	2.83	0.46	A	A	A
		T2	2	7	4.76	0.80	0.64	−0.09	0.23	0.58	0.46			
		T3	1	7	4.77	1.02	1.04	−0.07	0.23	1.28	0.46			
	Controlled Motivation	T1	1	7	4.27	0.96	0.92	−0.82	0.23	1.78	0.46	A	A	A
		T2	1	7	4.39	0.96	0.92	−0.47	0.23	1.36	0.46			
		T3	1	6	4.25	0.99	0.99	−0.29	0.23	0.59	0.46			

Table 1. *Cont.*

Study Variables			Min.	Max.	Mean	SD	Variance	Skewness		Kurtosis		Independent *t*-Test		
								Stat	Std. Err.	Stat	Std. Err.	T1 vs. T2	T1 vs. T3	T2 vs. T3
Well-being	Work Engagement	T1	2	7	5.02	1.06	1.13	−0.20	0.23	−0.41	0.46	A	A	A
		T2	2	7	4.99	0.99	0.98	−0.29	0.23	−0.01	0.46			
		T3	2	7	5.00	1.05	1.10	0.08	0.23	−0.46	0.46			
Ill-being	Physical and Psychological Exhaustion	T1	1	5	2.44	0.52	0.25	−0.09	0.23	−0.98	0.46	A	A	A
		T2	1	4	2.38	0.50	0.25	−0.15	0.23	0.20	0.46			
		T3	1	5	2.37	0.55	0.30	0.23	0.23	0.84	0.46			
GCO	Autonomous	T1	2	6	3.61	0.72	0.51	0.18	0.24	0.61	0.47	N/A	N/A	N/A
	Controlled	T1	3	7	4.83	0.78	0.62	−0.14	0.24	−0.12	0.47			
	Impersonal	T1	3	7	4.34	0.76	0.58	0.45	0.24	0.09	0.47			

Note: T1= Time one; T2 = Time two; T3 = Time three; N = 110 (list-wise deletion, between-person level); A = no difference in mean between groups; B = significant difference in mean between groups ($p < 0.5$).

Table 2. Simple Correlations between Study Variables.

	Scale			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	Basic Needs Satisfaction	A	T1	0.97																															
2			T2	0.59 **	0.70																														
3			T3	0.48 **	0.67 **	0.75																													
4		C	T1	0.29 *	0.24 *	0.28 **	0.97																												
5			T2	0.15	0.40 **	0.36 **	0.49 **	0.70																										
6			T3	0.21 *	0.29 **	0.45 **	0.43 **	0.59 **	0.83																									
7		R	T1	0.28 **	0.29 **	0.23 **	0.38 **	0.18	0.13	0.94																									
8			T2	0.19 *	0.36 **	0.45 **	0.30 **	0.36 **	0.35 **	0.38 **	0.78																								
9			T3	0.21 *	0.36 **	0.42 **	0.20 **	0.17	0.33 **	0.37 **	0.55 **	0.70																							

Table 2. *Cont.*

	Scale			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
10	Basic Needs Frustration	A	T1	−0.58 **	−0.46 **	−0.35 **	−0.25 **	−0.33 **	−0.27 **	−0.23 *	−0.19 *	−0.22 *	0.94																						
11			T2	−0.47 **	−0.60 **	−0.54 **	−0.13	−0.24 **	−0.12	−0.31 **	−0.25 **	−0.24 *	0.51 **	0.86																					
12			T3	−0.42 **	−0.47 **	−0.67 **	−0.22 *	−0.23 **	−0.30 **	−0.14	−0.17	−0.24 *	0.45 **	0.62 **	0.88																				
13		C	T1	−0.40 **	−0.25 **	−0.21 *	−0.13	−0.08	−0.01	−0.04	−0.15	−0.03	0.48 **	0.21 *	0.24 *	0.94																			
14			T2	−0.34 **	−0.36 **	−0.33 **	−0.29 **	−0.18	−0.11	−0.10	−0.06	−0.04	0.35 **	0.44 **	0.38 **	0.45 **	0.86																	
15			T3	−0.22 *	−0.29 **	−0.43 **	−0.21 *	−0.23 *	−0.29 **	0.07	−0.03	−0.11	0.24 *	0.36 **	0.59 **	0.22 *	0.42 **	0.75																
16		R	T1	−0.41 **	−0.36 **	−0.38 **	−0.42 **	−0.20 *	−0.32 **	−0.23 *	−0.38 **	−0.30 *	0.55 **	0.27 **	0.28 **	0.41 **	0.41 **	0.24 *	0.94															
17			T2	−23 *	−0.26 **	−0.25 **	−0.16	−0.10	−0.13	−0.06	−0.21 *	−0.19	0.25 **	0.32 **	0.31 **	0.42 **	0.54 **	0.34 **	0.42 **	0.80														
18			T3	−0.15	−0.13	−0.23 **	−0.12	0.06	−0.28 **	−0.03	−0.15	−0.19 *	0.15	0.03	0.39 **	0.20 **	0.19	0.32 **	0.36 **	0.54 **	0.87													
19	Motivation at Work	AM	T1	0.23 *	0.22 *	0.26 **	0.31 **	0.42 **	0.33 **	0.21 *	0.32 **	0.24 *	−0.30 **	−0.18	−0.17	−0.03	−0.08	−0.11	−0.32 **	−0.02	−0.02	0.97												
20			T2	0.21 *	0.34 **	0.29 **	0.23 *	0.32 **	0.24 **	0.16	0.21 *	0.25 **	−0.22 *	−0.19 *	−0.17	0.09	−0.05	−0.21 *	−0.08	0.05	0.02	0.37 **	0.81											
21			T3	0.23 *	0.21 *	0.32 **	0.25 *	0.40 **	0.59 **	0.22 *	0.22 *	0.40 **	−0.44 **	−0.13	−0.32 **	−0.15	−0.16	−0.23 *	−0.30 **	−0.04	−0.20 *	0.43 **	0.43 **	0.94										
22		CM	T1	−0.21 *	−0.14	−0.07	−0.01	0.11	0.22 *	0.06	0.02	0.09	0.04	0.18	0.13	0.18	0.21 *	0.19	0.06	0.28 **	0.10	0.40 **	0.23 *	0.35 **	0.97									
23			T2	−0.17	−0.04	0.04	0.11	0.16	0.13	−0.03	0.16	0.09	0.08	0.15	0.11	0.19 *	0.02	0.00	0.10	0.21 *	0.17	0.25 **	0.50 **	0.32 **	0.49 **	0.93								
24			T3	−0.10	−0.12	0.01	0.09	0.13	0.25 **	0.04	0.09	0.08	−0.06	0.17	0.10	0.08	0.02	0.14	−0.05	0.22 *	0.04	0.32 **	0.29 **	0.51 **	0.62 **	0.60 **	0.91							
25	Well-being	WE	T1	0.43 **	0.42 **	0.22 **	0.25 **	0.31 **	0.22 *	0.15	0.16	0.26 **	−0.41 **	−0.24 *	−0.26 **	0.18	−0.25 **	−0.12	−0.15	−0.18	−0.12	0.27 **	0.38 **	0.29 **	−0.02	0.21 *	−0.01	0.98						
26			T2	0.30 **	0.44 **	0.25 **	0.20 *	0.31 **	0.25 **	0.12	0.21 *	0.22 *	−0.37 **	−0.26 **	−0.21 *	0.04	−0.18	−0.18	−0.11	−0.03	−0.02	0.35 **	0.57 **	0.42 **	0.12	0.37 **	0.11	0.75 **	0.96					
27			T3	0.26 **	0.39 **	0.28 **	0.26 **	0.39 **	0.41 **	0.29 **	0.24 *	0.30 **	−0.43 **	−0.29 **	−0.26 **	0.08	−0.22 *	−0.19 *	−0.17	−0.19	−0.16	0.29 **	0.43 **	0.53 **	0.04	0.24 *	0.13	0.67 **	0.72 **	0.97				
28	Ill-being	ABQ	T1	−0.62 **	−0.42 **	−0.34 **	−0.34 **	−0.35 **	−0.28 **	−0.24 *	−0.20 *	−0.28 **	0.62 **	0.41 **	0.31 **	0.39 *	0.31 **	0.19 *	0.36 **	0.29 **	0.17	−0.25 **	−0.19 *	−0.31 **	0.12	0.03	0.04	−0.53 **	−0.40 **	−0.34 **	0.99			
29			T2	−0.35 **	−0.50 **	−0.43 **	−0.30 **	−0.37 **	−0.30 **	−0.19 *	−0.16	−0.29 **	0.35 **	0.49 **	0.43 **	0.08	0.37 **	0.40 **	0.15	0.27 **	0.06	−0.27 **	−0.38 **	−25 **	−0.07	−0.20 *	0.03	−0.48 **	−0.55 **	−0.50 **	0.57 **	0.90		
30			T3	−0.24 **	−0.37 **	−0.42 **	−0.19 **	−0.30 **	−0.48 **	−0.15	−0.19 *	−0.38 **	0.36 **	0.32 **	0.53 **	0.17	0.30 **	0.56 **	0.26 **	0.31 **	0.39 **	−0.18	−0.32 **	−0.51 **	−0.12	−0.13	−0.11	−0.35 **	−0.40 **	−0.48 **	0.42 **	0.62 **	0.92	
31	GCO	AUT	T1	0.05	0.09	0.09	0.12	0.05	0.27 **	0.21 *	0.26 **	0.30 **	−0.09	0.03	0.11	0.09	0.07	−0.26 *	0.01	−0.07	−0.07	0.20 *	0.34 **	0.27 **	0.29 **	0.13	0.18	0.12	0.21 *	0.16	0.02	0.00	−0.17	0.78	
32		CON	T1	−0.01	0.03	0.01	0.26 **	0.20 *	0.30 **	0.12	0.09	0.22 *	0.06	0.10	0.17	05	−0.07	−0.20 *	0.13	0.13	0.02	0.26 **	0.32 **	0.32 **	0.33 **	0.24	0.28 **	0.18	0.30 **	0.28 **	−0.18	0.20 *	−0.31 **	0.46 **	0.75

Note: WE = Work Engagement; AM = Autonomous Motivation; CM = Controlled Motivation; T1 = Time one; T2 = Time two; T3 = Time three; AUT = Autonomous Causality Orientation; CON = Controlled Causality Orientation; N = 110 (list-wise deletion); ** $p < 0.001$ *(two-tailed);* * $p < 0.05$ *(two-tailed).*

3.2. Measurement Invariance

We followed the generally accepted thresholds on the fit index (i.e., CFA $\geq$ 0.95; NNFI/TLI $\geq$ 0.93; RMSEA $\leq$ 0.05; SRMR $\leq$ 0.10) for CFA tests, according to Hooper et al. (2008). As a result (Table 3), satisfactory multi-group CFA results for metric invariance (see Table 3) were obtained for all the variables across the three times. In addition, nested model comparison results showed that the assumptions of metric invariance were met for all variables.

Table 3. Model Fit Index for Multi-group CFA Testing Metric Invariance for All the Measurements across the Three Times.

	Model Fit Index	χ^2	*df*	CFI	TLI	RMSEA	SRMR
Work Motivation	Autonomous Motivation	547.56	30	0.95	0.95	0.09	0.13
	Controlled Motivation	1348.62	135	0.96	0.96	0.06	0.10
Needs Satisfaction	Autonomy	312.03	18	0.98	0.98	0.06	0.07
	Competence	219.73	18	0.996	0.997	0.02	0.09
	Relatedness	347.70	18	0.96	0.97	0.08	0.08
Needs Frustration	Autonomy	296.51	45	0.96	0.96	0.04	0.08
	Competence	245.48	18	1.00	1.00	0.00	0.10
	Relatedness	260.25	45	0.91	0.92	0.06	0.10
Well-being	Work Engagement	3993.11	408	0.95	0.95	0.07	0.08
Ill-being	ABQ	2090.22	315	0.96	0.95	0.08	0.10

Note: N = 110 across T1 to T3.

3.3. Multivariate Latent Growth Curve Modelling

Multivariate Latent Growth Curve Modelling ("LGM"; von Soest and Hagtvet 2011) was run in Mplus 7.0 (Muthén and Muthén 2012) for growth analysis in this study. We relied on SEM operationalization to test the proposed linear temporal hypotheses. No growth trajectories were hypothesized and tested since dynamics of contextual level motivation at work are somewhat episodic and domain-dependent, and there were no significant deviations (for example, changes in the executive team; potential mergers and acquisitions; launches of new products/services) from organizations' regular operations noticed in our longitudinal dataset.

Parallel LGM models were run to regress the latent change score of the satisfaction and frustration of basic psychological needs for autonomy, competence, and relatedness on the intercept and slope of employees' well/ill-being for their hypothesized temporal relationships (H1 and H2).

LGM results (Table 4) showed that the change (slope) in employees' well-being was positively predicted by the change (slope) in satisfaction of needs for autonomy (β = 0.90, $p < 0.001$) and competence (β = 1.09, $p < 0.001$) across the three times (H1). At the same time, the change (slope) in employees' ill-being was positively predicted by the change (slope) in the frustration of needs for autonomy (β = 0.94, $p < 0.001$), relatedness (β = 1.09, $p < 0.001$), and competence (β = 1.24, $p < 0.001$) across the three times (H2). In addition, the changes (slopes) in well-being and ill-being were negatively correlated at the within-person level across the three times for autonomy ($r = -0.68$; $p < 0.001$) and competence ($r = -0.63$, $p < 0.001$) needs. It also showed that the initial level (intercepts) of ill-being was negatively related to the changes (slope) in the frustration of needs for autonomy ($\beta = -0.37$, $p < 0.05$) and competence ($\beta = -0.53$, $p < 0.001$), which means that individuals with higher starting levels of ill-being tended to experience a decrease in the perceived frustration of needs for autonomy and competence over time. There was also a negative coefficient ($\beta = -0.51$, $p < 0.001$) between the intercept of the need satisfaction for autonomy and the change in well-being, which showed that employees with higher starting levels of perceived needs satisfaction of autonomy were more likely to experience a decrease in change of well-being over time.

Table 4. Parameter Estimates for LGM Models: Needs Satisfaction/Frustration and Well-being/Ill-being.

	Autonomy Need			Competence Need			Relatedness Need		
	Estimate	**S.E.**	***p***	**Estimate**	**S.E.**	***p***	**Estimate**	**S.E.**	***p***
Mean Levels									
Intercept $_{Needs\_S}$	4.43 **	0.08	0.000	5.50 **	0.08	0.000	4.94 **	0.08	0.000
Intercept $_{Needs\_F}$	3.66 **	0.11	0.000	4.17 **	0.11	0.000	3.01 **	0.11	0.000
Intercept $_{well}$	5.02 **	0.10	0.000	4.97 **	0.10	0.000	4.97 **	0.12	0.000
Intercept $_{Ill}$	2.39 **	0.05	0.000	2.38 **	0.06	0.000	2.38 **	0.06	0.000
Slope $_{Well}$	−0.004	0.04	0.93	−0.01	0.04	0.92	−0.01	0.04	0.86
Slope $_{Ill}$	−0.04	0.03	0.12	−0.04	0.03	0.13	−0.04	0.03	0.13
Slope $_{Needs\_S}$	0.007	0.07	0.92	−0.05	0.07	0.46	−0.04	0.05	0.40
Slope $_{Needs\_F}$	−0.03	0.06	0.64	−0.11	0.07	0.11	−0.08	0.06	0.22
Variances									
Intercept $_{Needs\_S}$	0.40 **	0.07	0.000	0.38 **	0.08	0.000	0.16 *	0.04	0.000
Intercept $_{Needs\_F}$	0.69 **	0.12	0.000	0.43 *	0.09	0.000	0.48 **	0.11	0.000
Intercept $_{Well}$	0.74 **	0.12	0.00	0.77 **	0.12	0.000	0.76 **	0.12	0.000
Intercept $_{Ill}$	0.15 **	0.03	0.000	0.15 **	0.03	0.000	0.13 **	0.03	0.000
Slope $_{Well}$	0.03	0.02	0.13	0.03	0.02	0.13	−0.02	0.02	0.41
Slope $_{Ill}$	−0.05 **	0.01	0.00	0.04 *	0.01	0.005	0.04 *	0.02	0.01
Slope $_{Needs\_S}$	0.02	0.03	0.36	−0.01	0.04	0.75	0.01	0.02	0.64
Slope $_{Needs\_F}$	0.02	0.02	0.51	−0.03	0.03	0.36	0.06	0.04	0.18
Correlations									
Intercept $_{Needs\_S}$ ⟷ Intercept $_{Needs\_F}$	−0.84 **	0.07	0.000	−0.40 *	0.12	0.001	−0.14 *	0.04	0.002
Intercept $_{Needs\_S}$ ⟷ Intercept $_{ill}$	−0.72 **	0.08	0.000	−0.58 **	0.09	0.000	−0.07 *	0.02	0.001
Intercept $_{Well}$ ⟷ Intercept $_{Needs\_F}$	−0.48 **	0.09	0.000	−0.28 **	0.11	0.009	−0.12	0.08	0.115
Intercept $_{Well}$ ⟷ Intercept $_{Needs\_S}$	0.56 **	0.10	0.000	0.45 **	0.11	0.000	0.14 *	0.05	0.005
Intercept $_{ill}$ ⟷ Intercept $_{Needs\_F}$	0.79 **	0.10	0.000	0.56 **	0.12	0.000	0.16 **	0.04	0.000
Slope $_{ill}$ ⟷ Slope $_{Well}$	−0.68 **	0.14	0.000	−0.63 *	0.19	0.001	−0.02	0.01	0.119
Coefficients									
Intercept $_{Needs\_S}$ ⟶ Slope $_{Well}$	−0.51 **	0.12	0.000	−0.11	0.19	0.57	−1.28	0.88	0.15
Intercept $_{Needs\_F}$ ⟶ Slope $_{Ill}$	−0.37 **	0.12	0.002	−0.53 **	0.12	0.000	−0.67	0.67	0.33
Intercept $_{Well}$ ⟶ Slope $_{Needs\_S}$	−0.29 *	0.13	0.020	−0.17	0.15	0.27	−0.64	1.28	0.62
Intercept $_{Ill}$ ⟶ Slope $_{Needs\_F}$	−0.49 **	0.11	0.000	−0.28 *	0.13	0.03	−0.46 *	0.25	0.05
Slope $_{Needs\_S}$ ⟶ Slope $_{Well}$ (H1)	0.90 **	0.11	0.000	1.09 **	0.29	0.000	0.82	0.58	0.16
Slope $_{Needs\_F}$ ⟶ Slope $_{Ill}$ (H2)	0.94 **	0.08	0.000	1.09 **	0.11	0.45	1.24 *	0.49	0.01

Note: Needs_S = Needs Satisfaction; Needs_F = Needs Frustration; well = Well-being; ill = Ill-being; * $p < 0.05$; ** $p < 0.001$ *(two-tailed)*.

At the same time, the intercepts of the satisfaction of the basic needs for autonomy ($r = 0.56$; $p < 0.001$), relatedness ($r = 0.14$; $p < 0.05$), and competence ($r = 0.45$; $p < 0.001$) and employees' well-being were positively correlated, which implied that a higher starting level of needs satisfaction tends to be associated with a higher starting level of self-reported subjective well-being at work. Similarly, the same correlational patterns existed between the intercepts of perceived needs frustration of autonomy ($r = 0.79$; $p < 0.001$), relatedness ($r = 0.56$; $p < 0.001$), and competence ($r = 0.16$; $p < 0.001$) and employees' ill-being part of the dual-path model. The two paths being "symmetrical" could be understood as confirming the parallel dual path of employees' psychological health (i.e., well-being vs. ill-being) related to both starting level and changes in basic needs satisfaction and frustration independently at work.

In summary, H1 was supported for the basic psychological needs satisfaction of autonomy and competence, and H2 was supported for the basic needs frustration of autonomy, relatedness, and competence in the proposed dual-path change model.

Parallel LGM models were then run to regress the latent change scores of the perceived satisfaction and frustration of basic psychological needs for autonomy, competence, and relatedness on the intercepts and slopes of employees' autonomous and controlled work motivation for their hypothesized temporal relationships (H3 and H4).

See Table 5 for detailed parameters estimation of LGM testing H3 and H4. H3 and H4 were not supported as no significant coefficients were identified between the changes (slopes) of autonomy, relatedness, and competence needs satisfaction/frustration and the change (slope) in autonomous/controlled work motivation. However, the intercept of competence needs frustration positively correlated with the change of controlled motivation ($r = 0.08$, $p < 0.05$), which showed that employees with a higher starting level of competence needs frustration were likely to show an increased level of controlled motivation at work across times.

Table 5. Parameter Estimates for LGM Models: Needs Satisfaction/Frustration and Autonomous/Controlled Motivation.

	Autonomy Need			Competence Need			Relatedness Need		
	Estimate	**S.E.**	***p***	**Estimate**	**S.E.**	***p***	**Estimate**	**S.E.**	***p***
Mean Levels									
Intercept $_{Needs\_S}$	4.43 **	0.08	0.000	5.50 **	0.08	0.000	4.96 **	0.06	0.000
Intercept $_{Needs\_F}$	3.72 **	0.10	0.000	4.26 **	0.10	0.000	3.02 **	0.10	0.000
Intercept $_{Auto\_M}$	4.87 **	0.10	0.000	4.87 **	0.10	0.000	4.86 **	0.09	0.000
Slope $_{Auto\_M}$	−0.03	0.06	0.54	−0.03	0.06	0.57	−0.03	0.06	0.60
Intercept $_{Contr\_M}$	4.37 **	0.09	0.000	4.36 **	0.09	0.000	4.36 **	0.09	0.000
Slope $_{Contr\_M}$	−0.03	0.04	0.51	−0.03	0.04	0.54	−0.03	0.04	0.57
Slope $_{Needs\_S}$	−0.00	0.05	0.93	−0.02	0.06	0.71	−0.02	0.06	0.72
Slope $_{Needs\_F}$	−0.09	0.06	0.12	−0.21 *	0.06	0.001	−0.04	0.17	0.81
Variances									
Intercept $_{Needs\_S}$	0.41 **	0.09	0.000	0.42 **	0.10	0.000	0.16 *	0.05	0.002
Intercept $_{Needs\_F}$	0.66 **	0.13	0.000	0.34 *	0.10	0.001	0.66 *	0.19	0.001
Intercept $_{Auto\_M}$	0.31	0.24	0.19	0.41 **	0.11	0.000	0.38 **	0.10	0.000
Intercept $_{Contr\_M}$	0.30 *	0.15	0.04	0.41 *	0.15	0.008	0.55 **	0.11	0.000
Slope $_{Auto\_M}$	−0.06	0.10	0.54	0.09	0.06	0.14	0.03	0.03	0.41
Slope $_{Contr\_M}$	−0.13	0.08	0.10	−0.04	0.06	0.50	0.00	0.01	0.97
Slope $_{Needs\_S}$	0.06 *	0.03	0.03	−0.001	0.04	0.98	0.01	0.02	0.67
Slope $_{Needs\_F}$	0.11 *	0.05	0.03	−0.007	0.05	0.87	0.16	0.10	0.12
Correlations									
Intercept $_{Needs\_S}$ ⟷ Intercept $_{Needs\_F}$	−0.51 **	0.12	0.000	−0.13	0.07	0.06	−0.63 *	0.20	0.002
Intercept $_{Needs\_F}$ ⟷ Intercept $_{Auto\_M}$	−0.17	0.09	0.10	−0.09	0.08	0.27	−0.42 *	0.17	0.017
Intercept $_{Auto\_M}$ ⟷ Intercept $_{Needs\_S}$	0.20 *	0.07	0.007	0.29 **	0.09	0.001	0.56 **	0.16	0.000
Intercept $_{Auto\_M}$ ⟷ Intercept $_{Contr\_M}$	0.40 **	0.05	0.000	0.16	0.09	0.08	0.48 *	0.16	0.003
Intercept $_{Needs\_F}$ ⟷ Intercept $_{Contr\_M}$	0.17	0.09	0.06	0.17 *	0.08	0.03	0.13	0.10	0.19
Slope $_{Needs\_S}$ ⟷ Slope $_{Needs\_F}$	−0.07 *	0.05	0.01	0.02	0.03	0.62	0.41	1.24	0.74
Slope $_{Auto\_M}$ ⟷ Slope $_{Contr\_M}$	−0.01	0.03	0.67	−0.01	0.02	0.72	−6.51	92.63	0.94
Intercept $_{Needs\_F}$ ⟷ Slope $_{Auto\_M}$	0.07	0.05	0.17	−0.003	0.04	0.94	0.04	0.11	0.91
Intercept $_{Needs\_S}$ ⟷ Slope $_{Contr\_M}$	−0.08	0.06	0.18	0.03	0.08	0.72	−0.09	−0.24	0.81
Intercept $_{Needs\_S}$ ⟷ Slope $_{Auto\_M}$	0.03	0.05	0.60	0.04	0.04	0.21	4.19	59.02	0.97
Intercept $_{Needs\_F}$ ⟷ Slope $_{Contr\_M}$	0.08 *	0.04	0.05	0.07	0.05	0.13	−2.84	39.37	0.34
Coefficients									
Slope $_{Needs\_S}$ ⟶ Slope $_{Auto\_M}$ (H3)	0.09	0.34	0.79	0.94	0.53	0.07 †	0.82	0.38	0.22
Slope $_{Needs\_F}$ ⟶ Slope $_{Contr\_M}$ (H4)	0.16	0.21	0.44	−0.40	0.53	0.45	0.14	1.92	0.94

Note: Needs_S = Needs Satisfaction; Needs_F = Needs Frustration; Auto_M =Autonomous Motivation; Contr_M = Controlled Motivation; * $p < 0.05$; ** $p < 0.001$; † $p < 0.10$ *(two-tailed)*.

In the correlational results (Table 5), the initial level (intercept) of employees' autonomous work motivation was positively correlated with the initial level (intercept) of the satisfaction of basic needs for autonomy ($r = 0.20$, $p < 0.05$), competence ($r = 0.29$, $p < 0.001$), and relatedness ($r = 0.56$, $p < 0.001$). Intercepts between needs satisfaction and frustration of autonomy ($r = -0.51$, $p < 0.001$) and relatedness ($r = -0.63$, $p < 0.05$) were also negatively correlated. At the same time, intercepts between autonomous work motivation and controlled work motivation were positively correlated for the needs of autonomy ($r = 0.40$,

$p < 0.001$) and relatedness ($r = 0.48$, $p < 0.05$). These non-change correlational patterns were fully consistent with past cross-sectional research evidence under SDT framework (Ryan and Deci 2017).

Parallel LGM models were run to regress the latent change score of perceived satisfaction and frustration of basic psychological needs for autonomy, competence, and relatedness to employees' well/ill-being via their autonomous/controlled work motivation to test the indirect dual paths (H5 and H6).

Results (Table 6) showed insignificant coefficients for the change in autonomous motivation on the relationship between the changes in satisfaction for all three needs of autonomy, competence, and relatedness. Moreover, coefficients between the changes in autonomous work motivation and employee well-being were not significant either. At the same time, the coefficients for controlled work motivation on the relationship between the changes in the frustration of all three needs were insignificant, and the coefficients between the change in employee ill-being and controlled motivations were insignificant, too. Hence, H5 and H6 were not supported in this study.

The results also showed that the changes in needs satisfaction of competence ($\beta = 0.69$, $p < 0.01$) positively predict positive changes in employees' autonomous work motivation. Hence, H3 was only partially supported in the results. The significant path across the three basic needs was the positive coefficient between the change in basic needs frustration of autonomy ($\beta = 0.90$, $p < 0.05$), competence ($\beta = 0.94$, $p < 0.05$), as well as relatedness ($\beta = 0.84$, $p < 0.05$) and the change in employees' ill-being. This path was again confirmed for H2 in the indirect dual-path model testing results.

Table 6. Parameter Estimates for LGM Models: Indirect Path Models.

	Autonomy Need			Competence Need			Relatedness Need		
	Estimate	**S.E.**	***p***	**Estimate**	**S.E.**	***p***	**Estimate**	**S.E.**	***p***
Mean Levels									
Intercept $_{Needs\_S}$	4.41 **	0.09	0.000	5.50 **	0.08	0.000	4.96 **	0.06	0.000
Slope $_{Needs\_S}$	−0.01	0.05	0.98	−0.05	0.07	0.46	−0.05	0.04	0.18
Intercept $_{Needs\_F}$	3.72 **	0.11	0.000	4.25 **	0.10	0.000	3.05 **	0.10	0.000
Slope $_{Needs\_F}$	−0.09	0.06	0.11	−0.19	0.06	0.11	−0.14 *	0.06	0.01
Intercept $_{Auto\_M}$	4.86 **	0.09	0.000	4.86 **	0.10	0.000	4.85 **	0.09	0.000
Intercept $_{Contr\_M}$	4.36 **	0.10	0.000	4.35 **	0.09	0.000	4.35 **	0.09	0.000
Intercept $_{Well}$	5.00 **	0.10	0.000	5.00 **	0.10	0.000	5.01 **	0.10	0.000
Intercept $_{Ill}$	2.43 **	0.05	0.000	2.44 **	0.05	0.000	2.44 **	0.05	0.000
Slope $_{Auto\_M}$	−0.03	0.05	0.64	0.01	0.06	0.88	0.06	0.08	0.45
Slope $_{Contr\_M}$	−0.01	0.05	0.89	0.00	0.06	0.99	−0.01	0.06	0.87
Slope $_{Well}$	−0.06	0.17	0.72	0.03	0.06	0.61	0.10	0.21	0.64
Slope $_{Ill}$	0.05	0.06	0.38	0.14	0.09	0.14	0.08	0.08	0.29
Variances									
Intercept $_{Needs\_S}$	0.58 **	0.11	0.000	0.40 **	0.09	0.000	0.16 **	0.05	0.001
Intercept $_{Needs\_F}$	0.77 **	0.14	0.000	0.49 **	0.12	0.000	0.50 **	0.11	0.000
Intercept $_{Auto\_M}$	0.44 **	0.09	0.000	0.42 **	0.09	0.000	0.38 **	0.10	0.000
Intercept $_{Contr\_M}$	0.59 **	0.11	0.000	0.57 **	0.11	0.000	0.57 **	0.11	0.000
Intercept $_{well}$	0.82 **	0.13	0.000	0.79 **	0.12	0.000	0.77 **	0.12	0.000
Intercept $_{ill}$	0.22 **	0.04	0.000	0.19 **	0.03	0.000	0.18 **	0.04	0.000
Slope $_{Needs\_S}$	0.10 *	0.03	0.003	0.09 *	0.04	0.016	0.02	0.02	0.24
Slope $_{Needs\_F}$	0.08	0.05	0.07	0.10	0.06	0.08	0.06	0.04	0.15
Slope $_{Auto\_M}$	−0.02	0.03	0.56	−0.03	0.03	0.44	−0.02	0.04	0.54
Slope $_{Contr\_M}$	0.03	0.03	0.41	0.04	0.03	0.19	0.04	0.03	0.26
Slope $_{well}$	0.08	0.18	0.65	−0.03	0.04	0.43	0.02	0.11	0.83
Slope $_{ill}$	−0.02	0.03	0.47	−0.05	0.04	0.17	−0.00	0.02	0.92

Table 6. *Cont.*

	Autonomy Need			Competence Need			Relatedness Need		
	Estimate	**S.E.**	***p***	**Estimate**	**S.E.**	***p***	**Estimate**	**S.E.**	***p***
Correlations									
Slope $_{Needs\_S}$ ⟷ Intercept $_{Needs\_S}$	−0.12 *	0.05	0.01	−0.03	0.04	0.40	0.002	0.02	0.92
Intercept $_{Needs\_F}$ ⟷ Intercept $_{Needs\_S}$	−0.54 **	0.11	0.001	−0.22 *	0.07	0.002	0.11 *	0.05	0.05
Intercept $_{Needs\_F}$ ⟷ Slope $_{Needs\_S}$	0.08	0.05	0.09	0.08	0.04	0.40	0.01	0.03	0.78
Slope $_{Needs\_F}$ ⟷ Intercept $_{Needs\_S}$	0.08 *	0.04	0.04	0.04	0.03	0.18	0.03	0.03	0.26
Slope $_{Needs\_F}$ ⟷ Slope $_{Needs\_S}$	−0.05 *	0.03	0.03	−0.05	0.03	0.06	−0.03	0.02	0.10
Slope $_{Needs\_F}$ ⟷ Intercept $_{Needs\_F}$	−0.09	0.05	0.10	−0.10	0.07	0.14	−0.02	0.04	0.57
Intercept $_{Auto\_M}$ ⟷ Intercept $_{Needs\_S}$	0.19 *	0.08	0.01	0.27 **	0.07	0.000	0.10	0.06	0.06
Intercept $_{Auto\_M}$ ⟷ Slope $_{Needs\_S}$	0.02	0.04	0.59	−0.01	0.04	0.86	0.01	0.03	0.85
Intercept $_{Auto\_M}$ ⟷ Intercept $_{Needs\_F}$	−0.24 *	0.08	0.003	−0.14 *	0.06	0.03	−0.02	0.07	0.82
Intercept $_{Auto\_M}$ ⟷ Slope $_{Needs\_F}$	−0.02	0.03	0.42	−0.03	0.03	0.91	0.01	0.03	0.75
Intercept $_{Contr\_M}$ ⟷ Intercept $_{Needs\_S}$	−0.20 *	0.08	0.01	0.05	0.07	0.43	0.01	0.05	0.80
Intercept $_{Contr\_M}$ ⟷ Slope $_{Needs\_S}$	0.11 *	0.04	0.008	0.07	0.04	0.07	0.03	0.02	0.27
Intercept $_{Contr\_M}$ ⟷ Intercept $_{Needs\_F}$	0.19 *	0.09	0.03	0.20 *	0.08	0.01	0.21 *	0.08	0.01
Intercept $_{Contr\_M}$ ⟷ Slope $_{Needs\_F}$	−0.07 *	0.03	0.03	−0.08 *	0.04	0.05	−0.06	0.04	0.09
Intercept $_{Contr\_M}$ ⟷ Intercept $_{Auto\_M}$	0.29 **	0.08	0.000	0.25 **	0.08	0.001	0.25 **	0.08	0.001
Intercept $_{well}$ ⟷ Intercept $_{Needs\_S}$	0.40 **	0.10	0.000	0.25 *	0.08	0.002	0.12 *	0.05	0.02
Intercept $_{well}$ ⟷ Slope $_{Needs\_S}$	−0.10 *	0.05	0.03	−0.03	0.04	0.46	0.01	0.03	0.65
Intercept $_{well}$ ⟷ Intercept $_{Needs\_F}$	−0.39 **	0.10	0.000	−0.18 *	0.08	0.02	−0.11	0.08	0.18
Intercept $_{well}$ ⟷ Slope $_{Needs\_F}$	0.04	0.04	0.33	−0.001	0.03	0.96	−0.002	0.03	0.95
Intercept $_{well}$ ⟷ Intercept $_{Auto\_M}$	0.36 **	0.09	0.000	0.39 **	0.09	0.000	0.36 **	0.09	0.000
Intercept $_{well}$ ⟷ Intercept $_{Contr\_M}$	0.07	0.08	0.40	0.07	0.08	0.29	0.14	0.08	0.09
Intercept $_{ill}$ ⟷ Intercept $_{Needs\_S}$	−0.27 **	0.05	0.000	−0.15 **	0.04	0.000	−0.07 *	0.03	0.01
Intercept $_{ill}$ ⟷ Slope $_{Needs\_S}$	0.07 *	0.02	0.005	0.02	0.02	0.35	−0.004	0.01	0.76
Intercept $_{ill}$ ⟷ Intercept $_{Needs\_F}$	0.30 **	0.06	0.000	0.19 **	0.05	0.000	0.16 *	0.05	0.002
Intercept $_{ill}$ ⟷ Slope $_{Needs\_F}$	−0.06	0.03	0.053	−0.04	0.02	0.11	−0.04	0.02	0.13
Intercept $_{ill}$ ⟷ Intercept $_{Auto\_M}$	−0.13 *	0.04	0.002	−0.15 **	0.04	0.000	−0.14 **	0.04	0.001
Intercept $_{ill}$ ⟷ Intercept $_{Contr\_M}$	0.04	0.04	0.39	0.03	0.04	0.54	0.006	0.04	0.90
Intercept $_{ill}$ ⟷ Intercept $_{Well}$	−0.26 **	0.06	0.000	−0.21 **	0.05	0.000	−0.20 **	0.05	0.001
Coefficients									
Slope $_{Needs\_S}$ ⟶ Slope $_{Auto\_M}$ (H5a′)	0.13	0.23	0.56	0.69 *	0.27	0.01	1.54 †	0.80	0.06
Slope $_{Needs\_S}$ ⟶ Slope $_{Well}$ (H5c′)	0.81	0.80	0.31	0.97	0.67	0.14	2.55	4.03	0.53
Slope $_{Auto\_M}$ ⟶ Slope $_{Well}$ (H5b′)	−2.21	4.13	0.59	−0.44	1.01	0.66	−1.45	2.64	0.58
Slope $_{Needs\_F}$ ⟶ Slope $_{Contr\_M}$ (H6a′)	0.21	0.23	0.35	0.14	0.21	0.51	0.06	0.27	0.83
Slope $_{Needs\_F}$ ⟶ Slope $_{ill}$ (H6c′)	0.90 *	0.39	0.02	0.94 *	0.41	0.02	0.84 *	0.42	0.05
Slope $_{Contr\_M}$ ⟶ Slope $_{ill}$ (H6b′)	0.18	0.53	0.74	0.14	0.35	0.70	0.43	0.57	0.45

Note: Needs_S = Needs Satisfaction; Needs_F = Needs Frustration; Auto_M = Autonomous Motivation; Contr_M = Controlled Motivation; Ill = Ill-being; Well = Well-being; * $p < 0.05$; ** $p < 0$; † $p < 0.10$ *(two-tailed)*.

Next, we tested two LGM models (Tables 7 and 8) that included GCOs, work motivation, and well/ill-being. The regression results showed that employees' controlled GCO positively predicted the initial level of employees' controlled work motivation ($\beta = 0.24$, $p < 0.05$; Table 7) but not the change (slope) in employees' controlled work motivation. At the same time, employees' autonomous GCO positively predicted the initial level of autonomous motivation ($\beta = 0.24$, $p < 0.05$; Table 7) but not the change (slope) in autonomous work motivation. Hence, the results did not support H7 and H8.

The results (Table 8) showed that the intercepts of employees' well-being and ill-being were significantly correlated ($r = -0.25$, $p < 0.001$). They also showed that employees' autonomous GCO positively predicted the initial level of employee well-being ($\beta = 0.22$, $p < 0.05$; Table 8) but not the change (slope) in employee well-being, which means that employees with higher levels of autonomous GCO often have higher initial levels of well-being to start. On the other hand, employees' controlled GCO did not predict the initial level of employee ill-being or the change (slope) of employee ill-being ($r = -0.05$, *n.s.*). As a result, H9 and H10 were not supported.

Table 9 summarized the fit statistics of all the parallel LGM models testing the integrated research model.

Table 7. Parameter Estimates for LGM Models: GCO and Motivation.

	Parameter Estimate	S.E.	*p*
Mean Levels			
Intercept $_{Auto\_M}$	3.70 **	0.53	0.000
Slope $_{Auto\_M}$	−0.22	0.33	0.52
Intercept $_{Contr\_M}$	3.31 **	0.46	0.000
Slope $_{Contr\_M}$	0.11	0.23	0.64
Auto_GC	4.89 **	0.09	0.000
Contr_GC	4.41 **	0.08	0.000
Variances			
Intercept $_{Auto\_M}$	0.16	0.17	0.35
Slope $_{Auto\_M}$	−0.13	0.10	0.21
Intercept $_{Contr\_M}$	0.28	0.15	0.06
Slope $_{Contr\_M}$	−0.08	0.08	0.34
Auto_GC	0.76 **	0.10	0.000
Contr_GC	0.71 **	0.10	0.000
Correlations			
Intercept $_{Auto\_M}$ ⟷ Intercept $_{Contr\_M}$	0.04	0.12	0.74
Slope $_{Auto\_M}$ ⟷ Slope $_{Contr\_M}$	−0.07	0.07	0.14
Intercept $_{Auto\_M}$ ⟷ Slope $_{Auto\_M}$	0.14	0.11	0.22
Intercept $_{Contr\_M}$ ⟷ Slope $_{Auto\_M}$	0.10	0.08	0.24
Intercept $_{Auto\_M}$ ⟷ Slope $_{Contr\_M}$	0.11	0.07	0.14
Intercept $_{Contr\_M}$ ⟷ Slope $_{Contr\_M}$	0.14	0.08	0.11
Coefficients			
Auto_GC ⟶ Slope $_{Auto\_M}$ (H7)	0.04	0.07	0.57
Auto_GC ⟶ Intercept $_{Auto\_M}$	0.24 *	0.11	0.03
Contr_GC ⟶ Slope $_{Contr\_M}$ (H8)	−0.03	0.05	0.55
Contr_GC ⟶ Intercept $_{Contr\_M}$	0.24 *	0.10	0.02

Note: Auto_M = Autonomous Motivation; Contr_M = Controlled Motivation; Auto_GC = Autonomous General Causality; Contr_GC = Controlled General Causality; * $p < 0.05$; ** $p < 0$ *(two-tailed)*.

Table 8. Parameter Estimates for LGM Models: GCO and Well/Ill-being.

	Parameter Estimate	S.E.	*p*
Mean Levels			
Intercept $_{well}$	3.93 **	0.49	0.000
Slope $_{well}$	−0.005	0.23	0.98
Intercept $_{ill}$	2.64 **	0.22	0.000
Slope $_{ill}$	0.12	0.14	0.42
Auto_GC	4.89 **	0.09	0.000
Contr_GC	4.41 **	0.08	0.000
Variances			
Intercept $_{well}$	0.82 **	0.16	0.000
Slope $_{well}$	0.03	0.06	0.61
Intercept $_{ill}$	0.16 **	0.04	0.000
Slope $_{ill}$	0.03	0.02	0.08
Auto_GC	0.76 **	0.10	0.000
Contr_GC	0.71 **	0.10	0.000

Table 8. *Cont.*

	Parameter Estimate	S.E.	*p*
Correlations			
Intercept $_{well}$ ⟷ Intercept $_{ill}$	−0.25 **	0.06	0.000
Slope $_{well}$ ⟷ Slope $_{ill}$	−0.04	0.03	0.26
Intercept $_{well}$ ⟷ Slope $_{well}$	−0.06	0.08	0.43
Intercept $_{ill}$ ⟷ Slope $_{well}$	0.04	0.03	0.26
Intercept $_{well}$ ⟷ Slope $_{ill}$	0.04	0.04	0.32
Intercept $_{ill}$ ⟷ Slope $_{ill}$	−0.02	0.02	0.30
Coefficients			
Auto_GC ⟶ Slope $_{well}$ (H9)	0.00	0.05	0.35
Auto_GC ⟶ Intercept $_{well}$	0.22 *	0.10	0.03
Contr_GC ⟶ Slope $_{ill}$ (H10)	−0.05	0.05	0.27
Contr_GC ⟶ Intercept $_{ill}$	−0.05	0.05	0.35

Note: Ill = Ill-being; Well = Well-being; Auto_GC = Autonomous General Causality; Contr_GC = Controlled General Causality; * $p < 0.05$; ** $p < 0$ *(two-tailed)*.

Table 9. Summary of LGM Models Fit Statistics.

Model Types	Basic Needs	Summary of Fit Statistics			
		CFI	TLI	RMSEA	SRMR
Direct Path Model I *(Needs to Well/Ill-being)*	Autonomy	0.96	0.93	0.05	0.03
	Relatedness	0.96	0.93	0.03	0.05
	Competence	0.98	0.97	0.05	0.03
Direct Path Model II *(Needs to Motivation)*	Autonomy	0.98	0.96	0.05	0.03
	Relatedness	0.96	0.95	0.05	0.03
	Competence	0.96	0.97	0.01	0.03
Indirect Path Model *(Needs to Well/Ill-being* via *Motivation)*	Autonomy	0.98	0.97	0.04	0.03
	Relatedness	0.96	0.95	0.05	0.05
	Competence	0.96	0.96	0.04	0.02
Cross-Level Change Model	GCOs to Needs	0.98	0.97	0.06	0.07
	GCOs to Motivation	0.95	0.93	0.07	0.07

4. Discussions, Limitations, and Future Research

This study sought to investigate in the routine operations of organizations, from a dynamic perspective, whether changes in the satisfaction and frustration of basic needs for autonomy, relatedness, and competence led to changes in employees' well-being and ill-being through the changes in autonomous and controlled motivation via two distinct paths under SDT framework (Ryan and Deci 2017) and H-SDT (Vallerand 1997). At the same time, this longitudinal study also tried to move forward with the preliminary findings in some descriptive pioneer longitudinal studies (i.e., Wang and Gagné 2013; Bidee et al. 2016) to build more temporal explanations of the changes in motivation and its well/ill-being consequences at work. As a result, the LGM analyses suggested that needs satisfaction/frustration changes directly predicted the changes in employees' well-being/ill-being over a few months. Furthermore, when testing the cross-level effect of GCO (trait) predicting the changes in work motivation and employees' psychological health, the results showed that autonomous GCO positively predicted higher initial levels (intercepts) but not the changes (slopes) of autonomous work motivation and employees' subjective well-being. At the same time, controlled GCO positively predicted higher initial levels but not changes in controlled work motivation and employees' subjective ill-being. In summary, the results of this research replicated all the past cross-sectional theoretical relationships among the testing variables but only confirmed limited temporal relationships in our proposed research model.

From a theoretical standpoint, the results of this study suggested that dynamic relationships among different dimensions of employee work motivation and psychological health may be more complex as they did not unfold as expected in this empirical study, that is, as linear stable temporal change relations. It was also possible that other factors may intervene in these temporal relationships, such as a lack of dramatic organizational transformation or market changes, in which both contextual/situational factors could interact to initiate and sustain changes in employee motivation differently (e.g., at different acceleration or deceleration in changes). Of note, in this field study, the change in employees' autonomous motivation was found to be positively predicted by the change in their needs satisfaction for competence ($\beta = 0.94$, marginal as $p < 0.10$ in Table 5; $\beta = 0.69$, $p < 0.05$ in Table 6) but not the need satisfaction for autonomy and relatedness in this specific dataset.

The concepts and measurements of needs satisfaction and frustration were cross-culturally validated as universal (Chen et al. 2015; Nishimura and Suzuki 2016). However, individual beliefs and values of employees in different cultures at different times could still magnify their perceptions of different contextual settings and social interactions occurring within organizations, which may result in different motivation and motivational outcomes. As this field study was conducted in several small Chinese private businesses in the consumer product retail industry, other possible explanations could be that a highly performance-oriented and collectivistic organizational culture may make employees more sensitive to organizational cues (pay-for-performance reward policies) to satisfy their needs for competence. At the same time, it may also result from low sensitivity to organizational cues to satisfy the needs for autonomy and relatedness in a traditional collectivistic society, such as China. Although complex within-person psychosocial phenomena are difficult to disentangle theoretically and practically, their empirical investigation requires simultaneously considering both temporal (i.e., time) and spatial (i.e., culture) dimensions. Therefore, future cross-cultural longitudinal studies are warranted to examine the effects of individual/national cultural values on the motivational and psychological consequences resulting from satisfaction/frustration of the three basic psychological needs over time.

It should also be noted that a large percentage of varieties of the changes (slopes) calculated for the variables were not significant in the LGM results, suggesting an absence of significant linear changes in major variables during the measurement period (three to four months). This study is one of the preliminary explanatory longitudinal studies using SDT and H-SDT in this particular temporal pattern (months) with no strategic organizational changes during the data collection period. An absence of linear change variances suggests that future research may need to include more temporal intervals (i.e., days, weeks) with targeted organizational changes (i.e., the launch of a new product or service; execution of merger or acquisition), conditions, or other nonlinear complex research design and data analysis plans. In addition, research during a more extended period (years) may also need to capture widespread temporal variances and ecological data to test more complex hypotheses (e.g., nonlinear temporal relations among multiple measurements of critical variables across different measurement/testing levels). At the same time, conceptual levels of different types of work motivation (e.g., situational vs. contextual vs. global levels) also need to be carefully planned and measured at different times (frequencies) to incorporate all possible change parameters. For example, in future research, multiple synchronized/asynchronized frequencies could be applied when using the situational, contextual, and global measurements of work motivation, needs satisfaction/frustration, and psychological health across time; additionally, asynchronized frequencies can then be compared to understand possible nonlinear (i.e., chaotic) progressions.

One critical theoretical speculation out of the findings in this study confirmed that there could be nonlinear dynamic patterns when studying motivation from within-person perspectives (Navarro and Arrieta 2010). Under the calling to use nonlinear and dynamic approaches to organizational behavior research (Navarro et al. 2020), human motivation may follow a chaotic pattern, simultaneously demonstrating irregular and deterministic characteristics according to the chaos theory (Guastello et al. 2008). Researchers used the analytic

methodologies derived from chaos theory (i.e., recurrence plots, Lyapunov exponents, correlation dimension) to analyze human motivation and behaviors (i.e., Guastello et al. 2017). Navarro and Arrieta (2010) captured the changes in employees' self-reported work motivation to be 75% chaotic patterns (only 2.08% linear pattern, 6.25% at random), with more than 100 experiential sampling recordings of each participant (forty-eight participants reporting six times per day over twenty working days). SDT research accumulated longitudinal research in the past decade. However, empirical evidence supported that personal motivation profiles (Fernet et al. 2020) were relatively stable within a short period (i.e., months). At the same time, increasing longitudinal within-person inquiries had not confirmed the between-person findings (i.e., Bidee et al. 2016; Hogenelst et al. 2020) according to the current SDT framework. Similar to the non-significant results in this study, Hogenelst et al. (2020) used within-person experiential sampling methods and found no significant change in relations between work motivation and job performance at the within-person level. These research findings focused on the dynamics of motivation have been non-compliant with our past understanding of motivation patterns at the contextual (between-person) level. Hence, they indicated the need to discover work motivation as a complex psychological mechanism using the nonlinear and dynamic approach to engage more ecological data and nonlinear analytical methodologies in future studies.

From a practical standpoint, the results indicate that organizations must actively and intentionally avoid situations and prevent social interactions in which such basic needs could be thwarted, as such situations/interactions will lead to the deterioration of their employees' psychological and physical engagement at work overtime. In other words, organizations should actively adopt preventive measures against needs-thwarting contexts and social interactions, such as abusive supervision, lack of resources to complete work tasks, excessively tight deadlines that minimize feelings of competence, and social isolation among co-workers. At the same time, needs-supportive environments, including autonomy-supportive leadership, an inclusive work environment, and evidence-based and constructive performance feedback, should be established to promote employee well-being and organizational effectiveness. Findings on the trait level of autonomous GCO predicted initial levels of autonomous motivation at work and employee well-being over a short time (i.e., four months). These results could help organizations if they were to use GCO as a possible selection and development criterion to form effective talent acquisition/selection policies and human resource development (HRD) strategies. In addition, the assessment of GCO could also be used in leadership training and coaching within companies to help line up talent pools for better strategic human capital development results at the organizational level.

This study, of course, is not without its limitations. For example, even though latent growth modeling techniques were used to establish the temporal relationship among variables, experimental studies are still needed to establish direct causal relationships. Another limitation was the organizational context in which the data was collected: employees working for Chinese private organizations could have collectivistic and performance-oriented values and perceptions, making it challenging to generalize cross-nationally or cross-culturally. Finally, sample sizes from T1 to T3 were relatively small for the more sophisticated statistical modeling methods (i.e., latent profile/class analysis; Muthén 2002). At the same time, the small sample size also negatively affects the statistical power of factorial analysis (van Voorhis and Morgan 2007). These limitations likely hinder the generalizability of the results.

SDT proposes a complex theoretical framework that values supporting basic psychological needs as the essential nutrients for people's well-being (Deci and Ryan 2000; Ryan and Deci 2000) as well as a dimensional motivation model that can incorporate both quality and quantity of motivation (Ryan and Deci 2017; Gagné and Deci 2005). Again, research evidence from recent longitudinal investigations using SDT has called for the extension of the theory to incorporate the critical element of "time" (i.e., temporal changes; Shipp and Cole 2015) in order to explain further the factors, formulas, processes, and

patterns of changes in human cognition and behavior at work. When integrating the findings of our studies, we found that the results of our studies could extend some aspects of the theoretical understanding of the change process of motivation at work under the SDT framework. Within-person variations in different types of work motivation again confirmed the possibilities for changes in motivation in continuous work contexts; basic psychological needs acted as the gateway to initiate different changes (e.g., "internalization" vs. "externalization") in motivation when people were engaged in different tasks across domains. In order for the motivational changes to occur, personal (e.g., traits such as GCO), domain-specific contextual, and temporal (e.g., different perceptions of temporal urgency/depth/influence, speed/direction of change according to time) factors may all react together to fuel human behavior as a means for humans to thrive in the workplace.

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