THE IMPACT OF LOCKDOWN IN EMOTION AND BEHAVIOR USING TIME SERIES:

Distress, Depression and Anxious Arousal

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UNIVERSITAT JAUME·I

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Report presented by Patricia FlorArasil to apply for a Doctor Degree at the Jaume I University.

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"*Man is by nature a social animal; an individual who is unsocial naturally and not accidentally is either beneath our notice or more than human. Society is something that precedes the individual. Anyone who either cannot lead the common life or is so self-sufficient as not to need to, and therefore does not partake of society, is either a beast or a god.*"

— Aristotle, *Politics*

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ABSTRACT

The COVID-19 lockdown that struck Spain during March 2020 ended up with a period of 60 days of lockdown, a natural context where to study the effects of isolation or its feeling. It is known that long periods of isolation end up causing generalized anxiety, a feeling of incomprehension, discriminatory acts, and economic problems(Mandavilli, 2003; Risse, 1992; Twu et al., 2003). Therefore, it seems important to study in depth the consequences that may stem from it.

The main objective of this dissertation is to analyze the evolution and impact on mood when under lockdown and confined. The MASQE30 Questionnaire (González & Ibáñez, 2018) is included in the daily diary registration, where other factors that may be influencing a person's mood were also registered (such as activities carried out and other socio-demographic variables), with a total sample of 123 participants who completed the daily diary during a period of 20 to 45 days. Initially the main model we focused on was a three-dimensional structure of mood (Clark & Watson, 1991), understanding mood as a second order factor influenced by a person's distress, depression and anxiety. Findings suggest that a two-dimensional model is more suitable when compared to a three-dimensional model, similar to the model proposed by Watson & Tellegen (1985).

Furthermore, if at any point in the future another lockdown occurs, it is of vital importance to take into consideration the first week of this isolation period, since this is what will influence a major or minor fluctuation of a person's

mood. Statistically significant differences have been found for every factor that should be considered when talking about public health matters.

Key words: Lockdown, mood, distress, anhedonia, anxiety, panel model, time series, factorial structure

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RESUMEN EXTENDIDO

Es aparentemente conocido o sabido que las personas somos seres sociales. En pocas ocasiones las personas se desarrollan en ausencia de la sociedad, básicamente porque, al parecer, la ausencia de estímulos tiene efectos perjudiciales el desarrollo de una persona. Esto implica que la soledad o vivir aislado, implícito en ello las carencias sociales y afectivas, tiene consecuencias negativas en el crecimiento de una persona y probablemente derive en problemas cognitivos (Lee et al., 2020; Loades et al., 2020). Uno de los aspectos más complicados de la soledad o el sentimiento de soledad es la posibilidad de encontrar entornos naturales, en lugar de clínicos o controlados, para estudiar sus efectos. Sin embargo, la pandemia COVID-19 que derivó en un periodo de confinamiento de unos sesenta días aproximadamente durante marzo del año 2020 dio la posibilidad de estudiar de manera precisa los efectos anteriormente mencionados. Hasta el momento, era conocido que los periodos largos de aislamiento o confinamiento derivaban en ansiedad generalizada, sentimiento de incomprensión e incertidumbre, actos discriminatorios o de marginación social, y problemas económicos (Mandavilli, 2003; Risse, 1992; Twu et al., 2003).

El objetivo principal de la tesis doctoral es analizar la evolución y el impacto en el estado de ánimo de las personas cuando se encuentran confinadas y aisladas durante largos periodos, entendiendo el estado de ánimo como un factor de segundo orden precedido por los factores de ansiedad, optimismo y angustia. Como objetivos específicos, se realiza el análisis individual de cada uno de los factores (distrés general,

anhedonia y ansiedad somática) para observar la influencia de otras variables recogidas sobre ellos, además de llevar a cabo un estudio de su memoria temporal y proponer un modelo teórico de la estructura del estado de ánimo durante el confinamiento.

Para conseguir los objetivos planteados, se recogieron datos longitudinales a través de un registro diario durante un periodo de entre 20 y 45 días consecutivos, y 15 días posteriores a una muestra total inicial de 181 personas. La muestra se redujo a un total de 123 sujetos tras la revisión del número mínimo de 20 registros diarios cumplimentados. Un 38 % de los sujetos completó el registro durante 45 días consecutivos, otro 24 % lo completó durante un periodo de entre 40 y 44 días seguidos y, por último, el 38 % restante lo cumplimentó durante un periodo de entre 29 y 39 días consecutivos (solo el 11 % de la muestra completó menos de 30 días consecutivos el registro diario). En los datos recogidos se incluyen, además del registro diario del estado de ánimo, la versión española breve de 30 ítems del Cuestionario de Ansiedad y Depresión (MASQE30) de González e Ibáñez (2018): calidad del sueño preconfinamiento, actividad laboral considerada esencial o no, estatus marital y convivientes, actividades realizadas (tareas domésticas, lectura de libros o revistas, mirar redes sociales o la televisión, tener actividad sexual, escuchar música, jugar a juegos de mesa o de ordenador, estar al cuidado de niños o niñas o de personas dependientes, actividad física durante el día) y tiempo fuera del hogar, entre otros. A partir de los datos recogidos, se forman series temporales por cada uno de los sujetos que finalmente se

incluyen en el estudio y análisis, y estas se analizan una vez estabilizada la serie temporal, o lo que es lo mismo, una vez eliminada la tendencia.

Los resultados muestran, como era esperable, que los largos periodos de confinamiento tienen un impacto directo sobre el estado de ánimo de las personas. Aunque se ha analizado de forma independiente cada uno de los factores presentes en el instrumento utilizado, se propone un modelo teórico de dos dimensiones conforme la estructura de estado de ánimo propuesta por Watson y Tellegen (1985): un estado de ánimo en función de afecto positivo (factor original de anhedonia inversa) y afecto negativo (factores originales de distrés general y ansiedad somática).

Los principales hallazgos de la tesis doctoral incluyen la importancia de los hábitos saludables para la mejora del bienestar durante periodos largos de confinamiento. A grandes rasgos, los análisis indican que cada persona tiene su propio nivel de estado de ánimo, y que este cambia entre sujeto y sujeto. Los resultados señalan la importancia de la práctica deportiva de forma habitual en la disminución de los niveles de distrés general y anhedonia durante el confinamiento, además de la importancia de cuidar la higiene del sueño y subrayar la calidad de sueño como aspecto fundamental que se debe tener en cuenta en la estabilidad del estado de ánimo. Por otro lado, los datos parecen indicar que la compañía o con quien uno pase el confinamiento no influye en los niveles de distrés general, aunque el vivir solo sí parece tener un efecto sobre los niveles de

ansiedad, reduciéndolos. En relación con las relaciones de pareja, mantener relaciones sexuales durante los periodos de confinamiento reduce los niveles de distrés y anhedonia, y mejora el optimismo o la positividad. No obstante, en el caso de la ansiedad, el efecto parece ser mayor si se mantienen relaciones sexuales el día previo. En otras palabras, mantener relaciones sexuales en pareja ayer reduce los niveles de ansiedad hoy. En general, las mujeres tuvieron niveles de ansiedad más bajos en comparación con los hombres.

En lo referente a la progresión del estado de ánimo durante el periodo de confinamiento, parece que la memoria temporal de los datos muestra que la serie se estabiliza durante la primera semana, lo que podría indicar que las personas tienden a adaptarse relativamente rápido a estas situaciones, pudiendo ser sumamente importante lo que ocurra en esa primera semana para los niveles posteriores del estado anímico. Una propuesta futura sería el modelado de crecimiento latente de las curvas, además de analizar los efectos del modelo mixto propuesto. Por otra parte, la tesis se ha focalizado en analizar los aspectos que ocurren durante el confinamiento. Así pues, queda pendiente proseguir con los análisis de los datos recogidos en los días posteriores al final del confinamiento, y valorar el seguimiento a largo plazo.

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INTRODUCTION

1.1. General Overview: A Brief Perspective of the Current Situation and Study

It is known that humans are social beings. In rare occasions people are brought up isolated from society, basically because the latter is needed for us to grow and develop. The lack of emotional bonds and stimulation that stem from being isolated have negative consequences that can impact directly on a child's growth and very probably will lead to cognitive problems(Lee et al., 2020; Loades et al., 2020). The development issues caused by the absence of living in human society and human contact are evident: the language and social skills remain undeveloped in this type of situation (Lebrun, 1980).

Nowadays, social isolation can be understood as living alone and having poor or none social contact, as well as having poor meaningful social network ties (Holt-Lunstad et al., 2015). Having solid and strong social networks and the lack of feeling or being isolated is a protection factor for health and well-being, such as reduced mortality and a stronger immune system (Uchino, 2006). Therefore, it seems obvious that social contact is beneficial for reducing both mental and health issues.

Several situations have been observed or analyzed in relation to isolation and its impact. Apparently one of the most studied situations has been that of old people who have lost their significant other and are living in social isolation conditions. Yeh and Lo (2004)describe the difference between living alone and the feeling of being lonely through a sample of 4859 elderly

people: living alone tends to increase the perceived effect of loneliness and decrease the feeling of having social support. In short, both physical and mental issues were linked to living alone, and both social support and friendship had protective benefits in order to reduce the feeling alone sensation. Therefore the fact of being isolated and the feeling of being isolated are important factors to take into consideration (Cornwell & Waite, 2009).The impairment of cognitive functions is another aspect in which isolation has an impact. People who felt lonely or isolated also perceived having difficulties in other areas, such as mobility or risk perceptions, including the increased risk of death (Perissinotto, 2012).

Isolation or loneliness not only has an impact on cognitive functions, but also onmood and mood disorders. Depression seems to be the most probable mood disorder that is produced when somebody feels lonely or isolated, regardless of the person's social network (Golden et al., 2009). Other factors also influence on increasing depression symptoms, such as age, gender, marital status or stress. Nevertheless, feeling isolated seemed to be the most prominent influence factor (Cacioppo et al., 2006). In fact, it has been longitudinally observed that the feeling of loneliness can predict changes in depressive symptoms (Cacioppo, 2010). A debate was then opened to discuss whether loneliness caused depressive symptoms or *vice versa*.

Most of the studies described before were carried out with people over 50 years of age, since it seems to be a natural context where to study the effects of isolation. Despite the

negative impact on well-being and health that apparently being and feeling isolated has, there are also protective factors that are vital to consider. One of the most important factors in loneliness or its prevention is social support. Uchino (1996) considers social support as a multidimensional construct which has effects in behavioral processes (health), psychological processes (mood disorders such as depression) and biological processes (immune system). Social support and social bonding helps to reduce the feeling of loneliness and isolation (Rook, 1984), although new instruments or tools should be implemented in order to measure fluctuations and changes in feeling lonely and perceived social support (Routasalo et al., 2009). Furthermore, it is key to emphasize how important these elements are not only for general population but also for others such as cancer patients (Hawkley & Cacioppo, 2003; Yildirim & Kocabiyik, 2010). Fortunately nowadays technology and social networks may help to increase perceived social support and therefore reduce the impact of loneliness. Khosravi (2016) analyzed the use of technology and the impact of reducing the negative effects of living alone. He concluded that, although technology does seem to have a beneficial impact in reducing the feeling of loneliness, more studies are needed to measure its true effectiveness.

Differences between genders also have seemingly been found in isolation. Men and women seem to find social support in different ways. For instance, according to Vandervoort (2000), women tend to seek social support from friends, while men seem to look for this support in their partner and seem to feel more

lonely in contrast to women because they do not tend to have emotionally intimate relationships with others who are not their partners.

Generally speaking, a major highlight about isolation is that it has a vastly different impact on the well-being and health of a person that is or feels lonely in comparison to a person in the same situation but with social support. It is very important to take this into account in clinical practice, and therefore evaluating living alone and well-being so that measurements are not confused (Perissinotto & Covinsky, 2014).

One of the most complicated aspects when studying isolation and loneliness is using natural settings instead of clinical or controlled settings to study their effects, and this is one of the main reasons why elderly people are mostly used in studies related to loneliness. However, the COVID-19 lockdown that struck Spain during March 2020 ended up with a period of 60 days of lockdown, a natural context where to study the effects of social isolation or its feeling. Historically, It is known that long periods of isolation end up in generalized anxiety, a feeling of incomprehension, discriminatory acts, and economic problems (Mandavilli, 2003; Risse, 1992; Twu et al., 2003).

Previous literature related to confined context indicates that psychological distress seems to have a great impact on emergency situations (Cukor et al., 2011). One of the main limitations is the fact that not many of the aforementioned studies were carried out using longitudinal methodology, and therefore

there is a lack of analysis related to the associated psychological and emotional issues.

1.2. Mood and Psychology of Mood

Mood is a concept that affects several subjective states that humans experience and helps them guide their behavior (Reeve, 2014). Mood is in everybody's life. We all have a certain mood: positive or negative. The type of mood we experience varies depending on the day, the situation and many other factors. People tend to have a mood baseline that corresponds to their state mood. This baseline suffers fluctuations depending on factors, and this level of mood would correspond to a person's trait mood. Depending on the mood we are in we will want to do some things or others, therefore guiding with this our behavior. Deepening on the emotional aspect, it is supported that mood works as happiness or subjective happiness, in the sense that all of us as humans have a different baseline level of mood (Diener et al., 1995; Stein et al., 2007).

Although it may seem like a long time ago, it was not until the 1970s when researchers started to carry out studies manipulating feelings in laboratories and evaluating these effects on behaviors and thoughts. Thanks to this, in the 1980s and 1990s, mood was found to have clear influences over certain processes and their outcomes. These can be considered as very basic and obvious assumptions, but not even thirty or forty years

have passed for them to be statistically proved, rendering them unconsolidated.

In the past years, mood was a growing research topic. Nowadays, it appears to be a very well-established topic with well-known theories and tools to evaluate it. However, it also seems to be widely known that its dimensions are yet unclear. Classically, mood has two dimensions (Nowlis and Nowlis, 1956): intensity and duration. Is mood, as Osgood (1962) proposed, a bipolar state with positive and negative affect (or valence)? Is there only one unipolar state (one factor) with positive and negative indicators? Or are they two independent factors? According to more recent researches, such as Russell (2003) and Hoffmann et al. (2020), intensity and activation are the dimensions that best describe mood.

Something that has come to a consensus is its definition and its characteristics. According to Ekman (1992) and Frijda (2009), mood lasts longer that emotion (even hours or days). Nevertheless, it is not always easy to know why someone is in a certain mood sin, as Lazarus (1991) mentioned, the event or object that has made them get in that mood may not be present at that moment.

The ironic situation here is that, although certain aspects of the Psychology of mood may be established, there are no ideal tools to measure it, and the methodology used to come up with some of the theories and well endorsed research has not been reviewed (in relation to the methodological processes used to analyze the data provided). An accurate indicator of mood could

be accomplished using tests and factorizing the results using confirmatory factor analysis. If this applies to the construct (factor) mood, all of them would have significant values. Another option is applying the factor into a tau equivalence test (or of similar parameters for all variables). If no difference is found when using free parameters for all variables, this would mean that any variable would have the same reliability to measure mood. If the opposite thing occurs, then the variables with the largest parameters would be the most dependable.

Like many other concepts in Psychology, the definition of emotion and mood have been established by many psychologists from different perspectives. The first difficulty appears when trying to differentiate between emotion, mood, and personality trait. For instance, an emotion is generally defined as a characteristic response of the human psycho-physiological system when reacting to a specific situation or event, and that is relevant to the needs or goals of the organism. In contrast, mood lasts longer, is of a lower intensity and there is no need for the object to be present (Frijda, 2009), taking into consideration that mood varies from one situation to another. The characteristic that differentiates more clearly between emotion and mood is without a doubt its duration: an emotion is much briefer than mood (Reeve, 2014). In fact, some investigations conclude that mood can last for hours or days (Ekman, 1992) and perhaps even weeks (Ekkekakis, 2013). This last statement is more supported by clinical practice. It is yet unclear to what extent is mood influenced by other external stimuli and to what extent does it respond to internal states.

Similarly, there are no conclusive studies about mood following a cyclic pattern with regards to a circadian rhythm.

It is worth to highlight that mood has an influence on people, motivating and orientating our behavior (Izard, 2007; Moller et al., 2010). All in all, mood is a concept related with a diversity of subjective states that humans experience and that guides their behavior (Reeve, 2014).

Therefore, research has been done to verify how some situational and environmental factors influence mood. These factors include stress or anxiety (Garland et al., 2013; Watson & Pennebaker, 1989), weather (Lucas & Lawless, 2013; Sanders & Brizzolara, 1982), social activity (Watson et al., 1992), exercise or physical activity (Brown et al., 2013; Camacho et al., 1991; Fox, 1999). Other phenomena that have been studied in the psychology of mood field have been the rhythms of everyday experience, or in other words, patterned cyclicity or seasonality in mood. This is, for example, the effects of biological rhythms in mood. However, if we focus on the days of the week, people tend to think that Mondays are typically a bad mood day, whereas research shows that there is no evidence for this “Blue Monday” effect to be true (Hoffmann et al., 2020).

As a final note, and without entering too much detail, it is also important to briefly describe the consensus to which the scientific community that research mood has reached, and the assumptions that have been obtained from these studies.

1.3. Mood and Lockdown: Factors That May Influence Mood

Mood is in everybody's lives. Consequently, mood and emotions have an impact on people. The society we live in experiences constant and extremely quick changes. Therefore, when a mandatory lockdown is implemented, the need to adapt yourself and your life at an alarming speed originates. These changes are a challenge for humans, generally because we are said to be social beings; in fact, feeling part of a group can be considered a psychological and social need.

Adaptation per se brings stress with it. The confinement situation produced during March 2020 has opened a new study topic. It is indeed a completely new subject, and its most relevant factors related to mood are going to be discussed. Starting with age, most studies seem to point out that young adults and adolescents' mood was the most affected during the lockdown (Franchini et al., 2020; Gismero-González et al., 2020). One of the reasons for this was primarily the lack of social contact. In this sense, social media was used as an effective coping strategy to reduce anxiety levels in adolescent population (Cauberghe et al., 2020). This fact is brought up as to highlight the importance of social media as a protection factor, at least for adolescent population. Women's mood was affected more negatively (Nair et al., 2020; Pesce & Sanna, 2020), or had more mood and attitude changes than men(Hidalgo et al., 2020).

The activities carried out during lockdown also influenced the person's mood. The less activities people did, the more unhappy they felt, and changes in the sleeping patterns seemed to slow down the perception of time passing by (Martinelli et al., 2021). These factors could increase boredom and anxiety symptoms. One of the most studied activities was physical exercise. Regular exercise was associated with reductions of depression and anxiety(Clemente-Suárez, 2020)and mood improvement(Ingram et al., 2020). During lockdown, physical activity seems to work as a protector factor in the prevention of depression, stress and anxiety symptoms(Stanton et al., 2020). Some studies indicate that levels of physical activity previous to lockdown were maintained (Richardson et al., 2020); nevertheless, implementing campaigns to reduce sedentary lifestyle and increase physical activity during long periods of lockdown should be taken into consideration (Füzéki et al., 2020; Ginoux et al., 2021; Stockwell et al., 2021). In this sense, people who regularly exercised before lockdown remained motivated, committed, and had an increased feeling of self-efficacy and psychological need for sport, compared to those who did not practice sports before lockdown (Leyton-Román, 2021). With regards to gender results seem to be inconclusive, as it seems that men increased their levels of sport activity, differing from the results found in another study conducted in Spain(López-Bueno et al., 2020).

The opposite effect was also observed. There was a reduction of physical activity during lockdown that had a negative

impact on mood and a decrease in sleep quality (Chouchou et al., 2020; Ingram et al., 2020). However, it is yet unclear whether sleep impairment produces a negative mood or vice versa. Nonetheless, lockdown seems to have changed sleeping patterns (Gupta Ravi et al., 2020) where a general tendency of going to sleep and waking up at a later time but perceiving a lower quality of sleep seemed to be followed(Cellini et al., 2020), as well as changes in sleep patterns influenced by extreme levels of stress, anxiety and depression (Franceschini et al., 2020).

Toxic behaviors were also observed: there was a higher rate of alcohol consumption which, in excess, also induced higher levels of anxiety and depression (Schmits & Glowacz, 2021). In the case of being in a relationship, this could have had a negative influence on it. In this sense, marital quality or couple satisfaction can be a protective factor during lockdown when the relationship is highly satisfying (Pieh et al., 2020). Lockdown also seemed to have negatively influenced sex and sexual life, decreasing the satisfaction—especially in women—at least in Spanish population (Ballester-Arnal et al., 2020).

All things considered, it seems quite clear that mood suffered several fluctuations and diminished during the lockdown period (Taquet et al., 2021; Terry et al., 2020). This, in turn, could increase the risk of future psychopathology. In fact, prevalence rates in mood disorders such as depression, anxiety, and/or stress have increased (Fiorenzato et al., 2020; Ozamiz-Etxebarria et al., 2020; Pieh, Budimir, et al., 2020; Roma et al., 2020). Some of the protection factors studied have been perceived social

support (d'Arbeloff et al., 2018) and psychological flexibility (Landi et al., 2020). Risk factors related to higher levels of depression and anxiety, were being female, living alone, and being an essential worker during lockdown (health professionals) (Sigdel et al., 2020).

In summary, the consequences of what could and can happen in the long, medium, and short-term are also something that causes a great worry within the research community and, of course, public services. Issues such as general well-being and mood disorders will be the key focus of this dissertation.

1.4. The Three-Dimensional Structure of Mood

Mood and its various theories exist in order to describe the number of dimensions that lead to the creation of various measurement tools: from those based on positive and negative affect, to those based on mood disorders (depression, for instance). What it can be assured is that, regardless of focusing on a bi-dimensional or three-dimensional theory, mood influences behavior and therefore has consequences over human conduct and acts (Nettle & Bateson, 2012).

Figure 1.
Description of Facial Expressions in Two Dimensions (Schlosberg, 1952)

Figure 2.
Three Dimensions of Emotion (Schlosberg, 1954)

Rewinding the clock back to 1952, one of the first psychologists to propose a structure of mood, based on the descriptions of facial expressions, was Schlosberg (1952). Initially, his two dimensions were pleasantness-unpleasantness and attention-rejection (see Figure 1). Within the description span, some words were included that described those facial expressions. Two years later, this same psychologist proposed the same model as before, including a third dimension (tension-sleep), giving birth to the three dimensions of emotion (Schlosberg, 1954), described in Figure 2.

Later on, a new two-factor structure was proposed by Watson and Tellegen (1985). This is one of the theories or proposals which continues to be the base of measuring tools created to evaluate or asses mood, such as the use of The Positive Affect and Negative Affect Schedule (PANAS) (Baptista et al., 2020; Sandín et al., 1999; Seib-Pfeifer et al., 2017; Watson & Clark, 1988). The two-factor structure sustains the existence of

two main dimensions within mood: positive affect (PA) and negative affect (NA). These dimensions work as a continuum which varies from low to high affect, forming a quadrant where emotions can be used to describe the effect of mood, as exposed in Figure 3. positive affect represents the extent to which a person feels happiness towards his life at this moment, whereas negative affect represents to which extent a person feels unhappiness towards his life at this moment (Tellegen et al., 1999).

Other researchers have proposed similar structures naming different dimensions: tension-calmness versus tiredness-energy (Thayer, 1989), activation (high-low) versus pleasantness-unpleasantness (Larsen & Diener, 1992). According to Russell and Barrett (1999), all three models mentioned before (Larsen & Diener, 1992; Thayer, 1989; Watson & Tellegen, 1985) were explaining the same space within a two-dimensional proposal, thus indicating that the models are alternatives to one another, having a high percentage of common variance between them.

The arousal dimensions in mood, combined with the valence proposed in the first model described (see Figure 1) will form the circumplex model of affect (Posner et al., 2005) in Figure 4. This last two-dimensional model is the basis for the creation of the mood meter Tool proposed within the RULER method (Brackett et al., 2006). “The mood meter allows for individuals to explore and develop the emotion skills” (Brackett et al., 2019, p. 147), as well as learning about their emotions (Sánchez & Adelantado, 2019).

Figure 3.
Two-Factor Structure (Watson & Tellegen, 1985)

Figure 4.
Circumplex Model of affect (Posner, Rusell & Peterson, 2005)

The word “mood” is many times followed by the word “disorder”. Mood disorders have a space within the theories or models proposed before, where depression and anxiety, especially, found their space in it. If we analyzed in depth these two disorders, we would probably find that depression and anxiety both have communalities connecting them. With the objective of studying the relationship between them, Clark and Watson (1991) proposed a three-dimensional model which included somatic anxiety as a third dimension. With this, anxiety could be explained using the tripartite model of anxiety and depression: high negative affect and high physiological activation. Both anxiety and depression share symptoms with distress, according to Watson (1995). Table 1 shows the diagnostic criteria for General Anxiety Disorder, Major Depression and Adjustment Disorder, according to the Diagnostic and Statistical Manual of Mental Disorders

(APA, 1980) that was current when the two-factor structure of mood was proposed.

Table 1
Diagnostic criteria for General Anxiety Disorder, Major Depression and Adjustment Disorder, according to DSM-III

300.02 Generalized Anxiety Disorder
A. Generalized, persistent anxiety is manifested by symptoms from three of the following four categories; (1) motor tension: shakiness, jitteriness, jumpiness, trembling, tension, muscle aches, fatigability, inability to relax, eyelid twitch, furrowed brow, strained face, fidgeting, restlessness, easy startle (2) autonomic hyperactivity: sweating, heart pounding or racing, cold, clammy hands, dry mouth, dizziness, light-headedness, paresthesias (tingling in hands or feet), upset stomach, hot or cold spells, frequent urination, diarrhea, discomfort in the pit of the stomach, lump in the throat, flushing, pallor, high resting pulse and respiration rate (3) apprehensive expectation: anxiety, worry, fear, rumination, and anticipation of misfortune to self or others (4) vigilance and scanning: hyper attentiveness resulting in distractibility, difficulty in concentrating, insomnia, feeling "on edge/' irritability, impatience B. The anxious mood has been continuous for at least one month. C Not due to another mental disorder, such as a Depressive Disorder or Schizophrenia. D. At least 18 years of age.
296.2x Major Depression, Single Episode
A. Dysphoric mood or loss of interest or pleasure in all or almost ail usual activities and pastimes. The dysphoric mood is characterized by symptoms such as the following: depressed, sad, blue, hopeless, low, down in the dumps, irritable. The mood disturbance must be prominent and relatively persistent, but not necessarily the most dominant symptom, and does not include momentary shifts from one dysphoric mood to another dysphoric mood, e.g., anxiety to depression to anger, such as are seen in states of acute psychotic turmoil. (For children under six, dysphoric mood may have to be inferred from a persistently sad facial expression.) B. At least four of the following symptoms have each been present nearly every day for a period of at least two weeks (in children under six, at least three of the first four). (1) poor appetite or significant weight loss (when not dieting) or increased appetite or significant weight gain {in children under six, consider failure to make expected weight gains) (2) insomnia or hypersomnia (3) psychomotor agitation or retardation (but not merely subjective feelings of restlessness or being slowed down) (in children under six, hypoactivity) (4) loss of interest or pleasure in usual activities, or decrease in sexual drive not limited to a period when delusional or hallucinating (In children under six, signs of apathy)

(5) loss of energy; fatigue
(6) feelings of worthlessness, self-reproach, or excessive or inappropriate guilt (either may be delusional)
(7) complaints or evidence of diminished ability to think or concentrate, such as slowed thinking, or indecisiveness not associated with marked loosening of associations or incoherence
(8) recurrent thoughts of death, suicidal ideation, wishes to be dead, or suicide attempt
C. Neither of the following dominate the clinical picture when an affective syndrome is absent (i.e., symptoms in criteria A and B above):
(1) preoccupation with a mood-incongruent delusion or hallucination (see definition below)
(2) bizarre behavior
D. Not superimposed on either Schizophrenia, Schizophreniform Disorder, or a Paranoid Disorder.
E. Not due to any Organic Mental Disorder or Uncomplicated Bereavement

309.00 Adjustment Disorder with Depressed Mood or 309.24 Adjustment Disorder with Anxious Mood

A. A maladaptive reaction to an identifiable psychosocial stressor, that occurs within three months of the onset of the stressor.
B. The maladaptive nature of the reaction is indicated by either of the following:
(1) impairment in social or occupational functioning
(2) symptoms that are in excess of a normal and expectable reaction o the stressor
C. The disturbance is not merely one instance of a pattern of overreaction to stress or an exacerbation of one of the mental disorders previously described.
D. It is assumed that the disturbance will eventually remit after the stressor ceases or, if the stressor persists, when a new level of adaptation s achieved.
E. The disturbance does not meet the criteria for any of the specific disorders listed previously or for Uncomplicated Bereavement

Both the two-dimensional model and the three-dimensional model were developed according to the DSM-III (APA, 1980), or DSM-III-R (APA, 1990) in the case of the three-dimensional model, where anxiety and depression would be classified into Anxiety disorder and Mood disorder respectively. Mood disorders are subdivided into bipolar disorders and depressive disorders. The criteria for the diagnoses of Depression (296.2x Major Depressive Disorder, Single Episode; or 296.3x Recurrent Depressive Episode) can be found in Table 1.

When focusing in anxiety, DSM-III (APA, 1980) would classify it into Anxiety disorder (300.02 Generalized Anxiety Disorder), described mainly as worrying excessively about a vital circumstance in the person's life. Highlight the fact that criteria C (Table 1) refers to Mood disorders, besides being classified separately, indicating that the anxiety disorder must not be present only during a Mood disorder.

DSM-III (APA, 1980) does not refer specifically to stress or distress as a disorder, but could be classified into a subtype of Adjustment disorder, according to the specified criteria in Table 1 and following classification in Table 2. The adjustment disorder's main characteristic is the emotional response to an event or situation that has produced stress for that person. The classification subtype 309.28 Adjustment disorder with mixed emotional features describes a combination between depression, anxiety and other emotions, which could be the feeling of distress.

Table 2
Classification subtypes of Adjustment Disorder, according to DSM-III

Adjustment Disorder
309.00 Adjustment disorder with depressed mood
309.24 Adjustment disorder with anxious mood
309.28 Adjustment disorder with mixed emotional features
309.30 Adjustment disorder with disturbance of conduct
309.40 Adjustment disorder with mixed disturbance of emotions and conduct
309.83 Adjustment disorder with withdrawal
309.23 Adjustment disorder with work (or academic) inhibition
309.90 Adjustment disorder with atypical features

The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) (APA, 2013) used nowadays keeps a similar structure to the one included in the third edition, though

there continues to be evidence for mood and anxiety disorders to be merged in a single disorder: emotional disorders which could then be divided into the three factors (Watson, 2005, 2009), as in the previous edition. Table 3 shows the diagnostic criteria for General Anxiety Disorder, Major Depression and Adjustment Disorder, according to the current Diagnostic and Statistical Manual of Mental Disorders (APA, 2013).

Table 3
Diagnostic criteria for General Anxiety Disorder, Major Depression and Adjustment Disorder, according to DSM-V

Generalized Anxiety Disorder
A. Excessive anxiety and worry (apprehensive expectation), occurring more days than not for at least 6 months, about a number of events or activities (such as work or school performance). B. The individual finds it difficult to control the worry. C. The anxiety and worry are associated with three (or more) of the following six symptoms (with at least some symptoms having been present for more days than not for the past 6 months); Note: Only one item is required in children. 1. Restlessness or feeling keyed up or on edge. 2. Being easily fatigued. 3. Difficulty concentrating or mind going blank. 4. Irritability. 5. Muscle tension. 6. Sleep disturbance (difficulty falling or staying asleep, or restless, unsatisfying sleep). D. The anxiety, worry, or physical symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning. E. The disturbance is not attributable to the physiological effects of a substance (e.g., a drug of abuse, a medication) or another medical condition (e.g., hyperthyroidism). F. The disturbance is not better explained by another mental disorder (e.g., anxiety or worry about having panic attacks in panic disorder, negative evaluation in social anxiety disorder [social phobia], contamination or other obsessions in obsessive-compulsive disorder, separation from attachment figures in separation anxiety disorder, reminders of traumatic events in posttraumatic stress disorder, gaining weight in anorexia nervosa, physical complaints in somatic symptom disorder, perceived appearance flaws in body dysmorphic disorder, having a serious illness in illness anxiety disorder, or the content of delusional beliefs in schizophrenia or delusional disorder).
Major Depressive Disorder
A. Five (or more) of the following symptoms have been present during the

same 2-week period and represent a change from previous functioning: at least one of the symptoms is either (1) depressed mood or (2) loss of interest or pleasure.
Note: Do not include symptoms that are clearly attributable to another medical condition.
1. Depressed mood most of the day, nearly every day, as indicated by either subjective report (e.g., feels sad, empty, hopeless) or observation made by others (e.g., appears tearful). (Note: In children and adolescents, can be irritable mood.)
2. Markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day (as indicated by either subjective account or observation).
3. Significant weight loss when not dieting or weight gain (e.g., a change of more than5% of body weight in a month) or decrease or increase in appetite nearly every day. (Note: In children, consider failure to make expected weight gain.)
4. Insomnia or hypersomnia nearly every day.
5. Psychomotor agitation or retardation nearly every day (observable by others, not merely subjective feelings of restlessness or being slowed down).
6. Fatigue or loss of energy nearly every day.
7. Feelings of worthlessness or excessive or inappropriate guilt (which may be delusional) nearly every day (not merely self-reproach or guilt about being sick).
8. Diminished ability to think or concentrate, or indecisiveness, nearly every day (either by subjective account or as observed by others).
9. Recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide.
B. The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.
C. The episode is not attributable to the physiological effects of a substance or to another medical condition.
Note: Criteria A-C represent a major depressive episode.
Note: Responses to a significant loss (e.g., bereavement, financial ruin, losses from a natural disaster, a serious medical illness or disability) may include the feelings of intense sadness, rumination about the loss, insomnia, poor appetite, and weight loss noted in Criterion A, which may resemble a depressive episode. Although such symptoms may be understandable or considered appropriate to the loss, the presence of a major depressive episode in addition to the normal response to a significant loss should also be carefully considered. This decision inevitably requires the exercise of clinical judgment based on the individual's history and the cultural norms for the expression of distress in the context of loss.
D. The occurrence of the major depressive episode is not better explained by schizoaffective disorder, schizophrenia, schizophreniform disorder, delusional disorder, or other specified and unspecified schizophrenia spectrum and other psychotic disorders.
E. There has never been a manic episode or a hypomania episode.
Note: This exclusion does not apply if all of the manic-like or hypomanic-like episodes

are substance-induced or are attributable to the physiological effects of another medical condition.
Adjustment Disorders
A. The development of emotional or behavioral symptoms in response to an identifiable stressor(s) occurring within 3 months of the onset of the stressor(s). B. These symptoms or behaviors are clinically significant, as evidenced by one or both of the following: 1. Marked distress that is out of proportion to the severity or intensity of the stressor, taking into account the external context and the cultural factors that might influence symptom severity and presentation. 2. Significant impairment in social, occupational, or other important areas of functioning. C. The stress-related disturbance does not meet the criteria for another mental disorder and is not merely an exacerbation of a preexisting mental disorder. D. The symptoms do not represent normal bereavement. E. Once the stressor or its consequences have terminated, the symptoms do not persist for more than an additional 6 months.

The Tripartite Model of Anxiety and Depression has been tested based on clinical evaluation tests that are commonly used to diagnose anxiety and depression, such as BDI (González, 2004). The tool MASQ30, initially MASQ90 created by Watson et al. (1995), is proposed as an optimum instrument to measure anxiety and depression. It is based on the tripartite model of anxiety and depression and is designed to measure its three dimensions: negative affect (NA), positive affect (PA), and somatic anxiety (SA) (González & Ibáñez, 2018). Its symptoms are have been divided between general distress, anhedonic depression and anxious arousal (Wardenaar et al., 2010). This last classification is the chosen one to be used in this dissertation.

General Distress

Stress has become the “disease” of the 21st Century, according to the World Health Organization (Fink, 2016). Stress is initially a concept used to refer to neurobiological activations that take place with the presence of a stimulus that is considered harmful or dangerous (Smyth et al., 2013), and therefore “fight or flight” mechanisms begin due to the perception of a break up in the homeostasis of a person (W . B . Cannon, 1914). In this day and age, stress seems to be more “chronic” than “acute”, understanding this as feeling stress during a prolonged time lapse (Senanayake & Arambepola, 2019).

Stress has been defined as the actions the person makes in order to react to a certain demand for change (Selye, 1965), as well as a perceived feeling of too much demand (for example, work or chores) and not having enough resources to cope with the demands (Cherniss, 1980). It can also be defined as a threat that a person perceives and that they seem to be incapable of coping with (Biggs et al., 2017), based on Lazarus and Folkman’s transactional theory of stress and coping.

In many cases, the concept of stress has been divided between “the good and the bad” stress, identifying eustress as “the good stress” and distress as “the bad stress”, according to (Selye, 1976). However, Bienertova-Vasku et al. (2020) suggest that stress and distress can be used indistinctively.

As any other emotion or feeling, stress can have the power to spillover and affect other people around you in a

negative way. The term “adult co-regulation” would also appear here. This term refers to the power of “influencing each other’s moods and physiology” (pp. 92) according to Saxbe and Repetti (2010).

Stress is an interesting variable to analyze and study in such an exceptional situation as a compulsory and obligatory lockdown, as it can have a negative impact in motivation to perform activities that will act as a protective factor in the prevention of mood disorders. For example, high levels of stress influence in many other aspects of a person’s life such as insomnia induced by high cortisol levels (Nandkar, 2020; Rodenbeck et al., 2002). Furthermore it reduces the motivation to carry out chores or responsibilities and includes other responses such as eating too much or not eating enough (Dua, 2019; Ramalho et al., 2021), adopting toxic behaviors like alcohol consumption or smoking (Schmits & Glowacz, 2021), decreasing the marital quality, couple satisfaction (Pieh et al., 2020) or even the sexual life (Ballester-Arnal et al., 2020), and increasing work demand related to the adaptation to telecommuting (Aperribai et al., 2020).

Anxious Arousal

Anxiety is understood as an affective variable where a risk or danger is perceived, normally being uncontrollable or with a high level of ambiguity, which keeps the person hypervigilant, negatively biased and can finally lead to the development of an anxiety mood disorder (Easterbrook, 1959). It consists of three

dimensions: cognitive, physiological, and motor or behavioral (Zinbarg & Barlow, 1996).

The cognitive dimension seems to be the main characteristic in anxiety arousal (Hoehn-Saric & McLeod, 2000). At a cognitive level, it is normally described as the excessive worry (Mathews, 1990) towards events or situations that are yet to take place, having the feeling that something bad or wrong is going to happen. This worry can lead to sensing a danger or aversion that may be real or imaginary, activating alarm mechanisms so that the body and system can cope with them.

A harmful effect can be produced when anxiety levels surpass extreme parameters during prolonged exposure or over a prolonged period of time, frequency and intensity, which can reduce the effectiveness of a coping strategy for an event or situation (Arroll& Kendrick, 2018). This reduction of effectiveness or performance is originated mainly because the person focuses on their internal aspects (such as negative thoughts) rather than on the main task being accomplished. People with high anxiety levels divide their attentional focus between the task and their feelings: the higher the number of inferential elements, the less capability of intentionally selecting more relevant aspects of the tasks they have.

In general, deterioration in a person's performance will rise when an increased number of attentional resources are being needed to complete the task. It is important to note that this will have an impact on a working person's experience and capability. Therefore, it can be stated that people who are less anxious will

be more efficient than people with high levels of anxiety, even if they are using the same amount of resources. Other anxiety symptoms such as physiological or somatic symptomatology also need to be considered. Some somatic anxiety symptoms include shortness of breath, tension, dizziness or even oral dryness among others (Watson, 2000).

In an exceptional situation such as compulsory and obligatory lockdown, Fiorenzato et al. (2021) observed that, although lockdown seemed to have improved memory abilities, it also impaired other psychological skills and had negative impacts such as an increase in anxiety disorders. The influence of healthy habits, such as the practice of physical activity and sleep during lockdown seemed to be important as well-being levels were deteriorated and anxiety levels increased when both physical activity practice and sleep quality decreased (Chouchou et al., 2020). An increase in anxiety levels had a reducing effect in the levels of well-being. Once again, this highlights the relevance of these issues for public health services, who should consider them closely from here onwards, not only in case another lockdown takes place, but also as an everyday advice and prevention tool for society after the COVID-19 lockdown.

Anhedonic Depression

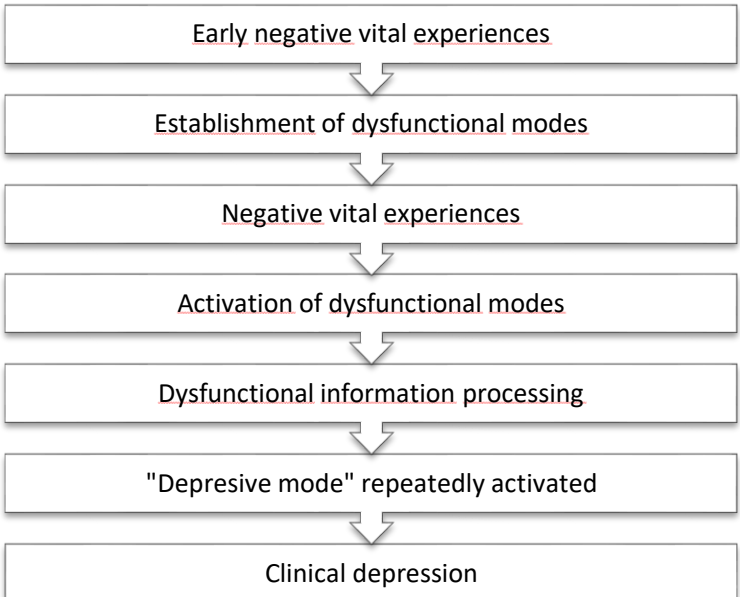
Depression is characterized by sadness and generalized disinterest in all things that a person used to like and enjoy, all together with a diminished level of physical and psycophisiological activity, expressed via lower motivational, appetite and sexual desire levels, insomnia, and even a lack of interest in life and living, which may even include suicidal thoughts (Cassano & Fava, 2002). It can therefore be stated that depressive symptoms include emotional, cognitive, behavioral, and somatic changes.

Behaviorism theories explain that depression is a consequence of a reduction or absence of positive reinforcement (Ferster, 1965). The lack of positive consequences would produce a decrease in the person's interest or motivation, therefore reducing the frequency of their activity. Furthermore, it can also be explained as aversive consequences like punishments that could inhibit or suppress a person's conduct.

From a Cognitive Behavioral Theory perspective, depression is understood as a dysfunctional attitude, attention and memory bias, and negatively-biased cognitive distortions (Beck et al., 1996). According to this theory, depression's most important aspect is related to cognitive processes, which include what is called mode (Apsche, 2005). The Theory of Modes (Figure 5) explains the existence of negative cognitive schemas that automatically impulse a person to behave in a certain manner when a negative situation or event takes place. When the

depression mode is activated, the person's behavior will therefore function in an automatic way. The modes do not react to external stimuli; they focus mostly on internal experiences and sad cognitive contents in a ruminating way.

Figure 5.
Theory of modes and impulses (Apsche, 2005)



Depression symptomatology does not only have cognitive implications in its cause or origin; neurobiological and neuropsychological causes have also been studied in relation to it. Neurotransmitters such as serotonin have been proven to be implicated in depression and suicidal ideation. Furthermore, the reaction of a hyperactivation of the amygdale, increase in cortisol,

and decrease in pre-frontal response should be included in Figure 5 as a complete depression model.

Depression seems to have greater affection in women than in men (Albert, 2015), and seems to be the main component in stress (Shively et al., 2005). As it is a disorder greatly related to mood, most therapies focus on trying to retrieve or regain the mood by modifying the negative cognitive schemas, until the person's levels of activity, well-being and life satisfaction are reestablished. Some of these modifications may include changes in the daily routine, pursuing religiousness or believing in conspiracy theories which act as self-protective factors (Fountoulakis et al., 2021).

The model and explanation proposed so far takes into consideration normal conditions in a person's life. However, an imposed lockdown is not considered to be a normal event or situation. Some studies have been made related to this matter. Considering other sociodemographic variables, living alone or not going out for work were predictors of an increase in depressive symptoms (Delmastro & Zamariola, 2020). Similar results were found by Han et al. (2021), which include gender and age differences that influence depressive mood: young females were more vulnerable to suffering depressive symptoms during lockdown than the other gender and age groups.

Overall, depression seems to have increased due to COVID-19 lockdown, which highlights the importance for both national and international public policies to focus on prevention and solution measures. Specifically in Spanish population,

“compared with a global estimated prevalence of depression of 3.44% in 2017, our pooled prevalence of 25% appears to be 7 times higher” (Bueno-Notivol et al., 2021).

4
OBJECTIVES AND HYPOTHESIS

The specific objective of the dissertation was to analyze the evolution and impact on people's mood when they are confined and isolated for long periods, understanding mood as a second-order factor preceded by anxiety factors, depression, and distress. This dissertation aims, therefore, to examine the way in which the three factors mentioned before, which form the three-dimensional structure of mood, evolved, and behaved during lockdown.

There are three primary aims of this study:

1. To investigate the way in which the factors behaved individually.

   The data collected forms a time series that will be detrended aiming to provide an overview of the fluctuations the subjects suffered per each of the factors along the confinement period. Furthermore, the time it took for a person to adapt itself to this lockdown situation will be estimated, as well as the time memory of each of the factors analyzed.

   It is hypothesized that people will adapt to the new situation and restore the initial anxiety, depression and distress levels, forming a u-shaped curve. There are no differences between the three factors, as they behave similarly.

2. To assess the extent to which these factors were influenced by other variables of interest such as activities carried out during the day, marital status, work status, age, sleep quality…

In order to explore the relationship between the three factors and the variables of interest three individual forecasting equations will be proposed, one per factor (anxiety, depression and distress).

It is hypothesized that each factor (anxiety, depression and distress) will be mostly influenced by different variables that encompass social variables, physical variables, family variables, emotional variables, and working variables. More specifically, per each of the factors the following hypotheses are stated:

- There are differences found between family variables and anxiety levels, where people who lived alone during lockdown will have lower levels of anxiety that those who live with a couple or have children.
- No differences will be found between family and working variables, and depression levels. Therefore, people carried out activities during the day (such as doing exercise) during confinement will have lower levels of depression.
- There are differences found between working variables and distress levels, where people who worked during the lockdown period will have lower levels of distress than those who did not work.

3. To ascertain a theoretical model of the structure of mood during confinement.

   Part of the aim of this dissertation is to explore how every factor (anxiety, depression and distress) behaved during lockdown. To do so it will be necessary to determine the extent to which the data collected adjusts to a three-dimensional model or fits better according to a two-dimensional model by testing the factorial analysis of the collected data.

   It is hypothesized that a two-factor model will fit better than a three-factor model, where anxiety and distress will form a unique dimension (positive affect) and inverse anhedonia or depression will create the second dimension (negative affect).

5
METHODOLOGY USING TIME SERIES

3.1. Longitudinal Data

Every study or research starts with a research topic that interests the researcher. The present research's main topic focuses on the three-dimensional theory of mood and how it is influenced during extended periods of lockdown by different variables, highlighting as its main interest mood or state of mind. Once you know what your research topic is going to be, it is easy to start making questions about which aspects of it may interest you, but most importantly which investigation aspects society needs. Besides this necessity, we cannot forget that society also demands applying knowledge in order to increase a person's well-being, perhaps with other economic interests, but nevertheless remembering the importance of having a good theoretical basis. Theory is the result obtained after carrying out a scientific investigation, so the latter is needed in order to increase knowledge and advance in extension and depth.

To acquire the aforementioned, this research's starting point is to read what has been done in relation to the problem question we want to solve. During this process, the initial hypothesis, objectives proposed, or even the whole problem question may suffer changes or updates. These variations will allow you to decide the type of investigation or research you want to carry out, and thus the way you are going to collect the data.

Data collection can be done in diverse ways: using observational methods, questionnaires, interviews, physiological measurements... This data may be collected in one single

moment or in several time moments, using the same or different sample each time. The number of times we collect the data is going to make that data be collected in a transversal or longitudinal way. Therefore, when data is collected at the same time but from different samples (year groups, ages, etc.), , a *transversal design* is being followed, whereas when repeated observations are made within the same sample, a *longitudinal design* is followed (Schober & Vetter, 2018; Singer, J. D. & Willett, 2003). Several types of longitudinal designs exist. For instance, data can be collected in different moments from the same sample. This is commonly known as a *longitudinal panel design*. Nevertheless, authors do not agree about terminology so, depending of their preferences, they also refer to this kind of research as *pooled time series* or *intensive longitudinal designs* (Collins, 2006; Wu et al., 2013). *Trend study samples* are another type of longitudinal designs, where observations are collected at different moments in time from different people but the same population (Leon & Montero, 2003), for example, when academic performance is registered in the same school year but not the same students throughout the different school years, this type of research is denominated as *univariate time series*. Lastly, there are also *cohort samples,* where data is collected from different people and sample but with similar characteristics (Leon & Montero, 2003).

If we focus on longitudinal panel designs, according to Wu, Selig and Little (2013), they can be classified depending on the amount of observation, whereas if there is a limited number of

observations then this would correspond to a longitudinal panel design. On the other hand, if the number of repeated registrations is exceptionally large, then this would be an intensive longitudinal design. One of the most commonly used methods to collect longitudinal data in a panel or intensive study is using daily diaries. These can be such as a series of questions that have to be answered at a certain point of the day. Participants can reply to the questions via online or paper formats.

To put all this information into context, we will now set an example of panel longitudinal data and intensive longitudinal data. For instance, Gonçalves et al. (2016) held a study inside a prison institution. The total number of infractions was classified as minor and severe in order to answer changes within them and to evaluate the impact of the lack of social support and the absence of mental problems. This questionnaire was completed by the same sample of prisoners during the first, third, sixth and twelfth month of their stay in prison. As we can see, it is a longitudinal design because the data is collected through the same sample at four different sets of time, although the starting point is different, but the time between the different measurements is the same for all cases. This would be an example of panel longitudinal design. Another example would be the one of Morrison et al. (2003), where they tried to study the relationship between sex and drinking within a sample of adolescents, using a total sample of 112 teenagers between 14 and 19 years old. The data was collected using a daily diary registration during eight weeks, with questions related to health and risk behaviors, such as smoking

or hours of sleep. This would be a description of an intensive longitudinal study because the number of repeated observations was exceptionally large (at least 56 consecutive repeated observations within the same sample).

Longitudinal studies can seem particularly useful. However, they have some complexities that must be taken into consideration. The main one is the experimental mortality. Although the sample may not need to be excessively big, the amount of people that drop out from the experiment tends to be high. Another drawback for longitudinal designs may be that they can last for a long period of time and thus it may take long to actually gather all the amount of data needed. Moreover, the researchers must carry out (or at least it is recommended that they carry out) a follow-up of the sample. This can be done via an interview, email, or text message to motivate them to continue with the registrations. However, longitudinal data is extremely useful when we want to describe the structure or trend of a certain variable. Longitudinal data allows the evaluation of change (in time) (Arnau et al., 2016), so we can analyze from it its cyclicity, seasonality or trend. Furthermore, diary reports, either in paper or using an application, may reduce bias and variance of the answers given by the participants, as the questions in them tend to be related to what has happened to the participant during the day, which will mean that the information is very recent and fresh in their minds (Walls, 2013).

When analyzing data that has been collected using an intensive longitudinal design, as all the data that has been

collected for this dissertation, it is important to pay special attention to the type of methodological technique approaches that are used. This is an ongoing topic when talking about methodology, because it is an effortless way of overestimating or underestimating parameters or errors. In intensive longitudinal data, it is stated that the individual deviations from the mean across time are not independent, and thus it is not recommended to use an ANOVA or regression (Wu et al., 2013), since it is assumed that the correlation is kept constant within the same subject. Other limitations of using ANOVA when analyzing longitudinal data is that, when a value of a subject is missing, it excludes the entire subject. Furthermore, it can only be used, generally, in normal distributions (Schober & Vetter, 2018). Therefore, it would be recommendable to apply a method that allows us to specify the covariance of the residuals and introduce random effects that can show the variations in time within the individuals. We have previously mentioned that intensive longitudinal studies are perfect to evaluate changes in time. With this type of studies, it is assumed that differences between the subjects exist. Evidence for these random effects will be shown with statistical differences in the intercept, meaning that every person has their own intercept, their own basal or mean level. Autoregression, multilevel modeling or mixed models, or structural equation modeling could be good options of analyzing intensive longitudinal data. Autoregression is based on a general estimating equation (GEE), which is commonly used to estimate robust standard errors allowing a more precise estimation (Omar

et al., 1999). Moreover, it assumes that the correlations of the data decrease as the time interval between the measurements increases (Schober & Vetter, 2018). Advantages of using mixed-effects models could be their inclusion of both fixed and random effects, which provides great flexibility and allows estimating changes between the subject and within the subject (Fitzmaurice & Ravichandran, 2008).

3.2. Time Series

A time series is the name used to refer to a set of data that has been registered numerically over a period of time, univariate (there is just a single time-dependent variable) or multivariate time series (there is more than one time-dependent variable), that can be continuous or not, and therefore a continuous time series or a discrete time series respectively (Jara & Rosel, 2002). Therefore, it could be considered intensive longitudinal data in which time change is a variable by itself, measuring different variables in the same person or in different people.

Time series are commonly used in the area of Econometrics, Engineering, Biology or Environmental Statistics. Examples can be, for instance, controlling and comparing the stock market, production, circadian rhythms, or geographical temperature. However, if we go to the basic definition of what a time series is, we will realize that individuals form time series

when measuring a variable in a continuous way, where time is also registered.

Repeated measurements from the same participant over a period of time tend to be correlated. Time series of multiple individuals can be a good approach used for making predictions (Castro-Schilo & Ferrer, 2013) when analyzed appropriately. Forecasting begins with gathering previous information, being this information valid. Using this available information as a base, we will be able to start forecasting. Beware forecasting is not always perfect, and it is particularly important we know the purpose why we forecast. As well as making predictions, intensive longitudinal data and thus time series gives us the chance to explore what are called the dynamic aspects that take place within the individual in relation to the variable of study (level 1) and within the individual differences between the total sample (level 2) (Hamaker & Wichers, 2017).

Once we have all the data, the time series analysis will allow us to see if there is seasonality. This means exploring if the data follows a systematic temporary pattern. From a classical perspective, it is considered that time series have four fundamental components, which would be formed by trend, cycle, seasonality, and error.

Here are some examples of research studies that have used time series. The first longitudinal research about mood was conducted by Weinstein et al. (2007), titled “Longitudinal Patterns of Daily Affect and Global Mood During Adolescence”. This article examines mood as divided into positive and negative affect. The

results obtained using mixed-effects regression models suggested that, although negative affect is relatively stable in 8th and 10th grade boys and girls, boys had more decreases in negative affect during the day than girls did, and consequently mood is more influenced by changes in positive affect rather than altering negative affect. A strong aspect in this article is the fact that the sample was kept equal for both genders, with this showing that they tried to make the number of male participants and the number of female participants as equal as possible.

The next article to take into analysis is a more recent article conducted by Jose and Lim (2015)called “Rumination as a Mediator and Moderator of the Relationship between Unpleasant Events and Unhappy Mood: A Daily Diary Study”. The variables to be studied were unpleasant events, rumination, and unhappy mood. The data was collected through an online diary, a registration which the participants had to complete during 30 consecutive days. The data was analyzed using multilevel random coefficient models (MRCM) with hierarchical lineal modeling software (HLM). They also used stability and crossed-lagged analysis. A crossed-lagged analysis is used to describe two variables measured in two different times (Kenny, 2005). The final results suggest that rumination has a negative impact on mood both during the day and over time, consequently it mediates and moderated in stress and depression. Unlike the first article, the sample used for this study was not balanced, and this could be a limitation since the existence of gender differences especially in women is assumed, unless at least thirty

observations were completed by all the subjects and there was no missing data (Frees, 2004). However, an advantage from this study was that, in order to avoid experiment mortality, a text message was sent to the participants when they had to complete the registration.

The last, but not least, of the articles chosen was “Daily Dynamics of Adolescence, Mood and Identity” by Klimstra et al. (2015). This article tries to statistically measure the changes in mood and identity during the adolescence. Results were analyzed using multilevel regression models. These showed that individuals are in a better mood when they have a stronger sense of identity, and that this effect lasted for days. The main strength of this study, agreeing with the strengths they exposed in the article, was the fact that they managed to collect a set of data over a very wide period of time and, despite that, had a respectable number of participants in terms of quantity.

If we focus only on the methodological aspects and the chosen method to analyze the results, the three articles have collected the data using a longitudinal design and time series. The three of them study psychological processes. But what are the differences between a time series with economy and stock variables and those time series which imply psychological variables? Well, mostly the individual. When analyzing time series, it is important to not only take into consideration the expected values from the observations (fixed effects) and variances and covariance from the observed subjects (random effect).

As exposed earlier on, the main characteristic of a time series is the fact that it is a set of data collected using a longitudinal design, which varies over time. Consequently, we have the opportunity to detect trends or patterns, and, focusing on time series collected for individuals, we are able to analyze the dynamic effects. For this reason, data analysis may be challenging. If we could visualize a data matrix in a database for individuals from which longitudinal data has been collected, for example, from a daily registration, then all the data from one single individual would be grouped together forming a time series, and then the next subject would have their data grouped together forming another time series, and so forth. Data analysis for time series can be challenging because you have to consider both what takes place within each individual and what takes place between the different individuals. Another challenge that researchers have to face is the fact that the mean deviations between individuals over time are not independent in longitudinal data. Therefore, it is not recommended to use traditional data analysis techniques such as regression or ANOVA, as they assume mean deviations as being independent (Wu et al., 2013). Both ANOVA and linear regressive models are not recommended or valid for time series analysis as they do not eliminate the autoregressive effects of measuring or residual errors.

Time series have four main characteristics or components: trend or long term movement, seasonality or regularity of the fluctuations, cycle or irregular fluctuations, and random component or residual (Grether et al., 1979). With this,

the main objectives of time series analysis is the description of the time influences within the selected variable or variables that form the time series, in order to create a model that enables the explanation of the behavior of that time series, and also predicts it in order to control future time series (Jara & Rosel, 2002).

Mixed lineal models are used to analyze time series data sets (Arnau & Bono, 2008). What differentiates a lineal mixed model from a general lineal model is the calculation of covariance parameters that allow analyzing longitudinal sets of data. The question is: do mixed linear models take into consideration time variances? Not exactly, unless specified by creating a variable that measures time, for example the number of days since lockdown by COVID-19 was decreed, and perhaps more importantly, the participants' data is grouped together forming a chronologically organized time series per participant. In a time series, it is assumed that serial correlation exists. That would imply we could assume that how you feel today is influenced by how you felt yesterday and so forth. To analyze a time series properly, the following procedure and steps should be followed.

According to Box et al. (2016) previous to the study of any time series, we need it to be stationary within mean and standard deviation, as if this is not accomplished, the predictions obtained could be inconclusive. Once the series is detrended or its trend has been eliminated, the autocorrelation function (ACF) and partial autocorrelation function (PACF) can be used as diagnosis tools in order to verify the stationarity of the series, both in mean and standard deviation.

Box and Jenkins (1976) suggested several tests to verify if the model proposed was suitable. For instance, overparameterizing a model and comparing if its parameters are statistically different to zero. If the model created is similar to the observed series, then the residual parameters would behave similar to white noise, and this can be contrasted using ACF and PACF. The results from both autocorrelation functions should not be statistically significant, being their autocorrelation zero or close to zero.

Once the detrend of the time series has been completed, and therefore the model has been identified, you can proceed to the analysis of the data.

3.3. Methodology used in the Present Dissertation

Data Collection Procedure

This study was opened to anybody who voluntarily offered themselves to participate, by its diffusion through social media (web-forum, WhatsApp, Twitter, Facebook).The link to the socio-demographic questionnaire where information such as general health, sleep quality—using the Pittsburgh Sleep Quality Index (PSQI) (Buysse et al., 1989)—, and physical activity was included, and an email address was requested so that participants could receive the Daily Diary that they had to complete until the lockdown ended. The fortnight after lockdown will allow us to observe the autoregressive pattern to analyze if the latter is maintained once the confinement period is over.

The Daily Diary's aim is to collect all the relevant data about the participant's mood during the day, therefore including the "Short adaptation of the Mood and Anxiety Symptom Questionnaire" (MASQ-D30) (Wardenaar et al., 2010), translated from English to Spanish (González & Ibáñez, 2018). This questionnaire is composed by a total of 30 items designed to measure the three dimensions of the tripartite model of anxiety and depression, namely, negative affect (NA), positive affect (PA), and somatic anxiety (SA) (Lee Anna Clark & Watson, 1991). No specific conditions were required for the final sample to participate besides being over-aged (only adults over 18 years of age could participate in this study). Allparticipants were living in Spain in the moment of lockdown and had access to the Internet.

Figure 6.
Lockdown chronology and data collection

In order togrant a more accessible and comfortable registration method for the participants, an online questionnaire was created using the platform interface of Qualtrics. Thanks to this application, the date and time in which the participant had completed the registration were automatically registered. To reduce the experimental mortality, a daily email was sent to the participants in order to remind them to complete the daily

questionnaire. Figure 6 shows the dates where lockdown was decreed to start and finish in Spain, and according to it, how the data collection was organized and arranged.

Data Analysis Procedure

The data was analyzed using IBM SPSS Statistic 25.0 program. The data matrix included the final participants selected, according to a minimum number of observations per participant, since the time series procedures establish that the distance between the time moments of the different observations should be kept constant (Jara & Rosel, 2002).

Once the data matrix was ready, we proceeded to modeling the time series. The modeling of the time series data followed a time-domain approach. To do so, for every dependent variable that would be used (these were every factor that will serve as the basis of this dissertation: general distress, anhedonic depression and anxious arousal), an exploratory study of the time series figure was done, and a new transformed detrended series for each factor was created when the variable did not follow a trend.

An Autoregressive Integrated Moving Average (ARIMA) Model is a time series modeling procedure that turns the time series into white noise (a purely random procedure) after being differentiated *d* times. The data modeling procedure used for the data analysis in this dissertation was a stochastic term or model defined by random variables arranged according to the parameter

one divided by time (1/time). The residuals obtained when the factor is analyzed using mixed linear models as a function of “one divided by time” will be transformed until the time series is fully stationary. This means that in order for the time series to be detrended completely, more transformations may be needed, for instance, transforming into z-scores (Box et al., 2016; Gujarati, 2004; Hox et al., 2017; Huckfeldt et al., 1982; Raudenbush & Bryck, 2002; Schuurman et al., 2016). The complete procedure or process is explained for every factor in the following chapter.

6
DATA ANALYSIS AND RESULTS

4.1. Conceptual Model Proposed

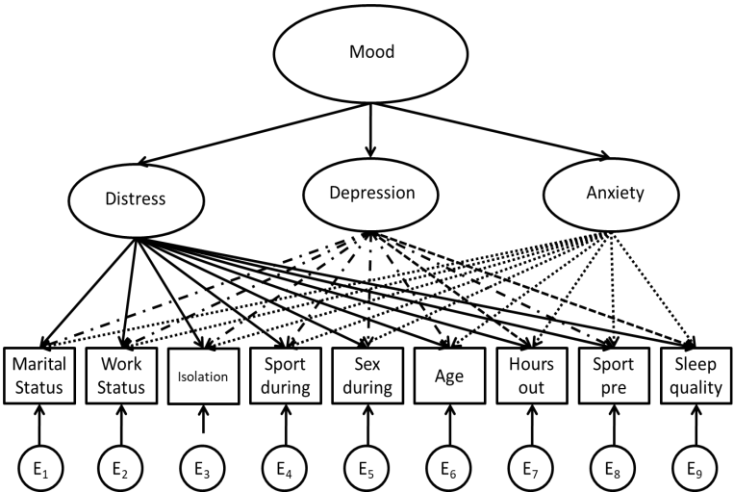
The main objective of this thesis is to study the evolution of a person's mood during long periods of isolation and confined context in Spanish population during COVID-19 lockdown in 2020.

Taking into consideration that mood is influenced by many variables; the conceptual model proposed is as stated below:

- Mood has three factors:general distress, anhedonic depression and anxious arousal. In order to simplify, the factors will be named distress or F1_Distress, anxiety or F2_Anxiety, and depression or F3_Depression. An exploratory and confirmatory analysis factor will be done in order to verify if the factors are as indicated according to Clark & Watson (1991).
- Each factor will be analyzed considering time as a variable, thus exploring the time memory per factor.
- Every factor will be analyzed individually as a function of variables considered.

The main model proposed is shown in figure 7, being E the error for every variable.

Figure 7.
Main model



4.2. Descriptive Statistics of the Sample

The research started with a total sample of 181 participants. Finally, 123 participants were selected from the total, thus participants with less than 20 observations or non-consecutive registries were excluded. In order to achieve the stated objectives, longitudinal data were collected through a daily record for a period of between 20 and 45 consecutive days, from an initial total sample of 181 people. The sample was reduced to a total of 123 subjects after reviewing the minimum number of completed daily records. 38% of the subjects completed the registry for 45 consecutive days, 24% of the subjects completed the registry between 40 and 44 consecutive days, and the remaining 38% completed it between 20 and 39 consecutive days

(only 11% of subjects completed the daily record for less than 30 consecutive days). The sample's ages were between 21 and 75 years old, with a standard deviation of 10 years. The sample was formed by 41 men (32% of the total sample) and 87 women (68% of the total sample). Other sample characteristics are showed in table 4.

Table 4
Sample descriptive characteristics

		N	%
Age (Mean / Sd)		42	10
Autonomous Region	Madrid	26	21.10%
	Valencia	20	16.20%
	Andalusia	20	16.20%
	Catalonia	17	13.90%
	Galicia	7	5.60%
	Basque Country	7	5.70%
	Navarra	6	4.90%
	Castile and Leon	4	3.20%
	Extremadura	4	3.20%
	Asturias	3	2.40%
	Castile- La Mancha	3	2.40%
	Murcia	2	1.60%
	Aragon	2	1.60%
	BalearicIslands	1	0.80%
Gender	Male	40	32.50%
	Female	83	67.50%
Marital Status	Married/Living with a couple	73	59.30%
	Divorced	15	12.20%

	Single/Living alone	35	28.50%	
Pre-Pandemic Free Time Physical Activity	Intense	44	35.77%	
	Moderate	56	45.53%	
	No	23	18.70%	
Cohabitation during lockdown[a]	Alone	26	12.90%	(21.30%)
	With children	46	22.80%	(37.70%)
	With my partner	71	35.10%	(58.20%)
	With my parents	18	8.90%	(14.80%)
	With my siblings	6	3.00%	(4.90%)
	With room mates	3	1.50%	(2.50%)
	With pets	32	15.80%	(26.20%)
Workplace	Non-essential	83	67.50%	
	Essential	40	32.50%	

a Multiple Response Variable. Dichotomous tabulated group in 1. The percentages between brackets shows combined responses over the total sample (N=202 combined responses).

If we focus on the health habits of the sample, previous to lockdown, approximately 80% of the sample seemed to practice intense or moderate physical activity (those who practiced sport did so between 6 and 7 days per week). Similar data is found with regards to sleep quality, where nearly 80% of the sample had a good or very good sleep quality previous to lockdown.

Table 5
Habits previous to lockdown

Sleep quality	n	
Very good	35	28.46%
Fairly good	59	47.97%
Fairly bad	19	15.45%
Very bad	10	8.13%
Physical activity (PA) practice		
No PA practiced	90	73.17%

1 day per week	1	0.81%
2 days per week	1	0.81%
3 days per week	2	1.63%
4 days per week	4	3.25%
5 days per week	3	2.44%
6 days per week	13	10.57%
7 days per week	9	7.32%

The practice of activities that could be of interest was also compiled in the daily diary. Table 6 shows the total percentage of the activities practiced by the selected sample during the lockdown period.

Table 6.
Activities practiced during lockdown

I have done house chores (cleaning, washing…)	16.90%	(72.40%)
I have done physical activity or exercise at home	7.50%	(32.00%)
I have read books	6.90%	(29.60%)
I have used social media (Twitter, Facebook, Instagram…)	20.40%	(87.40%)
I have had sexual activity	2.50%	(10.80%)
I have listened to music	12.90%	(55.40%)
I have watched television	17.90%	(76.50%)
I have played video games	5.60%	(23.90%)

a Multiple Response Variable. dichotomous tabulated group in 1. The percentages between brackets shows combined responses over the total sample (N=19731 combined responses).

4.3. Factor Analysis

A factor analysis provides an ideal entry point into the proposition of a model, especially latent variable modeling which will lead to a Structural Equation Modelling. The main objective of using factor analysis for the present dissertation was to find out the underlying structure behind the observed measures of the Tripartite Model proposed by Clark and Watson (1991). This

allows us to statistically compare if the data collected adjusts to the theoretical issue stated above, corresponding to the three factors shown in Figure 7.

Initially, an exploratory factor analysis (EFA) is carried out. Results show that most variance is explained by two main factors, rather than three as proposed by the Tripartite Model (see table 7).

Table 7
Total variance explained

Component	
1	25.33%
2	20.37%
3	7.43%
4	3.68%
5	3.57%

Extraction method: principal components analysis

The following table (Table 8) describes the component matrix according to the five extracted components and results per item in the Mood and AnxietySymptoms Questionnaire (MASQ) proposed by Wardenaar et al. (2010). Table 8 shows, in between brackets, the initial classification of the scale for each item.Analyzing every component, results show that component 1 seems to be more related with the factor named distress whilst component 2 seems to be more related with the factor named depression. An important aspect to highlight is that the factor depression is in reality inverse depression, following the items proposed in the Mood and AnxietySymptoms Questionnaire

(MASQ) proposed by Wardenaar et al. (2010), where inverse depression would in reality be the factor named positive affect according to the initial 90 item Mood and AnxietySymptoms Questionnaire proposed by Clark and Watson (1991).

Table 8
Components matrix for 5 extracted components

	Components				
Items	1	2	3	4	5
Felt dissatisfied (Distress)	.691	.290	-.283	-.040	-.031
Felt pessimistic about the future (Distress)	.666	.283	-.315	-.075	.052
Felt hopeless (Distress)	.664	.265	-.358	-.117	-.006
Felt worthless (Distress)	.628	.328	-.230	-.062	-.151
Blamed myself for a lot of things (Distress)	.613	.373	-.209	.045	-.103
Felt inferior (Distress)	.606	.301	-.248	-.090	-.155
Felt irritable (Distress)	.598	.259	-.244	-.001	-.008
Felt nervousness (Depression)	.560	.380	-.236	.080	-.087
Worried a lot about things (Distress)	.555	.395	-.285	-.008	.137
Heart was racing (Anxiety)	.552	.305	.447	.140	-.159
Had pain in my chest (Anxiety)	.518	.249	.440	.238	-.146
Had trouble making decisions (Distress)	.509	.353	.035	.262	.001
Felt confused (Distress)	.495	.317	-.018	-.045	.035
Felt lively (Depression)	-.546	.723	.018	.011	-.013
Felt really happy (Depression)	-.508	.721	.006	-.010	-.005
Felt optimistic (Depression)	-.505	.710	.041	.000	-.028
Felt I was having a lot of fun (Depression)	-.471	.690	.001	-.022	-.039
Felt really good about myself (Depression)	-.508	.690	-.027	.029	-.023
Felt accomplished (Depression)	-.475	.687	-.005	.045	-.029
Felt like I had a lot of energy (Depression)	-.493	.685	-.037	.030	-.091
Felt successful (Depression)	-.400	.666	.048	-.081	.094
Felt talkative (Depression)	-.361	.632	-.005	-.053	-.077
Easily startled(Anxiety)	.125	.507	-.069	.039	.332
Was short of breath (Anxiety)	.478	.239	.541	.063	-.190

Was trembling or shaking (Anxiety)	.366	.187	.477	.024	-.062
Had problems swallowing (Anxiety)	.286	.084	.268	.561	-.126
Felt nauseous (Anxiety)	.359	.163	.476	-.543	-.032
Felt dizzy (Anxiety)	.411	.206	.469	-.502	-.073
Muscles were tense (Anxiety)	.301	.229	.217	-.039	.656
Had hot or cold spells (Anxiety)	.385	.177	.276	.181	.553

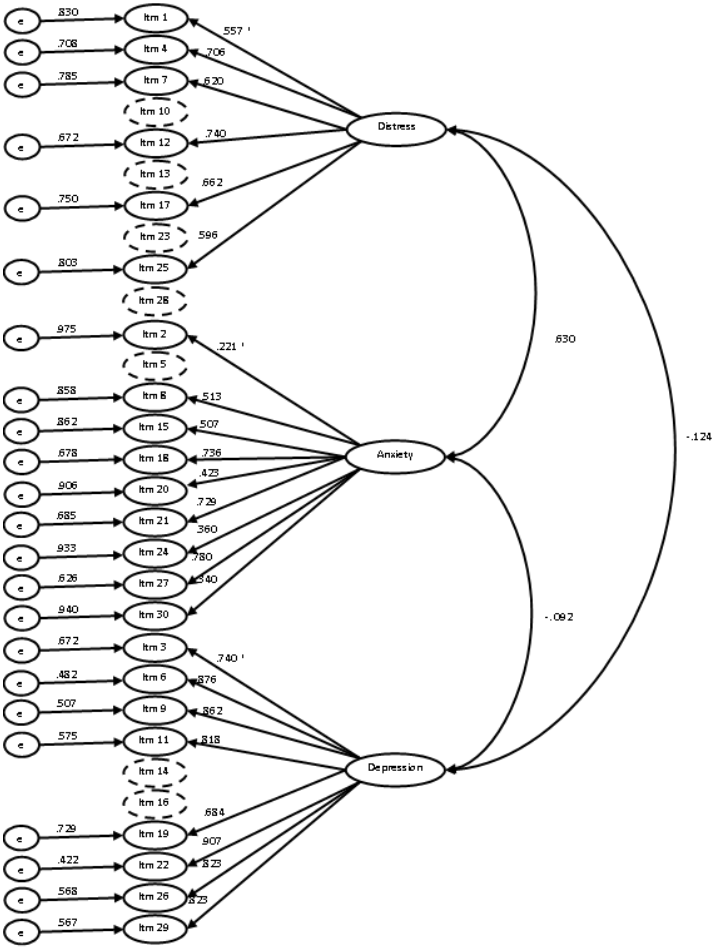
Extraction method: principal components analysis

The extraction method used for the exploratory factor analysis (EFA) was principal component analysis. This extraction method is not considered to be a factor analytic model; thus, a deterministic numerical estimate of the latent factor cannot be obtained. Nevertheless, this method was used, and therefore the main objective of the EFA was not to simplify the structure but to determine an overall view of the initial model proposed.

A confirmatory factor analysis (CFA) was then applied in order to formally test whether the data collected that will be used complies with the theoretical model (Figure 8) proposed by Clark and Watson (1991). The objective of the CFA is to test a theoretical model that specifies the number and nature of the latent factor behind the correlated measurements. The model is identified through restrictions on parameters. Rotation is not required in CFA. Special attention is paid to fit the model, and it is possible to identify because we fit the model. By fitting CFA, it can formally be tested if the data conforms to the theoretical model. Factor scores according to the final CFA model shown below were used for the posterior analysis.

Figure 8.

Final Confirmatory Factor Analysis Three-Dimensional Model obtained from the results of the Mood and Anxiety Symptoms Questionnaire (MASQ) of the collected data, in standardized values. All coefficients are significant. The fixed parameters were marked with "". Goodness-of-fit summary for Maximum Likelihood method: Independence Model χ^2_{253} = 53760.369; Akaike Information Criterion (AIC) based on Log Likelihood = 427503.380; Normed Fit Index = .910; Non-Normed Fit Index = .904; Root Mean Square Error of Approximation [90% CI] = .065 [.063, .066]; e = error.*

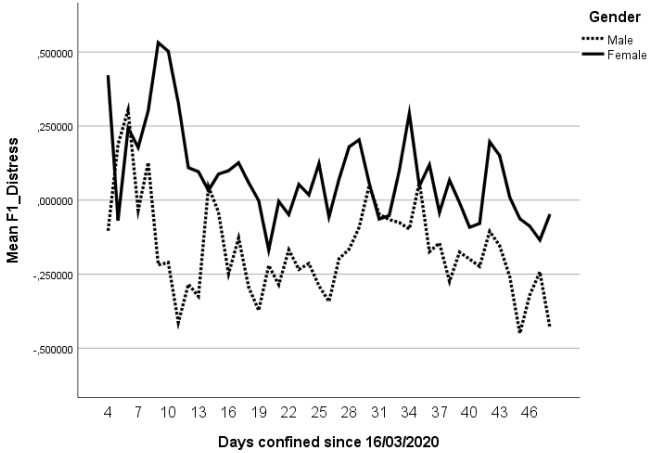


4.4. Data Analysis and Results of the Factors Proposed

General Distress

According to Box and Jenkins (1976)the first step in order to proceed in the analysis of a time series is to transform the data until it reaches the assumption of stationarity. The initial form for the time series of the first factor (F1_Distress) considering time since day one of lockdown and gender is shown in figure 9.

Figure 9.
Graph showing the mean levels of distress felt by the total sample considering the days since lockdown and gender.



Modeling the previous series in figure 9 a new asymptotic curve is obtained with F1_Distress as a function of one divided by time (1/time or 1/t); thus, the differences seem to be grater at the begging than at the end.

$$F1\_Distress_{tk} = b'0 + b'1 \cdot (1/t) + E_{tk}$$

(Equation 1)

The previous equation (Equation 1) contains the values of E_{tk} corresponding these to the residuals or white noise from F1_Distress with which the dimension stabilized (*StD*), so if their values are saved it can be modeled as a time series.

$$\begin{aligned} E_{tk} = (b_0 + b_{0k}) + [b_1 \cdot StD_{tk-1} + b_2 \cdot StD_{tk-1} \cdot Gender] + b_3 \cdot StD_{tk-2} + b_4 \cdot StD_{tk-3} \\ + b_5 \cdot StD_{tk-4} + b_6 \cdot StD_{tk-5} + b_7 \cdot StD_{tk-6} + b_8 \cdot StD_{tk-7} + b_9 \\ \cdot StD_{tk-8} + b_{10} \cdot StD_{tk-9} + b_{11} \cdot StD_{tk-10} + b_{12} \cdot StD_{tk-14} \\ + [b_{13} \cdot Telecommuting - b_{14} \cdot Telecommuting \cdot Gender] - b_{15} \\ \cdot SexualActivity \\ + [b_{16} \cdot Listentomusic + b_{17} \cdot Listentomusic \cdot Gender] \\ + [b_{18} \cdot Sport + b_{19} \cdot Sport \cdot Gender] + b_{20} \cdot Gender - b_{21} \cdot Age \\ + \varepsilon_{tk} \end{aligned}$$

(Equation 2)

The next step in the modeling of the time series is the selection of the variables to include, which would complete Equation 2, for example gender, age, and the selected lags from F1_Distress. With it, Equation 1 would remain as follows, forming Equation 3:

$$\begin{aligned} F1\_Distress_{tk} = b'0 + b'1 \cdot (1/t) + (b_0 + b_{0k}) + [b_1 \cdot StD_{tk-1} + b_2 \cdot \\ StD_{tk-1} \cdot Gender] + b_3 \cdot StD_{tk-2} + b_4 \cdot StD_{tk-3} + b_5 \cdot StD_{tk-4} + b_6 \cdot \\ StD_{tk-5} + b_7 \cdot StD_{tk-6} + b_8 \cdot StD_{tk-7} + b_9 \cdot StD_{tk-8} + b_{10} \cdot StD_{tk-9} + \\ b_{11} \cdot StD_{tk-10} + b_{12} \cdot StD_{tk-14} + [b_{13} \cdot Telecommuting - b_{14} \cdot \\ Telecommuting \cdot Gender] - b_{15} \cdot SexualActivity + [b_{16} \cdot \\ Listentomusic + b_{17} \cdot Listentomusic \cdot Gender] + [b_{18} \cdot Sport + b_{19} \cdot \\ Sport \cdot Gender] + b_{20} \cdot Gender - b_{21} \cdot Age + E_{tk}) \end{aligned}$$

(Equation 3)

The value of b_0 will statistically be 0. This is because, to check the stability of a longitudinal model in the Long Run Trend (Y_∞), itis achieved when(Gujarati, 2004; Huckfeldt et al., 1982):

(a) $t \rightarrow \infty$,

(b)$E[Y_1] = E[Y_2] = \ldots = E[Y_{t-1}] = E[Y_t] = \ldots = E[Y_\infty]$, if the model is autoregressive (AR), and

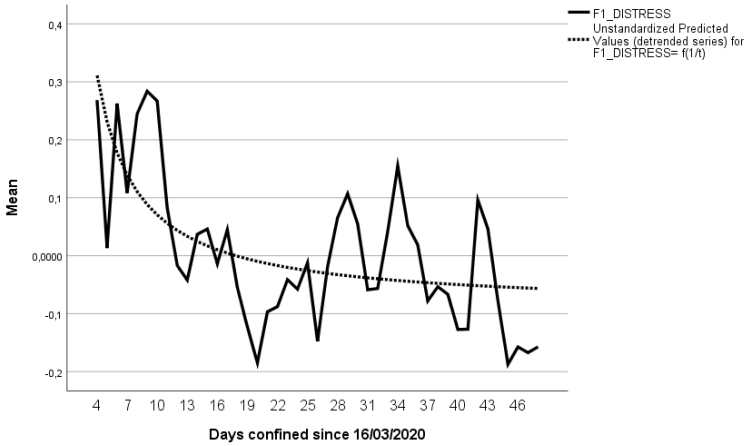
(c) $E[\varepsilon_{it}] = 0$ (forecast error)

(Equation 4)

The number of lags to include in the model will correspond to the total statistically significant lags both for the autocorrelation function (ACF) and partial autocorrelation function (PACF), therefore showing the stability or seasonality of the series.

Figure 10 shows the original values of the time series and the final values predicted from the time series that will be used (unstandardized predicted values).

Figure 10.
Multiple line graph that shows the adjustment of the original series F1_Distress and the Predicted values when modeling the time series.



From figure 10 we can also appreciate that the value of F1_Distress tends to become stationary; Table 9 shows the lineal descending trend of the curve. The dotted line from Figure 10 shows the predicted values of the series posterior to the adjustment of the function 1/t. According to Table 10, it can be stated that the moment at which the predicted values become stationary statistically should be at around -0.09 (extracted from the intersection estimate from Table 10), which is approximately around day 7 of lockdown. This estimate is not very accurate or precise, further statistical calculations should be done in order to increase accuracy.

Table 9.
Estimates of fixed effects

Parameter	Estimate	Std. Error	df	t	Sig.	95% CI LB	95% CI UB
Intercept	.12948	.040688	4856	3.182	.001	.04971	.20924
DaysLockdown	-.00506	.001435	4856	-3.528	.000	-.0078	-.0022

Dependent variable: F1_Distress

Going back to Equation 1, a forecasting equation for F1_Distress will be proposed. To start with, the regression coefficients for F1_Distress = f (1/t) in Table 10 will substitute Equation 1 to form Equation 5.

Table 10.
Regression coefficients for F1_Distress = f (1/t)

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.090	.028		-3.168	.002
	1/Time	1.604	.398	.058	4.034	.000

Dependent variable: F1_Distress

The new Equation 5 formed will be as follows when substituting into Equation 1:

$$F1\_Distress_{tk} = -.090 + 1.604*1/t + E_{tk}$$

(Equation 5)

From this new equation formed, it can be stated that the effect of time (t) disappears statistically significantly ($p < .000$) as time increases.

An exploratory analysis of stabilized distress has been made, and it has been verified that there are quite a few significant lags in the ACF and in the PACF, in addition to the Box-Ljung statistic having a value for 14 lags of 22785.740, *df*: 14, *p*<.001, so the data of the series are not 'white noise'; they present serial dependence, and must be modeled using time series with the variables presented and proposed in Equation 3.It is important to state that the non-significant intermediate lags have been maintained as indicated by Box et al. (2016); Delays 7 and 14 are maintained, since we see that the behavior presents a seasonality of 7 days. We have suppressed the variables Lag 1 stabilized distress×Gender (*b* = .002, *SE* = .023, *p* = .934), Age (*b* = -.001, *SE* = .001, *p* = .174) and the Listening music×Genderinteraction (*b* = .101, *SE* = .054, *p* = .062) because they are not statistically significant. The final stabilized model can be observed in Table 11.

Table 11
Estimates of fixed effects included in the final stabilized model of distress during lockdown.

Parameter	Est.	Std. Error	*t*	*Sig.*	η^2	δ	*1-β*
Intercept	.040	.030	1.312	.190	.001	1.303	.256
Lag 1 stab. distress	.313	.018	17.607	.000	.090	17.579	1.000
Lag 2 stab. distress	.106	.018	5.777	.000	.011	5.816	1.000
Lag 3 stab. distress	.031	.018	1.656	.098	.001	1.677	.388
Lag 4 stab. distress	.073	.018	3.992	.000	.005	3.952	.977
Lag 5 stab. distress	.100	.018	5.490	.000	.009	5.456	1.000
Lag 6 stab. distress	.080	.018	4.432	.000	.006	4.377	.992

Lag 7 stab. distress	.064	.018	3.488	.000	.004	3.495	.938
Lag 8 stab. distress	.019	.018	1.070	.285	.000	1.097	.195
Lag 9 stab. distress	.022	.018	1.227	.220	.000	1.217	.229
Lag 10 stab distress	.051	.017	2.960	.003	.003	2.948	.838
Lag 14 stab distress	.049	.015	3.276	.001	.003	3.225	.897
Telecommuting	.088	.046	1.895	.058	.001	1.884	.469
Physical Activity	.013	.050	.251	.802	.000	.248	.057
Sexual activity	-.127	.039	-3.236	.001	.003	3.222	.896
Listen to music	-.092	.025	-3.712	.000	.004	3.683	.957
Gender	.079	.034	2.309	.021	.002	2.283	.627
Telecom.×Gender	-.156	.056	-2.786	.005	.002	2.766	.790
Phys.Act×Gender	-.113	.060	-1.903	.057	.001	1.888	.471

Dependent Variable: Stabilized distress.
η^2: Partial Eta Squared. δ: Noncentrally Parameter. *1-β*: Observed Power.

There are no significant level 2inter-subject differences (intercept, Var[b_{0k}] = .000),which means that all subjects present the same interceptof distressbut not all individuals present the same level in the values obtained in the delays and in the variables included in the equation.

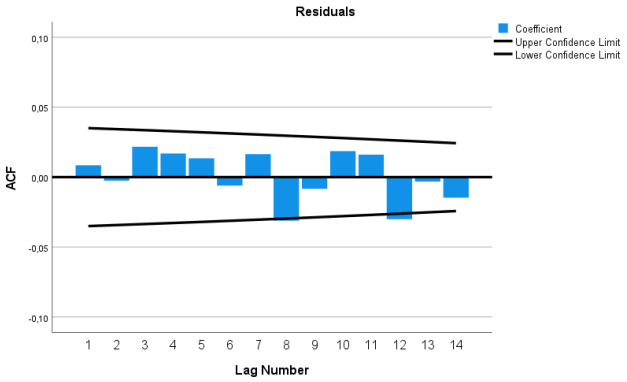
In order to test the significance of the total fit of the equation in Table 11, the value of its -2 logarithm of the likelihood (-2LL) is compared with its respective parameters (-2LL = 6396.565; parameters: 21), with that of the null model, only with the intercept of the series ($-2LL_0$ = 15737.478; parameters: 2), being the increment of values: Δ(-2LL)=9340.913, and Δ(*df*)= 19, which follows a chi squared distribution, so the fit of the model of the equation in Table 11 has ap<.001, the overall fit being significant.The R^2 value is .663 (p< .001), so approximately the

66% of the variance of distress is explained by the equation resulting from the variables included in Table 11.

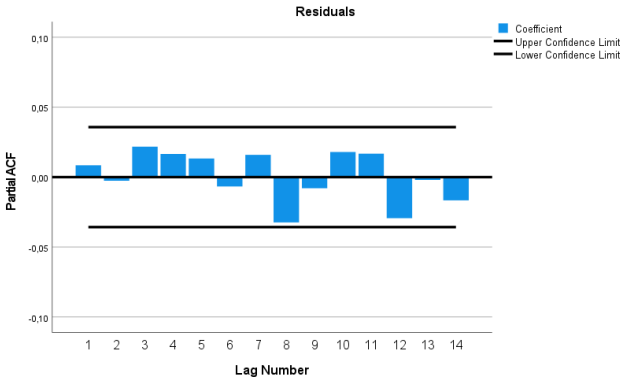
Table 11 shows that the variables related to physical activity (Physical Activity and Physical Activity×Gender) are not significant, but after removing them from the final equation, their Akaike Information Criteria (AIC) has passed from 6396.565 with these 2 variables (model in Table 11) to 6406,272, so apparently the model with physical activity is better than without it. We have verified if this improvement is statistically significant by comparing their respective -2LL, where the -2LL = 6392.467 for the model without Physical Activity and Physical Activity×Gender. Δ(-2LL) = 6406.272-6396.565 = 9.707, Δ(*df*) = 21-19 = 2, *p* = .008, so the difference is significant in favor of the model with the physical activity variables in Table 11. In other words, although individually the Physical Activity and Physical Activity×Gender variables are not significant separately, when their overall probability is calculated, it is significant, so we leave them in the final Equation of Table 11.

Figure 11.
ACF (a) and PACF (b) graphs for residuals of equation of Table 11 of distress.

(a)



(b)



Finally, the study of the model residuals is carried out to determine if they constitute white noise. As we can see in the ACF and PACF Figures 11a and 11b, we can determine that the time series for stabilized distress is correctly modelized, including the first10 lags and the 14th lag, as well as a group of variables that contribute to the explanation of the distress score(Box-Ljung statistic for 14 lags of 19.808, *df*: 14, *p*= .136). In Figure 11a it can

be seen that delays 8 and 12 are at the limit of significance, but bear in mind that for a delay to be significant it must be in its ACF and in its PACF.Since delays 8 and 12 of Figure 11b are not significant, nor is the result of the Box-Ljung test, the residuals constitute a 'white noise'.In Box-Jenkins terms, the model has a memory of 10 simple days plus a seasonality of 7 days for 2weeks, that is, it is an ARIMA $(10,0,0)(2,0,0)_7$ model.This check is very important from a statistical perspective because it indicates that the coefficients obtained are not biased and their standard errors are consistent, avoiding type I errors(Kmenta, 1971). In other words, the effects obtained are significantly so in reality.In summary, since the overall fit of the model is significant, and the residuals are 'white noise', we accept the model from Table 11.

Focusing now on the next part of the results of the model proposed shown in Table11, interactions between gender and some variables can be highlighted. Developing stabilized distress (E_{tk}), according to Table 11:

$$\begin{aligned} E_{tk} = .040 + 313 \cdot StD_{tk-1} + .106 \cdot StD_{tk-2} + .031 \cdot StD_{tk-3} + .073 \\ \cdot StD_{tk-4} + .100 \cdot StD_{tk-5} + .080 \cdot StD_{tk-6} + .064 \\ \cdot StD_{tk-7} + .019 \cdot StD_{tk-8} + .022 \cdot StD_{tk-9} + .051 \\ \cdot StD_{tk-10} + .049 \cdot StD_{tk-14} \\ + [.088 \cdot Telecommuting - .156 \cdot Telecommuting \\ \cdot Gender] - .127 \cdot SexualActivity - .092 \\ \cdot Listentomusic + [.013 \cdot PhysicalActivity - .113 \\ \cdot Sport \cdot PhysicalActivity] + .079 \cdot Gender + \varepsilon_{tk}' \end{aligned}$$

(Equation 6)

In Table 11 it can be seen that the delays 3, 8 and 9 of the stabilized distress variable are not significant, but they have been included since the subsequent delays are significant, that is, delay 4 and delay 10 (Box et al., 2016). Note how all the autoregressive coefficients are positive, which is consistent with the expected behavior of any individual. If distress increases on any given day, stress will tend to increase in subsequent days.

Previously it has been explained why Physical Activity and Physical Activity×Gender have been included, but it can also be seen that there isa simple variable, Telecommuting, that is not significant and has been kept in the equation. This is due to the fact that it is part of a significant interaction (Telecommuting×Gender), so it must be maintained due to the principle of 'nesting' in the interaction of variables. An important aspect to take into account is that when the interaction of gender with another variable is significant, the coefficient of that variable is different for men and for women(Hayes & Montoya, 2017). Thus, the interaction of Physical Activity and Telecommuting by gender indicates that both variables affect both genders differently in terms of its effect on distress. Specifically, due to its negative sign and the Gender values being 0 for male, and 1 for female, we can affirm that both variables reduce the perceived distress in women.

Considering that in Equation 3 E_{tk} is a part of Distress indicated in Equation 2, we can substitute E_{tk} from Equation 6 in Equation 5:

$$\begin{aligned}\text{F1\_Distress}_{\text{tk}} &= -.090 + 1.604\left(\frac{1}{t}\right) + \{\text{E}_{tk}\} \\ &= -.090 + 1.604(1/t) + \{.040 + 313 \cdot StD_{tk-1} \\ &+ .106 \cdot StD_{tk-2} + .031 \cdot StD_{kt-3} + .073 \cdot StD_{tk-4} \\ &+ .100 \cdot StD_{tk-5} + .080 \cdot StD_{tk-6} + .064 \cdot StD_{tk-7} \\ &+ .019 \cdot StD_{tk-8} + .022 \cdot StD_{tk-9} + .051 \cdot StD_{tk-10} \\ &+ .049 \cdot StD_{tk-14} \\ &+ [.088 \cdot Telecommuting - .156 \cdot Telecommuting \\ &\cdot Gender] - .127 \cdot SexualActivity - .092 \\ &\cdot Listentomusic + [.013 \cdot PhysicalActivity - .113 \\ &\cdot Sport \cdot PhysicalActivity] + .079 \cdot Gender + \text{E}_{tk}\}\end{aligned}$$

(Equation 7)

The final Equation 7 can be developed into two different equations, one for men and the other for women. Therefore, since it has been coded with the value of "0" for men and "1" for women, Equation 7 is substituted and simplified for each gender, and each corresponding interaction is replaced by its result, as follows:

$$\begin{aligned}&\text{F1\_Distress}_{\text{Male}_{\text{tk}}} \\ &= -.050 + 1.604 \cdot \left(\frac{1}{t}\right) + 313 \cdot StD_{tk-1} + .106 \\ &\cdot StD_{tk-2} + .031 \cdot StD_{tk-3} + .073 \cdot StD_{tk-4} + .100 \\ &\cdot StD_{tk-5} + .080 \cdot StD_{tk-6} + .064 \cdot StD_{tk-7} + .019 \\ &\cdot StD_{tk-8} + .022 \cdot StD_{tk-9} + .051 \cdot StD_{tk-10} + .049 \\ &\cdot StD_{tk-14} + .088 \cdot Telecommuting - .127 \\ &\cdot SexualActivity - .092 \cdot Listentomusic + .013 \\ &\cdot PhysicalActivity + \text{E}_{tk}\end{aligned}$$

(Equation 8)

$$\text{F1\_Distress}_{\text{Fem}_{\text{tk}}} = .029 + 1.604 \cdot \left(\frac{1}{t}\right) + 313 \cdot StD_{tk-1} + .106 \cdot StD_{t-2} + .031 \cdot StD_{t-3} + .073 \cdot StD_{tk-4} + .100 \cdot StD_{tk-5} + .080 \cdot StD_{tk-6} + .064 \cdot StD_{tk-7} + .019 \cdot StD_{tk-8} + .022 \cdot StD_{tk-9} + .051 \cdot StD_{tk-10} + .049 \cdot StD_{tk-14} - .068 \cdot Telecommuting - .127 \cdot SexualActivity - .092 \cdot Listentomusic - .100 \cdot PhysicalActivity + \text{E}_{tk}$$

(Equation 9)

We can observe different values of the intercept of men (.050) and women (.029). In the case of men, (Equation 8) this value is due to the result of the sum of the intercepts of Equation 5 (-.090) and Equation 6 (.040). In the case of women (Equation 9) this value comes from the previous result plus the value of .079·*Gender* = .079, being the result of -.090 + .040+ .079 = .029. In the same Equations 8 and 9 the effect of 1/*t* is significant (*b* = 1.604); this indicates that when the time from confinement increases, its effect on distress decreases, until it approaches the value of -.090 (distress baseline determined by the intercept of Equation 5). Initial values of Stress are very high, but they decrease gradually, rapidly in the beginning, and more slowly from day 30 onwards (Figure 10). An example will now be set in order to further explain this: in the case of keeping all the other variables of Equation 5 constant, on the first day of confinement (*t* = 1) the increase in distress was 1.604points; on the 15th day of confinement (*t* = 15), the increase in distress due time was 1.604·(1/15) = .107; on the 30th day of confinement (*t* = 30), the

increase in distress due time was 1.604·(1/30) = .053 and, on the last day of lockdown, the increase in distress was .033 (1.604·(1/30)). This verifies that when *t* increases, *1*/*t* approaches the value 0.

The proposed model has significant delays up to 14 days, which indicates that during the lockdown the 'time memory' of distress has been 2 weeks(Box & Jenkins, 1976). The term .313·StD_{tk-1} in the equation means that if one day any person's distress increases by one unit, the next day their distress increases by .313units.Similarly, .106·StD_{tk-2} indicates that for each unit of increase in distress, after two days the person's distress will increase by .106 units, and so forth until the 14^{th} delay was reached, when term .049·StD_{tk-14} indicates that an increase in one unit of distress would produce an increase of .049 units of distress after 14 days.

Regarding the term [.088·Telecommuting-.156·Telecommuting·Gender] of Equation 5, since the Telecommuting×Gender interaction was significant (p = .005), the simple variables telecommuting and gender have also been left in, with the following results for men: .088·Telecommuting-.156·Telecommuting·0 = .088·Telecommuting; and for women: .088·Telecommuting-.156·Telecommuting·1 = -.068·Telecommuting (Equations 7 and 8). Therefore, the coefficients are different for men and women, thus, in any man, the fact of teleworking increases distress by .088 units, while in women it decreases it by .068 units. Gender coefficient value

(.079) is not included because it has already been incorporated before, and it must be included only once in Equation 8.

Regarding the variable 'sexual activity' (b = -.127, p<.001), the practice of sexual activity reduces distress for a day by .127 units, and this occurs in both men and women.

We also observe in Table 2 that the Physical Activity×Gender interaction has been non-significant (b = -.113, p = .057), being the value of this interaction [.013·Physical Activity-.113·Physical Activity·Gender], plus the effect of gender, which has already been included (Equations 8 and 9). This would indicate that Physical Activity practice affects distress in a different way depending on whether one is male or female, although the practice of Physical Activity as a principal variable is not significant (b = .013, p = .802), as seen in Table 2. Therefore, in the case of men, [.013·Physical Activity-.113·Physical Activity·0] = .013·Physical Activity, which would indicate that the practice of Physical Activity increases distress in men by .013 points (although this value in itself is not significant, it is maintained because together with Physical Activity it is statistically significant). On the other hand, in women's case, [.013·Physical Activity-.113·Physical Activity·1] = -.100, which means that Physical Activity practice reduces distress in women by .100. This proves that there are significant differences between men and women.

Finally, the observed power ($1-\beta$) of the variables has been calculated, the lowest being that of the Physical Activity variable ($1-\beta$ = .057), although the interaction of Physical Activity

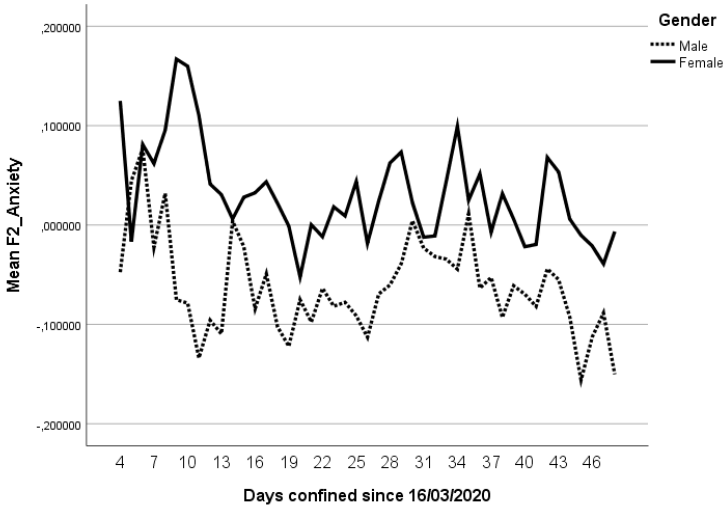
and Gender is higher (β = .471), and its coefficient is not significant (b = -.113, p = .057).Therefore, it would possibly be convenient to expand the sample, but if we consider that between both variables they have a p = .008, then the sample size is adequate. In other words, the power of the Physical Activity variable is associated with that of the Gender variable and the interaction of both variables. The highest power has been achieved in the variable StD_{tk-1} (β = 1.000), together with 1/t (β = .981), so that the temporary variables have a great power, being our sample sufficiently representative for robust effect parameters.

Anxious Arousal

The same procedure as the one used for F1_Distress will be used for the detrend and forecast equation for F2_Anxiety per each gender.

The initial form for the time series of the third factor (F2_Anxiety) considering time since day one of lockdown and gender is shown in figure 12.

Figure 12.
Graph showing the mean levels of anxiety felt by the total sample considering the days since lockdown and gender.



By modeling the previous series in figure 12, a new asymptotic curve is obtained with F2_Anxiety as a function of one divided by time (1/time or 1/t); thus, the differences seem to be greater at the begging than at the end.

$$\mathrm{F2\_Anxiety_{tk}} = \mathrm{b'_0} + \mathrm{b'_1}\cdot(1/\mathrm{t}) + \mathrm{E_{tk}}$$

(Equation 10)

The previous equation (Equation 10) contains the values of E_{t1}corresponding these to the residuals or white noise from

F2_Anxiety, so if their values are saved it can be modeled as a time series.

$$E_{tk} = b_0 + b_1 \cdot age + b_2 \cdot (week\_day) + b_3 \cdot E_{tk\_}F2\_Anxiety_{tk-1} + b_4 \cdot E_{tk}F2\_Anxiety_{tk-2} + \ldots + b_7 \cdot E_{tk1\_}F2\_Anxiety_{tk-7} + \ldots + \varepsilon_{tk}'$$

(Equation 11)

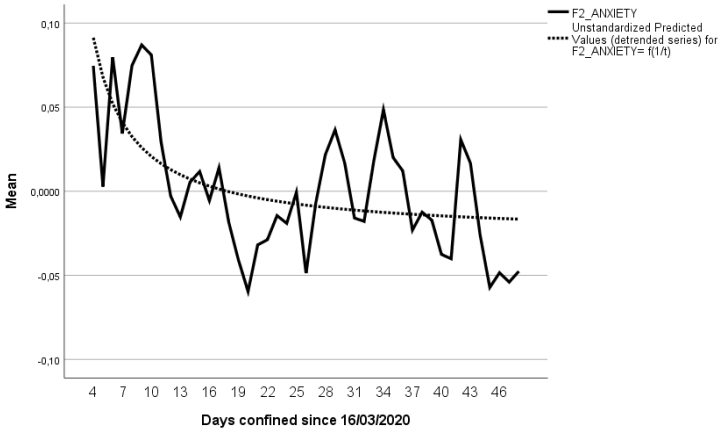
The previous Equations (Equation 10 and Equation 11) are put together, forming Equation 12:

$$F2\_Anxiety_t = b'_0 + b'_1 \cdot (1/t) + (b_0 + b_1 \cdot age + b_2 \cdot (week\_day) + b_3 \cdot E_{tk1\_}F2\_Anxiety_{tk-1} + b_4 \cdot E_{tk1\_}F2\_Anxiety_{tk-2} + \ldots + b_7 \cdot E_{tk1\_}F2\_Anxiety_{tk-7} + \ldots + E_{tk})$$

(Equation 12)

Figure 13 shows the final values predicted from the time series that will be used (unstandardized predicted values) and the original values of the time series.

Figure 13.
Multiple line graph that shows the adjustment of the original series F2_Anxiety and the Predicted values when modeling the time series.



From figure 13 we can also appreciate that the value of F2_Anxiety tends to become stationary; Table 12 shows the lineal descending trend of the curve. The dotted line from Figure 13 shows the predicted values of the series posterior to the adjustment of the function 1/t. According to Table 13, it can be stated that the moment at which the predicted values become stationary statistically should be at around -0.026 (extracted from the intersection estimate from Table 13),which is approximately around day 8 of lockdown. This estimate is not very accurate or precise; further statistical calculations should be done in order to increase accuracy.

Table 12.
Estimates of fixed effects

						95% CI	
Parameter	Estimate	Std. Error	df	t	Sig.	LB	UB
Intercept	.038	.013	4856	2.893	.004	.012	.063
Days_Lockdown	-.002	.000	4856	-3.208	.001	-.002	-.000

a. Dependent variable: F2_Anxiety

Going back to Equation 10, a forecasting equation for F2_Anxiety will be proposed per each gender. To start with, the regression coefficients for F2_Anxiety= f (1/t) in Table 13 will substitute Equation 10 to form Equation 13.

Table 13.
Regression coefficients for F2_Anxiety = f (1/t)

Model		Unstandardized coefficients B	Unstandardized coefficients Std. Error	Standardized coefficients Beta	t	Sig.
1	(Constant)	-.026	.009		-2.908	.004
	1/Time	.471	.127	0.053	3.700	.000

a. Dependent variable: F2_Anxiety

The new Equation 13 formed will be as follows when substituting into Equation 10:

$$\text{F2\_Anxiety}_{tk} = \text{-.026} + .471*1/t + E_{tk}$$

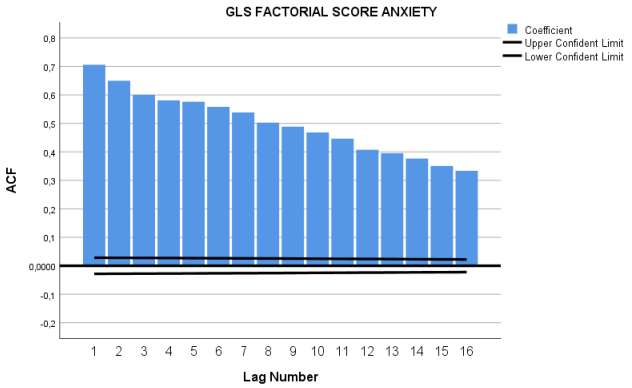
(Equation 13)

From this new equation formed, it can be stated that the effect of time (t) disappears statistically significantly ($p < 0.05$) as time increases. 10 days after lockdown, the effect of time over anxiety will be of .471*(1/10) = .05of anxiety increase; 30 days after, .471*(1/30) =.02; and 100 days after .471*(1/100) = .01, thus indicating the effect of time disappears as time passes by.

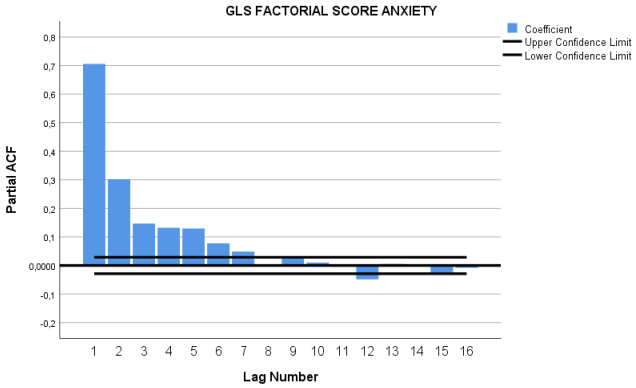
Going back to Equation 12, in order to complete Equation 13, the autocorrelation function and partial autocorrelation function were calculated. This is shown in Figure 14.

Figure14.
Graphs showing the results for the ACF (a) and PACF (b) for the Unstandardized Residuals in F2_Anxiety

(a)



(b)



According to the figures above, it is recommended to include a maximum of 7 lags in the final model proposed.

Table 14.
Estimates of the anxiety analyzed model

a. Estimates of fixed effects[a]

Parameter		Est.	Std. Er.	df	t	Sig.	95% CI	
							LB	UB
Intercept		-.006	.018	1337.591	-.358	.721	-.042	.029
Weekday	M	.018	.013	3951.790	1.397	.163	-.007	.043
	T	.033	.013	3957.334	2.515	.012	.007	.059
	W	.026	.013	3951.896	1.927	.054	-.000	.052
	T	.014	.013	3953.962	.976	.329	-.013	.039
	F	.009	.013	3949.690	.695	.487	-.017	.035
	S	.020	.013	3945.816	1.543	.123	-.005	.045
	S	0[b]	0					
Age		-.000	.000	73.955	-.658	.511	-.000	.000
RESIDUAL F2_1		.324	.017	321.395	18.871	.000	.290	.358
RESIDUAL F2_2		.144	.016	3984.607	8.881	.000	.112	.175
RESIDUAL F2_3		.047	.016	3985.246	2.890	.004	.015	.079
RESIDUAL F2_4		.077	.016	3978.388	4.726	.000	.045	.108
RESIDUAL F2_5		.097	.016	3978.416	6.053	.000	.066	.129
RESIDUAL F2_6		.110	.016	3985.999	6.925	.000	.079	.141
RESIDUAL F2_7		.106	.015	3985.631	7.032	.000	.076	.135

b. Estimates parameters of covariance[a]

Parameter	Est.	Std. Er.	Wald Z	Sig.	95% CI	
					LB	UB
Residual	.05	.001	44.209	.000	.048	.053
Intercept [subject = ID] Var	.000[b]	.000				
RSD_F2_1 [subject = ID] Var	.003	.002	1.908	.056	.001	.009

a. Dependent variable: RESID_F2

b. This parameter is established as 0 thus it is redundant. The parameters cannot be calculated.

If we admitted the model proposed in Table 14 to forecast E_{tk} inEquation 13, then:

E_{tk}= -.006 + [.018·D_Sun + .033·D_Mon + .026· D_Tues + .013· D_Wed + .009· D_Thurs + .02· D_Fri]- .0002·Age+ .324· $RSD\_F3_{\_1}$+ .144· $RSD\_F3_{\_2}$ +... + .11· $RSD\_F3_{\_6}$ + .106· $RSD\_F3_{\_7}$+ ε_{tk}'

(Equation 14)

The new equation formed, Equation 14, includes the effect of the day of the week and the effect of the time lags (up to 7 days). Take into consideration that the random intercept for the subjects appears to not be statistically significant, indicating that not every person has its own level over parameter b'_0.

Inserting Equation 14 into Equation 13 would form the new Equation 15 as follows:

$F2\_Anxiety_{tk}$ = -.026 + .471*1/t -.006 + [.018·D_Sun + .033·D_Mon + .026· D_Tues + .013· D_Wed + .009· D_Thurs + .02· D_Fri]- .0002·Age+ .324· RSD_F3_1+ .144 RSD_F3_2 +... + .11· RSD_F3_6 + .106· RSD_F3_7+ E_{tk}

(Equation 15)

Now, the Long Run Trend (LRT) of Equation15 for F2_Anxeity would be obtained:

$F2\_Anxiety_t$ = -.026 + .471*1/t -.006 + [.018·D_Sun + .033·D_Mon + .026· D_Tues + .013· D_Wed + .009· D_Thurs + .02· D_Fri]- .0002·Age+ .324· RSD_F3_1+ .144· RSD_F3_2 +... + .11· RSD_F3_6 + .106· RSD_F3_7+ et2= -.026 + .471*0-.006 + [week_day]- .0002·Age+ .324· RSD_F3_1+ .144· RSD_F3_2 +... + .11· RSD_F3_6 + .106· RSD_F3_7+ e_{t2}

(Equation 16)

In the results of the descriptive, the mean of (RSD_F2) = 0, so the same variable, lagged, would also have a value of 0:

$$F2\_Anxiety_{tk}=-.026 + .471*0-.006 + [week\_day]- .0002\cdot Age+ .324\cdot 0+ .144\cdot 0 +... + .11\cdot 0+ .106\cdot 0 = -0.032 +[week\_day]– .0002\cdot Age$$

(Equation 17)

Take into consideration that the values for “week_day” are very small (between .009for day 5, minimum, and .033for day2, maximum). The same happens with age (for example, the variable Age oscillates between 21 and 75 years, therefore the effect of age over the LRT of F2_Anxiety will vary between – 0.0042 and – .015 (= –.0002·age), respectively.

All the variables of interest were placed to be analyzed in the model as a function for F2_Anxiety. Table 15shows Type III tests of fixed effects, where statistically significant differences seem to be focused mainly on work variables, age and the factors tested in the initial model proposed.

Table 15.
Type III tests of fixed effects

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	104.517	2.595	.110
Age	1	104.526	1.732	.191
Gender	1	106.078	13.417	.000
Sleep_quality	3	107.892	.946	.421
Sport_Q6_3	1	3887.412	.804	.370
Sex_Q6_7	1	3854.854	.109	.741
Sex_previous	1	3857.284	.821	.365
Telecommuting_Q6_1	1	3877.828	.213	.644
Marital_Status	2	104.892	4.553	.013
Work_Status	5	105.711	.792	.558
Isolation	2	104.835	.415	.662
Pet	1	103.897	.682	.411
OUT_TIME	1	3842.812	8.132	.004
Sport_Pre	1	106.513	1.657	.201
F1_Distress	1	2851.641	133108.980	.000
F3_Depression	1	2480.235	324.110	.000

a. Dependent variable: RSD_F2_Anxiety

The statistically significant variables found on Table 15 are those which could influence anxiety related to gender, like the time the person spent out of their house and their marital status. The factors of distress and depression are also included in it and seem to be very statistically significant.

In accordance with the other factors analyzed (distress and depression), a model including the main factor lagged up to seven days is tested. Results are shown in Table 16, where marital status and gender show statistically significant differences,

indicating that these two variables play an important role in the influence of anxiety, as well as the two other factors analyzed in the present dissertation: distress and depression. Furthermore, lags 1, 3 and 6 seem to also have a significant influence in a person's anxiety levels.

Table 16.
Estimates of the anxiety analyzed model

a. Estimates of fixed effects[a]

Parameter	Est.	Std. Er.	df	t	Sig.	95% CI LB	95% CI UB
Intercept	-.01	.013	110.083	-.723	.471	-.036	.017
Sleep Quality							
Very bad	.003	.008	122.886	.381	.704	-.013	.019
Fairly bad	-.002	.006	114.046	-.272	.786	-.013	.001
Fairly good	-.002	.004	114.708	-.448	.655	-.010	.007
Very good	0[b]	0					
Marital Status							
Married / In union	.001	.005	110.359	.229	.820	-.008	.011
Divorced	-.017	.007	111.522	-2.485	.014	-.031	-.004
Single	0[b]	0					
Work Status							
Unemployed	-.010	.01	107.804	-.983	.328	-.030	.010
Student	-.006	.011	109.450	-.558	.578	-.029	.016
Non-essential Worker	.001	.007	109.479	.128	.899	-.014	.015
Essential Worker	.006	.008	108.930	.723	.471	-.01	.021
Retired	.021	.015	115.889	1.391	.167	-.009	.051
Other	0[b]	0					
Isolation	-.001	.003	111.985	-.323	.747	-.006	.004
Age	.000	.000	110.617	1.235	.219	-.000	.001
Sport	.002	.001	3242.894	1.637	.102	-.000	.004
Sex	-.000	.002	3201.978	-.127	.899	-.003	.003
Sex_previous	.003	.002	3205.908	2.012	.044	0,076	.006
Telecommuting	-.001	.001	3261.101	-.836	.403	-.003	.001
Pet	-.003	.005	109.873	-.717	.475	-.012	.006
OUT_TIME	.004	.004	3268.804	1.282	.200	-0,002	.012
Sport_previous	-.001	.001	111.665	-1.268	.207	-.002	.001
F1_DISTRESS	.31	.001	3144.071	365.89	.000	.308	.311
F3_INVANHEDONIA	-.002	.096	2618.938	-15.328	.000	-.002	-.001
Gender	.012	.004	112.908	2.892	.005	.004	.020
RESIDUAL F2_1	.005	.002	3189.485	2.358	.018	.001	.008
RESIDUAL F2_2	.002	.002	3191.235	1.089	.276	-.002	.006
RESIDUAL F2_3	.004	.002	3206.493	2.217	.027	.001	.008

RESIDUAL F2_4	-.000	.002	3205.109	-.124	.901	-.004	.003
RESIDUAL F2_5	.003	.002	3188.276	1.434	.152	-.001	.006
RESIDUAL F2_6	.005	.002	3195.840	2.522	.012	.001	.008
RESIDUAL F2_7	-.002	.002	3231.927	-1.207	.227	-.006	.001

b. Estimates parameters of covariance[a]

Parameter	Estimate	Std. Er.	Wald Z	Sig.	95% CI	
					LB	UB
Residual	.001	.013	39.593	.000	.001	.001
Intercept [subject = ID] Var	.000	.053	6.993	.000	.000	.001
Gender [subject = ID] Var	.000b	.000				

a. Dependent variable: Residual Values (detrended series) for F2_Anxiety= f(1/t).
b. This parameter is established as 0 thus it is redundant. The parameters cannot be calculated.

A final model proposed for the analysis of anxiety as a factor can be found in Table 17. In order to do so, a multilevel model was tested until the variables tested were found to be mostly statistically significant, thus the previous model was proposed as an exploratory model.

Table 17.
Estimates of the anxiety analyzed model

a. Estimates of fixed effects[a]

Parameter	Est.	Std. Er.	df	t	Sig.	95% CI	
						LB	UB
Intercept	-.02	.008	120.360	-2.462	.015	-.035	-.004
Marital Status							
Married / in union	.001	.004	120.245	.203	.840	-.007	.01
Divorced	-.013	.006	120.201	-2.019	.046	-.025	-.000
Single	0[b]	.000					
Age	.000	.000	120.339	1.759	.081	-.000	.001
Sex_previous	.002	.001	3925.581	1.767	0.77	-.000	.005
F1_DISTRESS	.31	.001	3981.229	494.568	.000	.309	.311
F3INVANHEDONIA	-.001	.000	3778.893	-22.098	.000	-.002	-.001
Gender	.01	.004	120.953	2.675	.009	.003	.017

RESIDUAL F2_1	.003	.002	3930.133	1.848	.065	-.000	.006
RESIDUAL F2_2	.000	.002	3927.557	.132	.895	-.003	.003
RESIDUAL F2_3	.004	.002	3935.657	2.756	.006	.001	.007
RESIDUAL F2_4	-.000	.002	3934.566	-.14	.889	-.003	.003
RESIDUAL F2_5	.003	.002	3924.243	1.921	.055	.000	.006
RESIDUAL F2_6	.002	.002	3927.622	1.291	.197	-.001	.005
RESIDUAL F2_7	-.002	.002	3959.236	-1.143	.253	-.005	.001

b. Estimates parameters of covariance[a]

Parameter	Estimate	Std. Er.	Wald Z	Sig.	95% CI	
					LB	UB
Residual	.000	.000	43.932	.000	.000	.001
Intercept [subject = ID] Var	.000	.000	7.436	.000	.000	.001

a. Dependent variable: Residual Values (detrended series) for F2_Anxiety= f(1/t).

b. This parameter is established as 0 thus it is redundant. The parameters cannot be calculated.

The factor anxiety seems to be influenced by marital status, sexual activity that had taken place the previous day, age, gender, and the person's levels of depression and distress that day. Furthermore, high levels of distress from the previous day increased the levels of distress the person felt the present day.

Considering the condition of marital status, results show statistically significant differences when a person was divorced compared to when a person was married or living with someone, decreasing anxiety levels according to the estimate value of -.013336 in contrast to the other conditions. Focusing on sexual activity the previous day, it increased distress levels in .002898 (according to the estimate value).

Statistically significant differences were found when anxiety was considered as a function of age and gender ($p<0.05$).

Furthermore, the random intercept per subject was also found to be statistically significant, indicating that every subject has its own mean level of anxiety.

In order to explore the factor in a more independent way, the variables considered of interest were grouped as in García and Musitu (2001)'s factors of self-concept as follows:

a. Family: age, marital status, isolation, sex, gender.
b. Work/Job: age, marital status, isolation, work status, telecommuting, time out of your home, gender.
c. Social: age, marital status, isolation, having a pet, gender.
d. Emotional: age, marital status, isolation, having a pet, sleep quality previous to lockdown, gender.
e. Physical: age, sleep quality previous to lockdown, sport or physical activity practiced during the day, gender.

Statistically substantial differences were found for the exploration of F2_Anxiety as a function of the variables grouped for Physical. Table 18 shows the results when F2_Anxiety was analyzed as a function of the variable included in the Physical factor, according to García and Musitu (2001).

Table 18.
Estimates of the anxiety analyzed model

a. Estimates of fixed effects[a]

Parameter		Est.	Std. Er.	df	t	Sig.	95% CI	
							LB	UB
Intercept		-.021	.061	62.392	-.351	.727	-.142	0.01
Age		-.002	.001	62.482	-1.675	.099	-.005	.000
Sleep Quality	Very bad	.268	.054	67.596	5.000	.000	.161	.375
	Fairly bad	.135	.04	63.992	3.354	.001	.055	.215
	Fairly good	.085	.029	63.642	2.919	.005	.027	.144
	Very good	0b	.000					
Sport		-.015	.017	3963.219	-.867	.386	-0.49	.019
Gender		.073	.028	67.804	2.564	.013	.016	.129
RESIDUAL F2_1		.263	.016	3986.795	16.728	.000	.232	.294
RESIDUAL F2_2		.107	.016	3966.639	6.688	.000	.075	.138
RESIDUAL F2_3		.027	.015	3984.593	1.716	.086	-,003	.057
RESIDUAL F2_7		.092	.014	3856.6	6.418	.000	.064	.12
Gender*Sport		-.048	.021	3970.723	-2.317	.021	-.088	-.007

b. Estimates parameters of covariance[a]

Parameter	Estimate	Std. Er.	Wald Z	Sig.	95% CI	
					LB	UB
Residual	.048	.001	43.289	.000	.046	.05
Intercept [subject = ID] Var	.018	.004	5.123	.000	.012	.027

a. Dependent variable: Residual Values (detrended series) for F2_Anxiety= f(1/t).
b. This parameter is established as 0 thus it is redundant. The parameters cannot be calculated.

No significant differences were found between age and anxiety, with a very small estimate of -.002. There was a

significant positive correlation between sleep quality and anxiety (p = .000). Sleep quality is a categorical variable with four conditions: sleep quality= 3 indicated that sleep quality during the past month was very good, sleep quality= 2 indicated that sleep quality during the past month was fairly good, sleep quality= 1 indicated that sleep quality during the past month was fairly bad, sleep quality= 0 indicated that sleep quality during the past month was very bad. Closer inspection for each of the categories show statistically significant differences for people who had sleep quality = 0, since their anxiety levels would be highest in .268, whilst people with sleep quality = 2 had lower levels of anxiety (estimate = .085), when the parameter sleep quality = 3 was fixed at estimate = 0.

From this data we can see that previous days influenced anxiety levels felt on the present day, specifically when the data was lagged 1, 2 and 7 days. Overall, the estimates show that a higher estimate in anxiety's mean levels today will be influenced by your anxiety levels yesterday and seven days before. No more lags were tested. The estimates show the influence is higher the days that are nearer to the present day, and its influence is apparently lost as day passes by. What is interesting about the data in this table is that, although sport practiced that day did not show statistically significant differences, and its estimate shows to be negative (estimate = -.015) showing a negative correlation between anxiety and sport. Further analysis of the data in the table shows that sport, in interaction with gender, does reveal significant differences, which is the main reason why sport

practiced in that certain day is kept in the main model regardless of not showing statistical differences.

Considering gender = 1 being women, a positive significant correlation is found when anxiety and gender were explored by themselves; these changed when gender and sport interact as a function of anxiety, which results in a negative or inverse positive correlation according to the estimates. Consequently, to the model proposed in Table 17, the random intercept per subject was also found to be statistically significant, indicating that every subject has its own mean level of anxiety.

Anhedonic Depression

The initial form for the time series of the second factor (F3_Depression) considering time since day one of lockdown and gender is shown in figure 15. The same procedure as the one used for F1_Distress will not be used to analyze the data for F3_Depression as the data decreases at the beginning but it seems to increase and stabilize as time passes by. Therefore, modeling the previous series in figure 15 is not necessary, differently to the previous factors (distress and anxiety).

The autocorrelation function and partial autocorrelation function are calculated and shown in Figure 16in order to determine the number of lags that can be proposed in the final model.

Figure15.
Graph showing the mean levels of depression felt by the total sample considering the days since lockdown and gender.

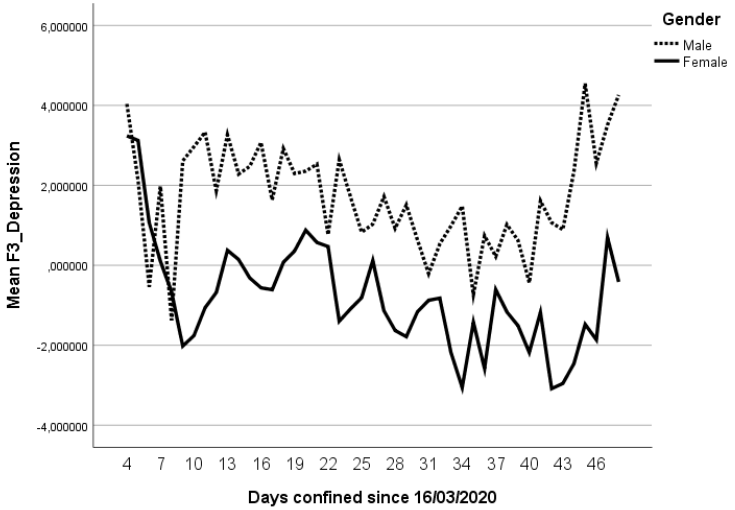
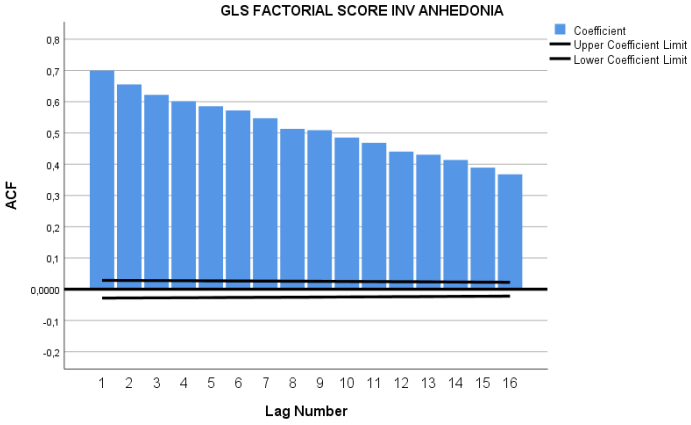
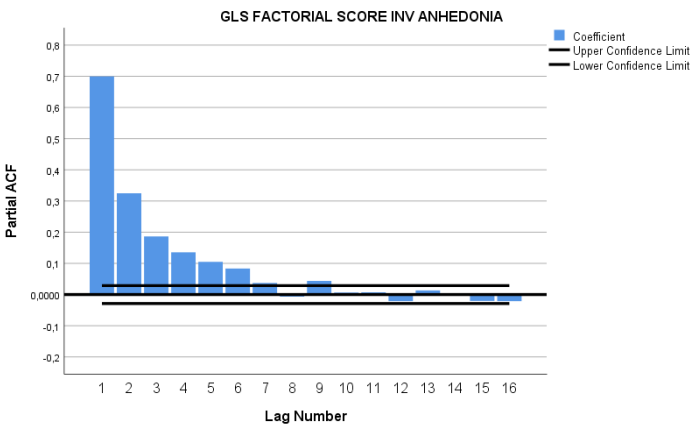


Figure16.
Graphs showing the results for the (a) ACF and (b) PACF for the Unstandardized Residuals in F3_Depression
(a)



(b)



According to the figures above, it would be recommended to include a maximum of 7 lags in the final model proposed, highlighting that lag 9 also seems that could bebe included. However, in order to maintain the same procedure and similar models, the number of lags included in the model will be of 7.

The variables of interest as a function of F3_Depression are analyzed, and the exploratory results are shown in Tables 19 and 20. As a simple reminder, this factor should be considered as inverse anhedonia or positive affect, thus the items are all inverse.

Table 19.
Type III test of fixed effects

Source	Num. df	Den. df	F	Sig.
Intercept	1	55.530	1.423	.238
WEEK_DAY	6	2666.124	2.580	.017
Gender	1	49.373	6.523	.014
Sport_Day	1	2967.484	25.862	.000

Sex_Day	1	2879.556	17.843	.000
Telecommuting	1	2850.535	5.992	.014
Listening_to_music	1	2970.347	22.024	.000
F3_DEP_1	1	2953.150	154.644	.000
F3_DEP_2	1	2891.880	28.578	.000
F3_DEP_3	1	2844.304	7.615	.006
F3_DEP_4	1	2820.916	8.656	.003
F3_DEP_5	1	2814.758	11.507	.001
F3_DEP_6	1	2869.456	10.489	.001
F3_DEP_7	1	2866.677	9.375	.002
F3_DEP_14	1	2971.682	33.500	0.000
Gender * Telecommuting	1	2915.065	9.500	0.002

a. Dependent variable: F3_Depression.

Table 20.
Estimates of the depression analyzed model

a. Estimates of fixed effects[a]

Parameter		Est.	Std. Er.	df	t	Sig.	95% CI LB	95% CI UB
Intercept		1.430	.737	64.988	1.941	.057	-.041	2.902
Weekday	M	-.710	.342	2644.093	-2.076	.038	-1.380	-.039
	T	-1.06	.364	2688.434	-2.908	.004	-1.770	-.345
		-1.139	.371	2705.630	-3.069	.002	-1.866	-.411
	T	-.332	.37	2709.418	-.898	.369	-1.056	.393
	F	-.525	.368	2684.521	-1.427	.154	-1.246	.196
	S	-.320	.349	2673.588	-.917	.359	-1.003	.364
	S	0b	0					
Gender		-2.14	.838	49.373	-2.554	.014	-3.824	-.457
Sport_Day		1.335	.263	2967.484	5.085	.000	.820	1.85
Sex_Day		1.475	.35	2879.556	4.224	.000	.79	2.16
Telecommuting		-1.239	.506	2850.535	-2.448	.014	-2.23	-.247
Listening tomusic		1.188	.253	2970.347	4.693	.000	.692	1.684
F3DEPRESION 1		.197	.016	2953.150	12.436	.000	.166	.228
F3DEPRESION 2		.086	.016	2891.880	5.346	.000	.054	.117
F3DEPRESION 3		.045	.016	2844.304	2.760	.006	.013	.077
F3DEPRESION 4		.047	.016	2820.916	2.942	.003	.016	.079
F3DEPRESION 5		.054	.016	2814.758	3.392	.001	.023	.086

F3DEPRESION 6	.051	.016	2869.456	3.239	.001	.02	.082
F3DEPRESION 7	.048	.016	2866.677	3.062	.002	.017	.078
F3DEPRESION 14	.083	.014	2971.682	5.788	.000	.055	.110
Gender * Telecommuting	.106	1.802	.585	2915.065	3.082	.002	.656

b. Estimates parameters of covariance[a]

Parameter	Estimate	Std. Er.	Wald Z	Sig.	95% CI	
					LB	UB
Residual	27.048	.745	36.297	.000	25.626	28.549
Intercept [subject = ID] Var	16.22	3.795	4.274	.000	10.253	25.658

a. Dependent variable: F3_Depression
b. This parameter is established as 0 thus it is redundant. The parameters cannot be calculated.

The coefficients shown in the model from Table 20 allow us to extract the forecasting equation for forecast today's depression mean levels shown below in Equation 18:

$$F3\_Depression_{tk} = (1.43 + \beta subject) + [1.34 \cdot Sport\_day + [week\_day] + 1.48 \cdot Sex\_day - 1.19 \cdot Listening\_to\_music] - 2.14 \cdot Gender - 1.24 \cdot Telecommuting + 0.11 \cdot GenderXTelecommuting$$

(Equation 18)

In the equation we have included the 'dummy' variables between squared brackets [Sport_Day], [Sex_day] and [Listening_to_music] to indicate that they are only one variable which includes different categories. Furthermore, it must be taken into consideration the codes for the variable Gender thus 0 is used for men and 1 is used for women.

The results show that F3_Depression, which could also be called anhedonia or daily and lifestyle well-being, as a function of several variables such as demographic variables (gender), work variables (telecommuting or not),physical variables (sport being practiced that certain day, having sexual relations that day),

and other factors such as the day of the week or if you listened to music that day, influence in the levels of well-being in a person, and that every person has their own and “unique” level of that well-being feeling.

If we focus on the demographic variables in Table 20, statistically significant differences between men and women’s influence in inverse anhedonia were found, indicating that women’s levels of well-being were lower in comparison to men. This can be observed looking at the estimate, where a negative high correlation can be appreciated (-2.14).

In relation to work variables, statistically substantial differences were found between telecommuting as a function of inverse anhedonia: telecommuting decreased well-being levels in 1.24 units. Close inspection of the table shows that when telecommuting is analyzed as an interaction of gender, in the case of women and telecommuting, well-being increased in 1.8 units.

Physical variables (practicing sport daily and having sexual relations) is where the greater statistically significant differences have been found. Table 19 shows the type III tests of fixed effects. It can be observed that practicing physical activity or exercise daily and having sexual relations has a substantial influence on the levels of depression or well-being (1.33 and 1.47 respectively). These are very statistically significant (p= .000).

From the data gathered in Table 19, the day of the week apparently also had an influence on a person’s well-being during confinement. Data from Table 19 can be compared to the one in

Table 20, where the days of the week are analyzed individually. Results show that, when taking as reference weekday = 7 (Saturday), weekday = 1 (Sunday), 2 (Monday) and 3 (Tuesday) showed statistically significant differences. According to the estimates in Table 20, a person's well-being levels will be lower on a Tuesday that on a Sunday, decreasing 1.14 and 0.71 units respectively.

A highly positive correlation was found between well-being and listening to music, influencing directly and significantly ($p = .000$) the feeling of well-being. Listening to music today increased average daily mood in 1.19 units.

The time memory of well-being was also tested. Results can be shown in Table 20, where the autocorrelation between the present day, the seventh previous day and day fourteen were tested. Estimates show the existence of a direct influence in well-being the previous day and up to fourteen days, probably showing a weekly influence, with the previous week having a stronger influence. Although the estimation's value for every lag tested may seem very small, results prove to be very significant ($p <.005$).

Lastly, the random intercept per subject was also found to be statistically significant, indicating that every subject has its own mean level of inverse anhedonia or well-being.

7
GENERAL DISCUSSION OF THE RESULTS

Mood is in everybody's life, but it is not an emotion, thus it is more stable than an emotion. The fluctuations a person may suffer during the day are caused precisely by feeling those emotions, and this, in turn, is what makes our mood turn towards one type or another. Several models have tried to build "the model" in order to describe mood and its structure. Even nowadays it may seem complicated to choose one. Maybe it depends on the use or meaning you want to give to mood, understanding this as the structure to use when defining mood may be determined by the objective: whether you want to describe clinical aspects of mood or use it for the general population. Even when relating personality to mood, it can be described as being formed by two dimensions of mood (Costa & McCrae, 1980).

The main aim of this dissertation was to explore how mood impacted in everybody's life during lockdown, from its beginning to its end. Several variables were measured using a daily diary during but only those more relevant for the dimension per se, or where statistically mostly significant and with which it was finally proven that worked better within the model tested were the only variables chosen for every dimension. This lockdown was announced with only 48 hours of anticipation. People were only given 48 hours to reorganize and rearrange their lives completely, amidst a feeling of uncertainty since they did not know how much time they would have to remain in such a situation. In fact, they did not even know what the situation was going to be like at all.

Broadly, from the results obtained, it can be stated that lengthy periods of lockdown as the compulsory lockdown during COVID-19 pandemic in Spain influenced people's mood, considering mood as a second order factor, as a function of the three evaluated first order factors: distress, depression, and anxiety.

During COVD-19 lockdown, mood, and behavior suffered fluctuations. According to Balluerka-Lasa et al. (2020) during confinement, people's mood changed from dysphoric states to euphoric states, but overall they highlight the perceived feeling of resignation.

If we examine individually each of the factors explored in this dissertation (general distress, anhedonic depression and anxiety arousal), a general aspect to highlight is the fact that the time memory was of approximately seven days. Therefore, what happened seven days ago has an influence on your levels of general distress, anhedonic depression or anxiety arousal today. A weekly cyclicity was not proven for the three dimensions, which means that, at least under these circumstances, results are not able to tell if your mean mood levels of today would influence your mean mood levels fourteen days later, twenty-one days later, and so forth. Furthermore, generally it seems that the mean levels of general distress, anhedonic depression and anxiety arousal you had during the first days will influence on how your lockdown mood levels will be, considering that all three dimensions tend to stabilize during the first week of lockdown (approximately).

If we take a better look into general distress, or distress to simplify, as well as other variables that can have a negative impact in a person's well-being, it has been studied in other countries and results tend to agree in the importance of focusing on the population's psychological and emotional well-being, thus highlighting mental health as a protection factor in future lockdown situations that could take place. Moreover, some variables that can act as protective factors are importantly studied to prevent negative consequences in extreme situations such as compulsory lockdown or any other situations where adaptation is necessary in order to increase the efficiency of coping strategies and resilience.

These findings broadly support the work of other studies in distress that link a gradual reduction of it with the maintenance of the situation over time. In this sense, we can observe that, during the first days of confinement, a prominent level of distress is observed, decreasing rapidly in the following days and more slowly in the final periods of the lockdown. As an interesting detail, it should be noted that on days 20, 34 and 49 from the beginning of lockdown, the Government approved extensions of the state of emergency, giving the media the news of the extension proposals 4-5 days before. These approvals and notifications coincide closely with abrupt increases in the level of distress of the subjects studied. These increases in distress in the face of the extensions of the confinement have their logic, since the perceived insecurity about the development of the pandemic, the economic and labor consequences both for oneself and for

their acquaintances and relatives together with the perception of the risk of infection, the serious course of the disease, and the length of the confinement itself are the main causes of perception of insecurity and distress. A remarkably similar image is noted in the results found for anxiety, thus proving the similarities between both factors.

Other significant findings to emerge from this study is that during the lockdown, the "memory" of distress has been 2 weeks, resulting in a significant inertia within each person, where no differences are observed between people in the process generation of distress because the level 2 coefficient is not significant. In general, these results indicate that levels of distress also depend on the activities that a person did during lockdown. In addition, interaction exists between gender and some behavioral variables. This means that for a female who during the day did some of the activities mentioned, her level of distress would be different compared to a male or a female who did not carry out these activities, and these differences were statistically significant. Comparing the results, generally females were more positively influenced by Telecommuting and practicing Physical Activity than males. Having sexual activity influenced positively all genders.

Significant statistical differences were found when considering distress as function of lag 1, lag 2, lag 4 to lag 7 and lag 10 and lag 14. The results of this investigation show that, during lockdown, people’s distress levels from previous days influenced the distress levels of that day, which meant that what

happens today will affect your distress levels up to 14 days later, but the effect is higher during the first two subsequent days, with the biggest values of lag coefficients. Furthermore, females had, in general, higher distress levels during COVID-19lockdown. A total of 56.25% (n = 72) of the participants telecommuted, and their distress levels where higher compared to those male participants who did not telecommute, but for female participants this activity decreased distress. Having sexual activity reduced distress levels in general, with no effect differences between men and women. Furthermore, music is a protective factor for both genders that helps to keep low distress levels. Age did not influence the level of distress experienced by the sample. Focusing on female levels of distress in comparison to male, doing daily physical activity reduced their daily perceived levels of distress, proving the importance for females to perform daily activities to reduce distress levels. This study proves that gender differences must be considered to correctly analyse lockdown data.

It is interesting to note that the general intercept b_0 was estimated as fixed effect and as random effect (individual effect level 2 variable) but the latter did not show significant statistical differences. This discrepancy could be attributed to a long-time memory of 14 days, with 11 autoregressive terms, from StD_{t-1} to StD_{t-10} including $StD_{t-14.}$ These 11 terms reflect every person's distress level, thus elevated levels of StD_{t-1} to StD_{t-14}will forecast high levels of the dependant variable distress and will make reflecting it in a level 2 intercept variability unnecessary.

Therefore, the fact that our individuals have a common intercept does not mean that they also have the same level of distress, since their daily level is conditioned by the levels of the previous 14 days.

Every person has their own mean levels of distress, and depending on the factors surrounding them, this unique distress levels will rise or diminish. Furthermore, a person will have higher levels of distress if their levels of anxiety are high, or rather distress and anxiety had similar patterns and fluctuations as confinement days passed by, as anxiety also tends to adapt or become stable approximately after a week of lockdown.

Anxiety has been another psychological state influenced during COVID-19 lockdown, especially because prevalence rates after lockdown seemed to have increased in anxiety and depression (Khubchandani et al., 2021). As a general or broad perspective, females had higher levels of anxiety than males, and these levels seem to be relatively stable during all lockdown, although by the end of confinement the levels diminished slightly. Remember that anxiety, specifically according to the definition of this factor, refers to the somatic aspect within anxiety. In addition, results show that every person has its own mean levels of anxiety that suffer fluctuations, depending on their own base or mean levels.

Anxiety levels during COVID-19 lockdown were affected or influenced by several variables, such as living as a couple or living together. A person who was not living alone had higher

levels of anxiety in comparison to a person who lived by themselves.

Sleep quality before lockdown was found to be an interesting variable to explore the variability of the mean levels of anxiety. For instance, a person whose sleep quality previous tolockdown was particularly good showed lower levels of anxiety compared to a person whose sleep quality was awfully bad.

Finally, the other two variables that reduced anxiety levels were sex and physical activity practiced that day. Both are seen as protection factors that influence anxiety levels and reduce them, and practicing daily physical activity may have a greater impact in other emotional aspects (Amatriain-Fernández et al., 2020). This effect was higher in women than in men. It is also important to mention that having sexual activity the previous day increased anxiety levels. Marital status and gender were not considered, and their differences were not explored.

With regards to anhedonic depression, depression, or, according to the questionnaire used to determine the participant's mood levels, inverse anhedonia (positive affect), men had higher levels of positive mood in contrast to women's mean levels. At the begging of lockdown, the levels of all genders seemed to be similar, but by the end of lockdown these differences were greater, and women showed lower levels of positive affect as compared to men. Furthermore, in general, the levels of positive mood of both genders were reset by the end of lockdown. This may seem logical considering that two weeks prior to the end of lockdown people were informed about the official date when they

would be able to start doing more activities outside their home again, thus they started to have the perception that lockdown was going to end.

The reason for this decrease of the mean levels of inverse anhedonia or the increased levels of depression can be due to several factors. For instance, if you practice physical activity and have sexual relations, your mean positive mood will increase. Furthermore, a weekday effect was found, where Mondays and Tuesdays registered the lowest levels of well-being. Telecommuting decreased well-being in general; however, if we focus on women who telecommuted, then their well-being increased.

Compulsory lockdown's restrictions meant that people were only allowed out of their homes to go shopping, go to work, visit a dependent person, take their pet for a walk, or throw away the trash. As it can be observed, they were not given many options. This can be one of the reasons why positive affect diminished by the end of lockdown period. It was found that the possibility of going outside of your house, for any of the activities mentioned above, did not have a positive impact in mood, increasing its daily mean levels.

The main idea of this dissertation was to analyze the psychological, emotional, and behavioral impact of prolonged periods of a lockdown which was made compulsory with short notice. Therefore, the main contributions include the importance for people in keeping daily routines and are specially influenced by physical activity practiced and other activities that could

modulate a person's well-being to help decrease their mean levels of anxiety and distress. Another important aspect resides in sleep quality previous to this period. This last variable has seemed to be especially important in the contribution of an adequate balanced emotional level, highlighting it as a critical issue to promote from public and health institutions: sleep hygiene education programs. Free access quality programs about sleep hygiene education and sport routines for the general population combined would have been two measures that could have prevented posterior emotion and mood disorders.

It is probable that many things in this dissertation could have been done differently, considering that the time to process and initiate the data collection was very reduced due to the fact that there was not a clear idea of the amount of days confinement was going to be maintained. In the end, 48 days of compulsory lockdown left us with a maximum of 44 observations per participant, which is less than the minimum recommended number of between 50 and 60 observations in order to analyze time series data (Box & Jenkins, 1976).

The total sample is also small (123 participants) although a minimum of 20 observations per participant were registered due to some of the subjects initiating the daily diary in a different day (perhaps earlier on or after the beginning of lockdown). Furthermore, a longitudinal data collection encounters risks such as an experimental mortality which we tried to controlbysending a daily reminder email but being an online random sampling may contribute to the reduction of compromise feeling to continue until

the end of compulsory lockdown. Other interesting measures could have been included, such as the use of applications for meditation, relaxation, or yoga practice (including the frequency and time of the day when they were practiced).

As future proposals, an extended model of the initial proposal could be necessary, using data analysis that could enhance it (factorial dynamic analysis or structural equation modeling, for example). This would probably give a broader look and better understanding to what mood looks like when compulsory extended periods of lockdown are imposed. Furthermore, it could be interesting to keep a follow-up (perhaps biannually) in order to maintain the longitudinal registry and analysis of the increased or decreased prevalence in mood disorders or emotional unbalance, and how a person evolves within their mood.

The analysis of the latent growth curve model, in addition to studying the effect of the proposed model are two pending things to be done in the near future.

In summary, these findings suggest the importance for public health to apply measures on well-being.

8
CONCLUSIONS

According to the Spanish National Institute of Statistics (INE, 2020) mental health has been one of the most affected areas by lockdown, in which increased prevalence has been stated, especially noticed in a reduction in the interest of people in doing things that made them happy, as compared to before the confinement period. Thus, this dissertation's main findings show the importance of keeping healthy habits in order to increase well-being and mood during prolonged periods of confinement.

The daily practice of sport or physical activity joined with the importance of keeping an adequate sleep routine or hygiene, highlighting sleep quality as a fundamental aspect in the stability of mood, have a positive impact in a person's distress and anhedonia levels. On the other hand, the fact of being alone during lockdown did not have as much influence as it could have been thought (it is important to differentiate between being and feeling alone). Having daily sexual relations (understanding this as sexual relations with another person, not in alone) reduced levels of distress and anhedonia, therefore indicating that perhaps living with a couple could increase well-being if sexual relations were practiced. Gender had a strong influence in all three factors and the activities performed.

All three factors (distress, anhedonia or inverse anhedonia, and anxiety) seem to form a mood structure that has yet to be explored. Nevertheless, and despite the pending model proposal, mood fluctuated according to many variables of which we have just shown a reduced version. These fluctuations were found to be different for every subject. This means that every

person has their own mood levels, which fluctuate or change based on the person's behavior.

Furthermore, these fluctuations seemed to be higher during the beginning of the COVID-19 lockdown, but stabilized during the first week of confinement, which could indicate that people tend to adapt quickly to confinement or isolation periods and situations, highlighting the importance of what happens during the first week.

It might seem that the main weakness of this study was the number of observations registered per participant when considering a time series, since, according to Box et al. (2016, p. 31)"*to obtain a useful estimate of the autocorrelation function in practice, we would typically need at least 50 observations*", and the strict confinement in Spain lasted 48days. At that point the de-escalation period began, allowing certain confinement relief measures at different stages. In addition, a daily record is difficult for the participants to follow, which has meant that in approximately two-thirds of the subjects there were omissions in the completion of several consecutive days, or that they completed it for less than 20 days, proceeding to their elimination of the study sample.

The sample of participants used has consisted of volunteers and unpaid people, so there are variables that are not 'balanced' (gender, age, telecommuting, if they practice regular physical activity, ...) and, therefore, it could be argued that it is not sociologically representative. On the other hand, it has the advantage that it presents ecological representativeness, since it

is assumed that the process of mood change (understanding mood as the three factors studied) has been very similar in our sample and in the general population. In addition to that, in Psychology, without forgetting the sample representativeness, special attention has to be paid to the representativeness of the process studied in the research carried out. More studies should be conducted to see if the psychological effects of mood during the pandemic have been short-lived or if they have a longer-term effect.

In addition, computerized registration systems allow almost continuous data collection, as in the present investigation. Different variables have been collected over multiple days belonging to different individuals, which requires appropriate data analysis models for the system used, so it is expected that training in data-intensive analysis models using pooled time series and other techniques (multilevel analysis, resampling,…) will increase(Bolger & Laurenceau, 2013; Nusser et al., 2006; Rosel et al., 2020; Walls, 2013).Consequently, future studies should be conducted on the temporal processes of Mood to check if its memory and the influential independent variables are similar during confinement and under non-confinement conditions like in the “de-escalation” of confinement limitations, and in periods of normality. Future research could usefully consider in-depth analysis of the temporary processin order to study the trajectories and changes of the main variable during time.

Finally, it is not only important to study the emotional and psychological effects during the lockdown (Palinkas et al., 2004), but also the effects posterior to it.

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