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How Are You, My Dearest Mozart? Well-being and Creativity of Three Famous Composers Based on their Letters

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Abstract: The importance of creativity is being increasingly recognized by economists; however, the possibility that emotional factors determine creative processes is largely ignored. Building on 1,400 letters written by three famous music composers, I obtain well-being indices that span their lifetimes. The validity of this methodology is shown by linking the indices with biographical information and through estimation of the determinants of well-being. I find, consistent with the psychological economics literature, that work-related engagements and accomplishments are positively related with well-being, while poor health or the death of a relative are detrimental. I then exploit the data and provide quantitative evidence on the existence of a causal impact of negative emotions on outstanding creativity, an association hypothesized across several disciplines since the Antiquity, but that has not yet been convincingly established for the case of extraordinary achievers.

Keywords: Creativity, well-being, health, labor, music history, textual analysis.

JEL Classification Numbers: D60, I31, J24, N33, Z11.

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1 Introduction

Anecdotal accounts on the presence of psychological anomalies can be found in the biographies of numerous great artists, scientists, social activists, politicians, and entrepreneurs (e.g., Ludwig, 1995; Jamison, 1996). This is an astonishing disclosure, especially if one considers that these famous and extremely creative people have shaped our cultural heritage, pushed the boundaries of knowledge, contributed to the development and growth of countries, and created economic welfare. Obviously, creativity — “the key ingredient for job creation, innovation and trade” (UNCTAD, 2010) — is largely the domain of extraordinary individuals or small groups. Nonetheless, within economics the study of behavior and achievements of specific individuals is rather scarce. Only recently have some economists begun to investigate how these extraordinary individuals make their discoveries (e.g., Galenson, 2005; Galenson and Weinberg, 2001). Creativity is typically modeled as a result of rational decision-making (Frey, 2000) or as a function of some objective and quantifiable factors, such as general education or experience (Bryant and Throsby, 2006). However, the possibility that emotional drivers determine creative processes is neglected and in stark contrast to applied psychology literature that portrays creativity of great achievers typically as a result of various psychotic anomalies (e.g., depression). In fact, the existence of a link between negative emotions and creativity has been hypothesized and studied in a variety of forms and across several disciplines.¹ Despite those efforts, the association between outstanding creativity and psychopathology remains controversial, and it rather lacks convincing evidence (e.g., Waddell, 1998; Schlesinger, 2009). This study, by disclosing the role of emotional factors in the creativity of famous achievers, introduces a new angle to the growing economic research on creativity. Furthermore, by using rigorous quantita-

¹See for example Kaufman and Sternberg (2007) for a review of creativity research across such fields as psychology, education, and the arts. The notion that creativity and emotional state are somehow related arguably goes back to the time of Aristotle.

tive methods, it potentially answers a question that has fascinated many for more than two millennia and remains disputed up until today.

I construct lifetime well-being indices using around 1,400 letters written by Wolfgang Amadeus Mozart, Ludwig van Beethoven, and Franz Liszt throughout their lives.² This is done by the employment of a linguistic analysis software that is able to illuminate to what extent a written text uses words related to positive emotions (e.g., happiness) or negative emotions (e.g., grief). What emerges is a unique longitudinal dataset for, admittedly, only three subjects, but which, however, covers the lifespans and a large number of observation points. The immediate contribution of this research design is that it allows unique insights into the dynamics of a person's emotional state throughout life.³

It is probably the first time in economics that a textual analysis is used; this requires rigorous testing.⁴ Useful for the testing is that we know a lot about the lives of the composers covered, and this allows to, first, link the well-being indices qualitatively with biographical information and, second, estimate quantitative models for the determinants of well-being. The obtained data is further tested by analyzing other dimensions and the content of written texts, such as the intensity of writing about financial concerns.

The estimated well-being models indicate that labor market outcomes (in particular artistic production or touring activity) increase positive emotions and decrease nega-

²See Section 3.2 for a discussion of the selection.

³The fact that the analysis looks at the lives of three music giants who have left their permanent imprint on our cultural heritage makes this study perhaps particularly interesting and interdisciplinary. Numerous music historians have devoted their careers to the study of either of these composers. See, for example, Saffle (2009) for an impressive 520-page review of research and data sources concerning Franz Liszt alone.

⁴Text analysis methodology is relatively new, albeit increasingly used in other disciplines (e.g., psychology or linguistics). It arguably incorporates a large potential in explaining people's behaviors: "We are in the midst of a technological revolution whereby, for the first time, researchers can link daily word use to a broad array of real-world behaviors." (Tausczik and Pennebaker, 2010, p.24). Within economics, two years after the underlying study appeared as a working paper, Hills et al. (2015) show convincingly that textual analysis can also be applied to digitized books and used to construct country-specific subjective well-being indicators.

tive ones, whereas an illness strongly leads to the opposite effects. Negative emotions are also found to be sensitive to an extreme case of worsening of a composer's personal relationships, reflected by the unexpected death of a family member. To my knowledge, this is the first analysis based on well-being data for the (almost) entire lifespan of a person. Thus, the methodological approach constitutes potentially a useful contribution towards the fast growing field of happiness economics, where longer panel data are still rare, yet needed, in order to extend our understanding of what the determinants of well-being are (Dolan et al., 2008). Panel data are also essential to address a number of issues related to causality, about which the current knowledge is far from satisfying.

The main contribution of this research is the exploration of a causal relationship between negative moods and creativity. Using the created index of negative emotions and utilizing instrumental variables, I am able to study the causal impact of negative emotions on creativity, measured as the number of important, quality-adjusted compositions written by each composer in a given year. I use the incidence of the unexpected death of a composer's family member as an exogenous source of variation of his negative feelings.⁵ The identification exploits the historical vulnerability of people to various life incidences, such as illnesses that would usually result in imminent death. The emerging findings imply that the number of works written is causally attributable to an increase in negative emotions. Disaggregating negative moods into anger, anxiety, and sadness, I further identify sadness as the main negative feeling that drives creativity. This new evidence comes close to the previously posited association between creativity and depression, which is a form of chronic sadness.

The paper is organized as follows. Section 2 provides a literature review. Section 3

⁵See Kessler (2001) for a review of the literature on how stressful life experiences worsen the well-being of a person or Monroe et al. (2001) on how severe life events increase the risk of depression. I will show later that the unexpected death of a family member drives artistic productivity through emotional fluctuations, as opposed to through some other channels, for example, a change in the composer's financial situation.

discusses the approach undertaken to obtain the well-being data and motivates the selected sample. Section 4 introduces the set of models to be estimated. Section 5 presents the results for the determinants of well-being and the effect of negative emotions on creativity. Finally, Section 6 provides concluding remarks.

2 Literature Overview

The discipline of economics is increasingly beginning to explore the area of creativity, which is rather new grounds and yet of enormous potential. It is perhaps not a coincidence that two substantial contributions recently appeared under the same title "The Economics of Creativity" (Burger-Helmchen, 2013; Menger, 2014). Burger-Helmchen (2013) posits that an understanding of the economic implication of creative individuals is not only of immense importance for the new economy, but also academically relevant in related fields, such as the economics of knowledge, the economics of science, and innovation management. Burger-Helmchen further advocates more economic research on how creative people work and think and how to foster their creative productivity. Menger's (2014) focus is rather on creativity within the arts, where economists tend to agree that the creative process is governed by uncertainty, without which neither self-realization nor creative innovation is possible. According to Menger, artistic success does not depend only on a good network, influential managers and patrons, or the talent of the artists, but also on the uncertainty that affects the careers of any creative individual.

Cultural economists point to the synergies that have long existed between the arts and economics, illustrating the mutual benefit that the two disciplines offer each other (e.g., Gray et al., 2016). Without steady economic foundations art cannot exist, and without creativity the economy cannot thrive. The study of these two distinct fields in partnership represents a further opportunity to be gained, namely

in the application of economic thinking to the arts. In a "work-preference" model of artists' time allocation choices, [Throsby \(2001\)](#) shows that the creative process can be categorized within rational decision-making. [Bryant and Throsby \(2006\)](#) attempt to identify particular features of creativity and describe an artist's production function for creative output as a result of general education, arts training, experience, and creative talent.

The literature on the effects of mood and thought on creativity is vast, albeit outside the area of economics. As [Jamison \(1989\)](#) observes, in relation to artistic creativity, psychological aspects have been studied for "as long as man has observed and written about those who write, paint, sculpt or compose." [Andreasen \(2005\)](#) reviews research on the relationship between creativity and mental distress and concludes that mood disorders could possibly be conducive to artistic creation. Andreasen explains that in some instances those negative emotions may provide fertile material upon which the creative person could draw. [Akinola and Mendes \(2008\)](#) discuss how intense negative emotions can create powerful self-reflective thought and perseverance, leading to increased creativity. Furthermore, Akinola and Mendes demonstrate in a laboratory experiment that individuals exposed to a situation that causes intense negative feelings exhibit the greatest degree of creativity. [Kyaga et al. \(2013\)](#) draw on a large sample of 1.2m patients from the register in Sweden and find that people in creative professions are linked to an increased risk of manic depression. Further, for a sub-sample of writers, an increased risk of other mental health conditions has been observed. While these results have been enthusiastically acclaimed by the media as the final proof of the existence of an association between creativity and mental anomaly, the issue of endogeneity remains open and is not even considered as a possibility by the authors.

Happiness economists and psychologists acknowledge the difficulty in obtaining information on how a person feels by simply asking her about her well-being. The

respondent's answer might not be accurate due to her wishful thinking and various mechanisms of defense. A potentially superior way of obtaining insights about a person's anxieties and conflicts is to study the way she communicates. This psychoanalytical method is formulated by [Gottschalk and Gleser \(1969\)](#). Research on the use of words has especially increased recently due to the access to increasingly versatile computer programs that are able to provide various indicators on the social, personality, cognitive, and biological processes of an author of any text ([Chung and Pennebaker, 2007](#)).

It has been shown that the language people use is affected by various factors. [Pennebaker and Stone \(2003\)](#) build on a sample of 10 famous literary artists born between 1762 and 1895, and show how language changes over the course of a person's life. They show that older people appear to disclose an increased cognitive complexity in the linguistic styles, and even if these results could be distorted by cohort effects, the role of age appears as an important factor. It is also established that significant events might affect the mood (and language use) of a person. [Cohn et al. \(2004\)](#) show how the vocabulary used by users of an U.S. online journaling service changed due to the traumatic incident of the September 11 attacks. Immediately after the attacks, the investigated users expressed more negative emotions, were more cognitively and socially engaged, and wrote with greater psychological distance.

A study that comes close to the methodology of the underlying research is provided by [Danner et al. \(2001\)](#), who obtain indicators on the extent of positive emotions from autobiographies written by Catholic nuns. The authors show that positive emotional content in early-life autobiographies is related to longevity later in life. However, these findings are largely based on the assumption that the emotional well-being of a person remained stable throughout life.

According to my knowledge, this is the first economic study that exploits linguistic

features of written texts. The suggested approach is used here to shed light on a person's emotional welfare, complementing so the literature which relies usually on subjective well-being indicators (e.g., Helliwell, 2003) or the occurrence of various medical conditions (e.g., Brown, 2000). One of the main research areas within happiness economics deals with the determinants of well-being. A review of this research is provided by Dolan et al. (2008) and previously by Frey and Stutzer (2002). The authors conclude that a person's well-being depends primarily on three types of determinants. First, well-being depends on labor market involvement and outcomes, in particular on income and employment status (Clark et al., 2008). Second, personal relationships, especially with family members (Martin and Westerhof, 2003), play a vital role as does being in a stable partnership with another person (Helliwell, 2003), independent of whether the relationship is certified by marriage or occurs as cohabitation (Brown, 2000). Third, health conditions have been shown to have an effect on subjective well-being (e.g., Shields and Price, 2005).

Next, a distinction has to be made between everyday creativity and eminent creativity, termed by Kaufman and Beghetto (2009) as the "Big-C". It is only the latter which constitutes a remarkable and lasting contribution in a domain and usually influences the further developments in a field. Obviously, outstanding creative accomplishments that become history might be triggered, if at all, to a different extent by negative emotions than everyday creativity.⁶ This paper focuses on eminent creativity.⁷

Psychologists have repeatedly studied distinguished creativity, the "Big-C", in rela-

⁶For example, Simonton (2014) suggests that mental illness is unevenly distributed across the population of creative people. He argues that typically creative individuals exhibit better mental health than do non-creative; however, among creative individuals the most creative are more susceptible to mental illness than are the less creative. It is the creative genius which is at the risk of psychopathology.

⁷The reader interested in the association between happiness and everyday creativity (i.e., the "little-c") is referred to, for example, Dolan and Metcalfe (2012), who show that subjective well-being correlates with innovation at workplace, but also acknowledge that causality in this relationship has yet to be established. Another study on the "little-c", by Oswald et al. (2014), documents that happier people perform better at solving simple mathematical problems, which is used as a proxy for tasks associated with white-collar jobs.

tion to mental abnormalities, by identifying such states using information found in biographies of prominent achievers. For example, Post (1994, 1996) studies a sample of famous men in science, thought, politics, and art and finds that certain pathological personality characteristics, as well as tendencies towards depression, are linked to the creativity of those individuals. This association is especially strong for the case of poets and writers, who also come closest to the artists covered in this research. Schildkraut et al. (1994), based on a small sample of mid-twentieth-century artists, argue that depression may have driven these artists to produce. Ludwig (1995) analyzes the biographies of famous people from a number of creative professions and concludes that his sample is about twice as likely to experience some mental disorder in life as noncreative individuals.⁸

Finally, the good data availability on music composers has previously been exploited within psychology and economics. Within psychology, for example, Simonton (1991, 1998) studies composers' career development and explore how historical reception influences the prominence of a composition nowadays. Within economics, O'Hagan and Borowiecki (2010) and Borowiecki and O'Hagan (2012) introduce large and comprehensive data on important music composers and explore the intensity of geographic concentration and extent of migration. Borowiecki (2013b, 2015a) shows how geographic clustering and peer effects can enhance composers' creative output, while Borowiecki and Kavetsos (2015) demonstrate the cost of such peer-interaction in terms of adverse health effects. The effect of war and social unrest has been analyzed in relation to conflict-induced migration of composers (Borowiecki, 2013a), geographic shifts of music clusters (Borowiecki, 2012), and creative output (Borowiecki and O'Hagan, 2013), while Borowiecki (2015b) discloses persistency in the demand

⁸However, those studies might be biased if not all psychological states of a person were recorded in biographical sources or if the biographer had the incentive to particularly describe the dramatic moments of a person's life. Furthermore, this literature does not usually consider emotional variation over time, which means that it does not shed light on the issue of causality. Finally, only extreme emotional conditions are considered, and it is assumed that the distribution of psychological anomalies in a population remained constant over several centuries.

for music and geography of composer births in Italy over a period of seven centuries.

3 Data

3.1 Emotional content of written texts

Emotional content is embedded in our communication, and it is fairly established that the words used by individuals, whether verbally or in written texts, are related with mental health (e.g., Pennebaker et al., 2007). In this line of research, emotional content is extracted from written texts by utilizing the Linguistic Inquiry and Word Count (LIWC) text analysis software.⁹ The software processes each word of a text by searching for a match with an on-purpose developed dictionary and conducts a count of words that corresponds to certain categories. In total, the dictionary includes around 4,500 words and word stems, such as "*happi**" which allows for any target word that matches the first five letters (including happiness, happier, happiest).

The software considers a wide range of word categories tapping into psychological constructs (e.g., affect, cognition, biological processes).¹⁰ Out of those, of primary interest to this research are two categories that indicate either positive or negative emotions, which are measured by means of 406 words (e.g., love, joyful, nice) and 499 words (e.g., hurt, grief, nervous), respectively. The occurrence of these words is counted and expressed as a fraction of the total word count. This means that, for example, with a rising relative occurrence of words reflecting positive emotions, one observes a higher value on the scale of positive emotions.

⁹The first version of the software was introduced by Pennebaker and Francis (1996) and has been further developed since then. Here the version of 2007 is used.

¹⁰Appendix A provides an overview of other categories covered by LIWC, which include, for example, linguistic dimensions or personal concern categories. There presented is also a more detailed assessment of the reliability of the method and LIWC.

The internal reliability and external validity of LIWC has been demonstrated in various contexts and using different approaches (Pennebaker and Francis, 1996; Pennebaker et al., 2007). These analyses include a range of crosschecks using expert opinions and have been carried out over a range of different types of texts, including personal writings, blogs, novels, science articles, or orally communicated texts. Pennebaker et al. (2007) also show that the LIWC software performs well for historically written texts. Based on 209 novels published in English between 1700 and 2004, a match of 84% with the dictionary vocabulary is disclosed, which is indistinguishable from the mean dictionary match of 83% for all studied contemporary types of texts. Furthermore, Tausczik and Pennebaker (2010) provide an overview of 121 recently published articles that use LIWC and conclude that these empirical results demonstrate the ability of LIWC to detect meaning in a wide variety of settings, including to identify emotionality.

3.2 The letters

This research requires a sample of creative people for whom good biographical information is available as well as a sufficiently large selection of letters covering their lives. Therefore, the focus is on letters written by Wolfgang Amadeus Mozart, Ludwig van Beethoven, and Franz Liszt, and there are several reasons for this particular selection. First, the available selections of letters cover the entire lives of each composer. This is not obvious, as some other available compendiums of letters written by composers (or other creative people) cover only specific periods of their lives, a dialogue with a particular peer (e.g., Hueffer, 2006), or correspondence with a selected number of music composers (e.g., Nohl and Wallace, 2009). Any of these selections might provide some insights on the writing habits in the profession, but would not, however, allow me to shed light on the lifetime well-being of a person. Second, the chosen sources include only letters, as opposed to a heterogeneous se-

lection of writings, such as reports, testimonials, complaints, thank-you notes, and other texts (e.g., David et al., 1999). Third, the selected compendiums of letters are currently the only selections of letters written by composers that are available electronically and are provided in the Gutenberg database.¹¹ A further, implicit advantage of the choice of these three composers is that their lives evolved around roughly the same time period and there is a reasonably large overlap of the years covered. Mozart died when Beethoven was just turning 21, and Beethoven died when Liszt was 16. Finally, at the turn of the 18th/19th century the Germanic countries, particularly Austria and some parts of Germany, were globally the main centers for music. It is therefore not a coincidence that there also exists a fair overlap in the geography of the composers covered, whose longest parts of life took place in Austria and south-east Germany.

The letters of each composer have been collected, edited, and translated in all three cases from German to English by established contemporary figures. Language translation could lead to a bias if the translator's errors were systematic—for example, if for some reason positive emotions were translated in a different way to negative emotions. It is nonetheless regarded as an advantage that all three composers covered wrote in the same language and that the used resources are based on direct translations into English. Furthermore, since the selection and translation occurred soon after each composer's death, the historical character of the original writings survived and has not been distorted by later trends or preferences.¹² Below I show that the letters have been selected with rather scholarly accurateness aimed at bringing to light all available writings, as opposed to a subjective selection of a sample that may perhaps be particularly attractive to the reader.

¹¹This is connected to the fact that the works have been compiled a long time ago and their copyrights have expired. Note also that using pre-edited electronic formats ensures a high degree of accuracy in the further conducted processing of those texts.

¹²This is another benefit of building on these particular composers who became famous already during their lifetime. Many great artists become regarded as outstanding only post-mortem, sometimes even several decades later, and it would not be before that time that scholars begin to write about them or collect their letters.

Mozart's letters were curated in 1864 by Ludwig Nohl, a highly regarded writer on music of his time, and translated by Lady Wallace in 1866.¹³ The selection arguably constitutes a "full and authentic edition of Mozart's Letters" and is aimed at providing a "faithful production of the letters, nothing being omitted (...)" (Wallace, 1866b, preface). It is further interesting to observe that already Mozart's contemporaries commented on the expressive nature of his writings that illuminates "the impulses of his own heart" and is a relation to others of what the composer "saw and heard, and felt and thought" (Wallace, 1866b, preface). Mozart's letters by being "simple outpourings of his heart" are thus a mirror of his emotional side and hence "rather resemble a journal than a correspondence" (Wallace, 1866b, preface).

The translation of the letters written by Beethoven was likewise conducted by Lady Wallace in 1866 and was based on the compilation of Ludwig Nohl from 1865. Also here the aim is "to bring to light, at all events, the letters that could be discovered" (Wallace, 1866a, preface). Interestingly, the translator was somewhat perturbed by Beethoven's emotional fluctuation "between explosions of harshness and almost weak yieldingness, while striving to master the base thoughts"; however, none of "this less pleasing aspect of the Letters ought to be in the slightest degree softened".¹⁴ This decision is important for this study, as we are left with an authentic and emotionally loaded content.

Liszt's voluminous correspondence was collected and edited by La Mara Marie Lipsius, who worked under the pen name of "La Mara" and spent 25 years editing Liszt's correspondence. The translation into English was conducted by Constance Bache in 1893. As in the case of the previous composers, the translator has endeavored to "adhere as closely as possible to all the minute characteristics that add expression

¹³Nohl's contribution was already regarded as being of high value by his contemporaries and resulted in him being awarded, at the age of 34, by King Ludwig II the title of Professor of Music at the University of Munich.

¹⁴The allegedly substantial variation in Beethoven's mood will later be observed in the standard deviation coefficients of his negative or positive emotions, which are found to be significantly higher (p -value < 0.01) than for the other two composers (Table 2).

to Liszt’s letters” (Bache, 1893, preface). It is further instructive to note that all these selections have remained influential reference works within music history, as reflected in the continuous citations throughout most biographies of the composers covered.

Appendix B shows two exemplary letters for each composer, together with the emerging metric of positive and negative emotions.

4 Methodology

The main aim of the econometric estimations is to shed light on the association between negative emotions and creativity. Given the novelty of the text analysis method, the reliability of the obtained indices is first tested. For this reason, I introduce a model that sheds light on the association between various life incidences and the well-being indices. The selection of the key explanatory factors is based on a recent review of the well-being literature provided by Dolan et al. (2008), who conclude that labor market involvement and outcomes as well as personal relationships including marital status and health are the crucial determinants. In constructing a model of a composer’s well-being these variables are measured (or approximated) as accurately as the data availability allows. Formally, the model for the estimation is given as follows:

$$\begin{aligned}
 Emotions = & \alpha_0 + \alpha_1 \mathbf{Age} + \alpha_2 \mathbf{Labor} + \alpha_3 \mathbf{Relationships} + \\
 & + \alpha_4 \mathbf{Unexpected\ death\ of\ relative} + \alpha_5 \mathbf{Health} + \\
 & + \alpha_6 \mathbf{\#Letters} + \alpha_7 \mathbf{Composer}_{FE} + \alpha_8 \mathbf{Addressee}_{FE} + \epsilon
 \end{aligned} \tag{1}$$

where *Emotions* measures the extent of either positive or negative emotions. The *Age* vector is a fourth order age polynomial to allow for multiple turns of a person’s

well-being index. The *Labor* vector measures labor market involvement in three different ways.¹⁵ First, it is measured how many compositions have been produced in the year a letter has been written. Since we are interested in correlations, the variable is identified at the year level. The productivity measure is obtained from [Gilder and Port \(1978\)](#), who conducted a selection of the most important works for a number of famous composers, including the three covered in this research. The fact that only important works are considered constitutes an implicit advantage, as those are the compositions that made a significant contribution to the classical music canon. Therefore, the selection is free from biases caused by pieces of no lasting value, such as the jottings of composers, trifling pieces, or unfinished works. As such, this variable will later also serve as a measure of a composer's creativity.

Second, the model includes an indicator for whether the composer was permanently employed in a given year. Since tenured occupations were usually official posts (e.g., as court organists), this type of information has been recorded in historical archives and is relatively accurate. Furthermore, tenured positions were per definition offered for at least a couple of years and should indicate some extent of occupational stability of the individual, which is potentially conducive to his well-being. These data are obtained from [Grove Music Online \(2013\)](#).

It is fairly out of scope to depict adequately whether and how much a composer has been performing at a given time. The numbers of performances are simply too large and too heterogeneous to be measured in a reliable way. It is nonetheless possible to introduce a further indicator of whether a composer has been touring in a given period of time. The location choices of a composer are sufficiently well recorded in order to identify the years that he spent traveling and performing across different locations. This variable might be interpreted as an approximation of the

¹⁵The proposed baseline specifications includes all three measures of labor market involvement or accomplishments. One might prefer to include each of these labor variables separately, as they might be related in some way. The further presented findings would nonetheless remain consistent (not reported).

intensity of performing activity. An alternative, perhaps more conservative, interpretation of the variable is that it indicates the demand for the composer's works, as travels have usually been planned before departure and in response to received invitations.¹⁶

It would also be interesting to measure the teaching commitments of each composer. Liszt, for example, taught from his late teenage years and was still giving lessons during the last month of his life, nearly 60 years later. Walker et al. (2013) describe that more than 400 pupils studied with Liszt; however, they also acknowledge that the number is impossible to prove. A further difficulty lies in the definition of a "pupil", as it is likely that Liszt's involvement and well-being differed depending on the number of students, the continuity of the education, and perhaps even the quality of a pupil. Unfortunately, this type of information is not available.

Next, the *Relationships* variable relates to the structure or quality of the personal relationships of a composer. For this reason, I record whether a composer was married or living in cohabitation at a given time, as registered in Grove Music Online (2013). Furthermore, since relationships with family members are arguably an important determinant of happiness, I introduce an indicator for the death of a family member, which constitutes the extreme case of worsening of a composer's family ties.¹⁷

In order to measure the physical health of a composer, a dummy variable is included measuring the years when he was suffering from health problems. While states of good health are not observable in the source dictionaries, various illnesses and health

¹⁶Note that the variable captures only voluntary migration, as none of the covered composers has been forced to migrate (e.g., due to war). Data on earnings are not consistently available. However, in two robustness estimations in Appendix C, I show that the well-being indices perform in accordance with theory, using tentative indicators on the financial situation of a composer.

¹⁷This identification is similar to the "real-life happiness shocks" defined by Oswald et al. (2014) as either bereavement or illness in the family. Nonetheless, the underlying historical research setting allows to mitigate the worry that some people were more likely to experience a bad life event. At the turn of the 18th/19th century everybody, independent of status, has been prone to illness, which was often followed by imminent death.

deteriorations are, especially if they were regarded to be of significance to the life and work of a composer. This variable includes, for example, the years when Beethoven was experiencing serious hearing problems. The variable thus measures the inverse of good health and it is based on data from [Grove Music Online \(2013\)](#).

A number of additional control variables are included to ensure the reliability of the estimations. In order to deal with any possible differences in the writing frequency depending on the emotional state, I account for the number of letters written in a given year (*#Letters*). The model also includes composer fixed effects to account for any other unobserved differences across composers. Moreover, each specification includes controls for the relationship with the addressee. This set of variables mitigates the bias arising from the possibility that a person exhibits different degrees of openness depending on the nature of the relationship with the receiver. In additional robustness tests, I further include a set of time controls to deal with any unobserved differences arising over time (decade fixed effects) or controls for the city where the letter has been written (city fixed effects).

Assuming that the obtained indices will be proved valid and reliable, and using the introduced variables of model 1, I next introduce a two-stage least-squares model that enables an analysis of the causal association between negative emotions and creativity. The focus of this specification is on negative emotions for two reasons. First, the relevant literature usually claims the existence of an association with negative rather than positive emotions. After all, the popular and controversial "mad genius" hypothesis argues that various mental anomalies, such as depressions, are related to creativity, if at all. Second, the chosen research methodology enables the employment of a unique instrumental variable for negative emotions.

The employment of instrumental variables is important, as it may allow us to overcome biases that could simply result from studying the correlation between creative output and negative emotions. There are several reasons why this could be so. First,

certain potentially valid explanatory variables are not available, and this might lead to an omitted variable bias. One such variable could be income, which might be related to both negative emotions and output. Second, one might be concerned with reverse causality. It is possible that the completion of a composition leads to a worsening of a person’s well-being, since the pleasure derived from creating something new ceases (Steiner and Schneider, 2013). Alternatively, some of the finished works may not have been understood nor sufficiently appreciated by contemporaneous audiences, and hence the supply of an outstanding work might actually contribute to a worsening of the creator’s mood. This is a nonnegligible scenario given the covered sample of composers, who have been far more innovative in their compositions than the standards of their time. A further possibility is that the individual who ”made it” and became a public figure, became exposed to harmful critique, which could be detrimental to his well-being.

I will thus estimate the following pair of equations:

$$\textit{Negative emotions} = \beta_0 + \beta_1 \textit{Unexpected death of relative} + \beta_2 \mathbf{Z} + \mu \quad (2)$$

$$\textit{Output} = \gamma_0 + \gamma_1 \textit{Negative emotions} + \gamma_2 \mathbf{Z} + \nu \quad (3)$$

where Z is a vector consisting of the previously introduced control variables reflecting factors that are potentially conducive to creativity, such as age, labor market characteristics, relationship indicators, health measures, and a set of letter-related controls. In its structure and set of control variables equation 2 closely resembles equation 1 for the case of negative emotions, with the only difference that the *Output* variable is excluded. The *Output* variable approximates for creativity and measures the number of important works composed in the year a letter has been written. The works covered have been identified as lasting con-

tributions to the classical music canon by two music experts, Gilder and Port (1978), as previously described. Equation 2 is the first-stage regression that makes use of the instrumental variable, *Unexpected death of relative*, measured over the year prior to the letter being written. It is required that the instrument predicts negative emotions, $\rho(\textit{Unexpected death of relative}, \textit{Negative emotions})! = 0$, but must be conditionally uncorrelated with the error term from the final equation 3, $\rho(\textit{Unexpected death of relative}, \nu) = 0$.

It is important for the identification strategy that in the period covered catching an illness was as good as randomly assigned and could lead to a quick death, fairly independent of the status or health endowments of a person. Mozart’s mother, for example, unexpectedly succumbed to an undiagnosed illness about mid-June of 1778 and, despite being treated by a doctor, died few days later on 3 July. Table 1 provides a list of relatives who died unexpectedly along with the date and cause of death.¹⁸

In order to fulfill the exclusion restriction, the unexpected death of a family member cannot affect the composition intensity in any other way than through the impact on negative emotions. A concern might be that the death of a parent has affected the financial situation of the composer. The income shock could be positive due to inheritance. In the biographical entries, however, no indication of inheritance could be found. Alternatively, and possibly more likely, the shock may be negative if the household loses a family member who would otherwise contribute to the household budget. This effect is possibly the strongest for the loss of a father, who is usually the main breadwinner in a household. Either shock (positive or negative) would affect the financial capabilities of the composer, which is likely to be correlated with his creative output, and would hence violate the exclusion restriction. Appendix D shows that the further presented results would hold if one excludes the death of a

¹⁸These incidences are usually described by the biographer as "unexpected", "sudden", or "within days".

father from the analysis. Appendix D also shows that there is no statistical association between the death of any relative and the intensity with which the composer was writing about financial matters. These results strengthen the argument that the death of a relative affects emotions directly and not through any fluctuation of the composer's finances.

5 Results

5.1 Descriptive statistics

Table 2 provides summary statistics. For each individual the first part of the table reports background information on labor market variables, measures of social relations, indicators of periods affected by family death, and a health indicator. The latter part summarizes statistics on the letters including the measures of emotional content, the frequency of writing, and the occurrence of writing to a specific type of addressee.

Figures 1, 2, and 3 visualize time-series data reflecting positive emotions in the left panel and negative emotions in the right panel as a function of time for each of the composers. The correlation coefficient between the pooled negative and positive indices is equal to -0.13 (p -value < 0.01), implying a statistically significant negative association. Appendix E discusses the emerging indices in relation to corroborating evidence found in the biographies of the composers.

Figure 4 provides an overview of the number of letters written throughout the life of each composer. It can be seen that the intensity of writing is higher later in life; however, the composer would typically begin to write already in his mid-teenage years. This allows the first insights into the person's well-being already at an early stage in life. We can further observe that there exists a relatively high volatility in

the writing patterns. This variation is explored in Appendix F, where I determine when a composer writes more frequently. It has to be noted that in all models investigating the determinants of emotional well-being or the impact of emotions on creativity, I will deal with this variation by accounting for the number of letters written in a given year.

Figure 5 shows to whom the letters are addressed and how this frequency changes throughout life. During youth most letters are written to family members who constitute the composer’s network since birth. The share of family members among the addressees decreases during mid-life before somewhat bouncing off again later in life. Friends become an increasingly important share of addressees over the course of life. These two groups of receivers are most common and account for almost two-thirds of all letters. Professional correspondence over the course of life follows the shape of an inverted-U and, interestingly, comes close to the typical pattern of many labor market variables, such as income or working time. A somewhat similar shape is disclosed by letters written to strangers — a category that includes potential professional associates or public figures. Correspondence with peers is rather scarce and declines slowly throughout life.

5.2 The determinants of well-being

The regression results from estimating model 1 are presented in Table 3 for either negative emotions (columns 1 to 3) or positive emotions (columns 4 and 5). Column 2 gathers both negative and positive emotions indicators into one model in order to illuminate the association between them. All results are reported with composer fixed effects and addressee fixed effects and then further extended by including decade fixed effects and city fixed effects (columns 3 and 5).

Age is found to be significantly related to positive emotions, but only in the baseline model with composer fixed effects and addressee fixed effects (column 4). Output

exhibits a positive correlation only with positive emotions in both specifications. For negative emotions the only significant measure of labor market involvement is the touring indicator. The coefficient remains consistent in size and significance across all three specifications. The negative sign implies that composers involved in intense work-related traveling exhibit a lower degree of negative emotions. The coefficient is positive, albeit statistically insignificant, for positive emotions.

The variable measuring the effect of marriage (or cohabitation) turns out to be insignificant. Perhaps it is not a surprise that this social relationships proxy does not have a clear impact on the well-being of the composers covered, since their relationships were not always happy.¹⁹ For example, Liszt's relationship with Princess Carolyne von Sayn-Wittgenstein constituted a bitter 13-year fight to secure her annulment from a previous unhappy marriage (Walker et al., 2013). The other variable measuring social relationships — the death of a family member — turns out to be a highly significant driver of negative emotions. The disclosed coefficient comes close to one implying an almost doubling of negative emotions in the case of the death of a family member. Negative emotions also increase strongly due to poor health. A large effect of illness is found also for positive emotions, implying that poor health is associated with a marked decrease in positive affect. It is also interesting to observe the significant negative coefficient on the number of letters written in a given year. This suggests that composers wrote less when their positive emotions were high. A more detailed analysis of the determinants of writing patterns and of the probability of writing to a specific type of addressee is presented in Appendix F. Finally, the correlation between negative and positive emotions is negative and highly significant (column 2). This implies that the two types of emotions are to some degree opposite to each other. Here it can be also seen that the above described results are not influenced by the inclusion of this additional variable into the negative emotions

¹⁹The insignificant association is robust to alternative ways of measuring the relationships - for example, as the number of years spent in a relationship or as the incidence of getting married (or entering into cohabitation).

regression.

While some variables turn out to be insignificant, those estimated with sufficient statistical precision appear with the expected sign. As such, despite the obvious measurement difficulties these results support the validity of the calculated well-being indices. The reported correlation between output and emotion is not claimed to be causal here because of the suspicion that output is itself determined by emotion — and that is what will be shown in the next section.

In Appendix C several additional tests are conducted. First, I explore the role of earnings using a measure of the intensity with which a composer was writing in his letters about money-related concerns. Second, I use income information for 11 years of Mozart’s life, as provided by Baumol and Baumol (1994). Both measures indicate that fewer money-related concerns or higher income of Mozart correspond to greater positive emotions, which is in accordance with theory. I also estimate the correlates of the financial concerns variable using the available background information for each composer and show that the variable decreases if the composer has tenured employment. The validity of the LIWC variable is further documented using indicators on the intensity of writing about death-related concerns or social relationships.

5.3 Creativity and negative emotions

With increased confidence in the obtained well-being indices, I study next the existence of a causal link between negative emotions and creativity and begin by estimating OLS coefficients between the two variables of interest. As can be seen in columns 1 and 2 of Table 4, the estimated coefficients on negative emotions come with the plus sign, but are, however, statistically significant in the specification with age fixed effects only. In analogy with the previous estimations, the baseline specification is extended by the inclusion of decade and addressee fixed effects. An

interesting side result is that obtaining a permanent position (tenure) exhibits a strong negative correlation with the productivity measure. This is consistent with what one might expect and also in line with previous research.²⁰ Obtaining job security or, alternatively, becoming involved in new duties not directly related to composing results in a lower creative output for a composer. Being married or living in cohabitation is also negatively related with compositions written. Finally, the number of works composed is positively related with the letter writing frequency, which possibly indicates the periods when a composer was professionally more active or perhaps wrote more letters in order to promote a new piece.²¹

The first-stage results are presented in columns 3 and 4 of Table 4.²² Consistent with previous specifications explaining negative emotions, the variable measuring the unexpected death of a family member is found to be a significant determinant. It can be further observed that the coefficient for the unexpected death variable does not change when other variables are included: this supports the argument that death really occurred randomly. The second-stage results are presented in columns 5 and 6. It can be observed that the IV estimates are positive, large, and statistically significant, implying a causal impact of negative emotions on the number of compositions written. The coefficient in the preferred specification (column 6) indicates that a 0.1 point rise (approx. 9.3% increase) in negative emotions leads to the creation of additional 0.25 works in the following year (approx. 6.3% increase). Considering the average value of the negative emotions index (Table 2), an increase in negative emotions by about 36.7% inspires one additional important composition the following year.²³

²⁰See for example Holley (1977), who finds a negative impact of tenure decisions on the research productivity of academics.

²¹The OLS, as well as the first-stage and IV results, are robust to the inclusion of decade fixed effects and city fixed effects, with the only exception that the significant association for the married (or living in cohabitation) variable disappears.

²²The estimation in column 4 is very similar to the model estimating negative emotions in column 1 of Table 3, with the only difference that the output variable is not included in the first stage.

²³For further discussion of the timing issue, see Appendix G. The IV coefficients on negative emotions remain very stable in size and significance also if one includes the positive emotions

There can be several reasons why the OLS coefficients are downward biased. First, it is possible that output may have a decreasing role on negative emotions. A successful, well-received composition may be the reason why negative emotions decrease. Alternatively, the effect may also work through positive emotions, which — as we have observed — are negatively correlated with negative emotions (e.g., column 2, Table 3). Furthermore, it could be the case that the composer burns down his negative affect in the creative process. He draws upon negative emotions, but once this "fertile material" (Andreasen, 2005) expires, the creative process ends.

An arising question deals with the precise type of emotion that raises creativity. A way to address this issue is to use a disaggregated measure of negative emotions, which is provided by the LIWC software for anxiety, anger, and sadness. In analogy with the previous approach, I instrument for each of these three types of negative emotions with the incidence of death of a family member in order to find the causal impact on productivity and present the results in Table 5. The first-stage coefficients indicate that the instrumental variable exhibits a positive and significant association with each type of negative mood, even if it somewhat decreases in size and precision for anxiety and anger. Interestingly, the IV parameters imply that a significant causal effect on creativity can be detected only for the case of sadness (p -value = 0.052), whereas the effects of anxiety and anger are estimated to be just outside the usual confidence intervals (p -value < 0.12). Since depression is strongly related with sadness (Monroe et al., 2001) and is sometimes even defined as a state of chronic sadness, this result comes very close to the previous claims made by psychologists that depression leads to increased creativity (e.g., Andreasen, 2005).

It is interesting to note the coefficients on the intensity of letter writing in the first-stage regressions. It can be seen that composers have been writing more letters when they were angry, perhaps in an attempt to release their anger. However, the association with sadness is negative, which is consistent with the notion that

variable as an additional control (not reported).

isolation and solitude is the most common coping mechanism for sadness (Goleman, 1996).

6 Conclusions

In recent years, psychology research has increasingly relied on the analysis of word use in order to shed light on the emotional well-being of a person. Building on the association between a person's emotional state and his language use, I apply this methodology in an economic analysis and utilize an innovative computer software in order to calculate the extent of positive and negative emotions expressed in a large number of letters written by three famous composers. This allows me to create unique well-being indices that reflect emotional fluctuations of three famous artists throughout their lifetime. I further show that the shape and patterns of the emerging well-being indices find corroborating support in the biographies of the composers covered.

In further support of the validity of the methodology, I quantitatively investigate the determinants of well-being. The results indicate that the artists covered reacted emotionally to various life incidences in a similar fashion to people in general. Labor market achievements, measured as the composition of an important piece and touring activity, increase positive or decrease negative emotions, while the illness or death of a family member raises negative emotions. It may almost come as a surprise that the three music geniuses, who have shaped the classical music canon like probably nobody else in history, are only human after all and are affected by life events in a similar way as anybody else.

The data is then used to explore how negative emotions are associated with outstanding creative achievements. By utilizing instrumental variables and by exploiting the temporal dimension of the data, I show that creativity, measured by the number of

important compositions, is causally attributable to negative moods, in particular to sadness. This constitutes important insights on an issue that has fascinated many since the Antiquity.

This study contributes to the new and fast growing literature within economics on creative processes of successful people. The insights come in partial response to a recent claim by Galenson that "economists' failure to study [creative] individuals has prevented them from understanding the sources of the contributions of the most productive people in our society" (Galenson, 2010). Despite the small sample and the risk of some degree of measurement imprecision, the disclosed results appear to be consistent across different specifications and throughout several robustness tests. While further research on the potential of generalization of this study is required, the presented research design and findings contribute to the methodology and knowledge within several areas in economics: innovation, happiness, labor, and health economics, but also to psychology and music history. Furthermore, the text analysis method, which is seen by some psychologists to be "revolutionary", may possibly become a useful tool also in economics and help us better understand people's behaviors and their decision making processes.

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7 Tables

	Date of death	Relationship	Cause
Mozart:	3 July 1778	Mother	Illness
	19 August 1783	Son	Infancy
	15 November 1786	Son	Infancy
	28 May 1787	Father	Illness
	29 June 1788	Daughter	Infancy
	25 December 1789	Daughter	Infancy
Beethoven:	17 July 1787	Mother	Illness
	18 December 1793	Father	Illness/Alcoholism
	15 November 1815	Brother	Illness
Liszt:	28 August 1827	Father	Illness
	13 December 1859	Son	Illness
	11 September 1862	Daughter	Giving birth

Source: [Grove Music Online](#) (2013).

Table 1: List of unexpected deaths of family members

	(1)	(2)	(3)	(4)	(5)	(6)
	Mozart		Beethoven		Liszt	
	1756-1791		1770-1827		1811-1886	
	mean	sd	mean	sd	mean	sd
<i>Background</i>						
output (# works p.a.)	9.529	5.027	4.976	3.231	0.658	0.971
tenure (dummy)	0.260	0.439	0.081	0.274	0.684	0.465
touring (dummy)	0.216	0.417	0.017	0.130	0.117	0.323
marriage or cohabitation (dummy)	0.250	0.439	0	0	0.355	0.479
death of relative (dummy)	0.054	0.229	0.051	0.222	0.018	0.133
illness (dummy)	0.027	0.164	0.153	0.363	0.026	0.160
<i>Letters</i>						
positive emotions	4.979	2.007	4.584	2.819	6.340	2.614
negative emotions	1.067	0.714	1.273	1.283	0.932	0.797
anxiety	0.269	0.372	0.253	0.470	0.150	0.251
anger	0.209	0.291	0.237	0.539	0.178	0.327
sadness	0.340	0.381	0.403	0.666	0.274	0.452
word count per letter	557.5	454.3	198.5	189.8	339.2	257.1
# letters per year	13.13	14.84	14	14.88	11.26	8.043
<i>Addressee</i>						
family	10.35	14.23	1.176	6.167	0.817	1.330
friend	1.435	1.805	5.971	7.538	6.064	5.265
peer	0	0	1.382	2.188	1.308	1.812
business associate	0.783	1.506	5.412	6.021	2.644	2.670
stranger	0.087	0.288	0	0	0.407	0.853
unknown	0.522	1.410	0.059	0.239	0.017	0.130

Table 2: Summary statistics

Notes: The uneven columns report the mean value of a variable for each composer; the even columns report the standard deviation. The background variables refer to whole life. The letters and addressee variables are expressed per year, refer to periods in which letters are recorded, and are based on 299 letters written by Mozart, 473 by Beethoven, and 660 by Liszt. The death of a relative variable is recorded over a 12-month period after the death has occurred.

	(1)	(2)	(3)	(4)	(5)
	Negative emotions OLS	Negative emotions OLS	Negative emotions OLS	Positive emotions OLS	Positive emotions OLS
age	0.122 (0.131)	0.141 (0.130)	0.227 (0.261)	0.598* (0.343)	0.245 (0.675)
age ² / 100	-0.569 (0.512)	-0.648 (0.511)	-0.918 (0.984)	-2.448* (1.343)	-1.587 (2.548)
age ³ / 10000	1.010 (0.821)	1.140 (0.819)	1.533 (1.526)	3.983* (2.153)	3.480 (3.951)
age ⁴ / 1000000	-0.614 (0.460)	-0.685 (0.459)	-0.889 (0.829)	-2.192* (1.206)	-2.204 (2.147)
output	0.00486 (0.00958)	0.00670 (0.00957)	0.00366 (0.0110)	0.0566** (0.0251)	0.0585** (0.0284)
tenure	0.0128 (0.0707)	0.0169 (0.0704)	0.0576 (0.0961)	0.125 (0.185)	0.180 (0.249)
touring	-0.303** (0.119)	-0.288** (0.119)	-0.333** (0.153)	0.480 (0.311)	0.208 (0.397)
marriage (or cohabitation)	-0.0214 (0.0993)	-0.0231 (0.0990)	-0.0239 (0.129)	-0.0528 (0.260)	-0.118 (0.334)
death of relative	0.854*** (0.236)	0.870*** (0.236)	0.879*** (0.249)	0.481 (0.620)	0.306 (0.644)
illness	0.601*** (0.221)	0.550** (0.221)	0.618** (0.244)	-1.569*** (0.580)	-1.276** (0.632)
# letters	0.00189 (0.00241)	0.00134 (0.00241)	0.00212 (0.00272)	-0.0169*** (0.00632)	-0.0175** (0.00703)
positive emotions		-0.0326*** (0.0101)			
Observations	1,432	1,432	1,432	1,432	1,432
R-squared	0.032	0.039	0.043	0.052	0.086
Composer FE	✓	✓	✓	✓	✓
Addressee FE	✓	✓	✓	✓	✓
Decade FE			✓		✓
City FE			✓		✓

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3: The determinants of well-being

	(1)	(2)	(3)	(4)	(5)	(6)
	Output OLS		Negative emotions First-stage		Output IV	
negative emotions	0.254*** (0.0943)	0.0611 (0.0737)			2.189** (1.113)	2.537** (1.016)
tenure		-0.542*** (0.196)		0.0103 (0.0705)		-0.543** (0.263)
touring		0.282 (0.332)		-0.302** (0.119)		1.045* (0.543)
marriage (or cohabitation)		-1.093*** (0.275)		-0.0264 (0.0988)		-0.979*** (0.371)
illness		0.193 (0.615)		0.611*** (0.220)		0.480 (1.016)
# letters		0.0519*** (0.00656)		0.00214 (0.00236)		0.0473*** (0.00899)
death of relative			0.867*** (0.237)	0.865*** (0.235)		
Observations	1,432	1,432	1,432	1,432	1,432	1,432
R-squared	0.065	0.187	0.012	0.032		
Age FE	✓	✓	✓	✓	✓	✓
Composer FE		✓		✓		✓
Addressee FE		✓		✓		✓

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4: Creativity and negative emotions

	(1)	(2)	(3)	(4)	(5)	(6)
	Anxiety	Output	Anger	Output	Sadness	Output
	First-stage	IV	First-stage	IV	First-stage	IV
death of relative	0.155* (0.0887)		0.180* (0.0989)		0.299** (0.127)	
tenure	-0.000470 (0.0265)	-0.510 (0.421)	0.0130 (0.0296)	-0.676 (0.422)	0.0234 (0.0379)	-0.688** (0.346)
touring	-0.0674 (0.0447)	1.235 (0.943)	-0.0526 (0.0499)	0.921 (0.811)	-0.0729 (0.0638)	0.813 (0.636)
marriage (or cohabitation)	0.0131 (0.0372)	-1.233** (0.596)	0.0148 (0.0415)	-1.227** (0.585)	-0.0169 (0.0531)	-0.922* (0.482)
illness	0.00800 (0.0830)	1.917 (1.315)	0.101 (0.0926)	0.796 (1.488)	-0.120 (0.118)	2.911** (1.162)
# letters	0.000147 (0.000887)	0.0507** (0.0141)	0.00252** (0.000990)	0.0220 (0.0234)	-0.00255** (0.00127)	0.0715*** (0.0151)
anxiety		14.18 (9.081)				
anger				12.22 (7.691)		
sadness						7.329* (3.770)
Observations	1,432	1,432	1,432	1,432	1,432	1,432
R-squared	0.012		0.015		0.016	
Composer FE	✓	✓	✓	✓	✓	✓
Age FE	✓	✓	✓	✓	✓	✓
Addressee FE	✓	✓	✓	✓	✓	✓

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Creativity gains by type of negative emotion

8 Figures

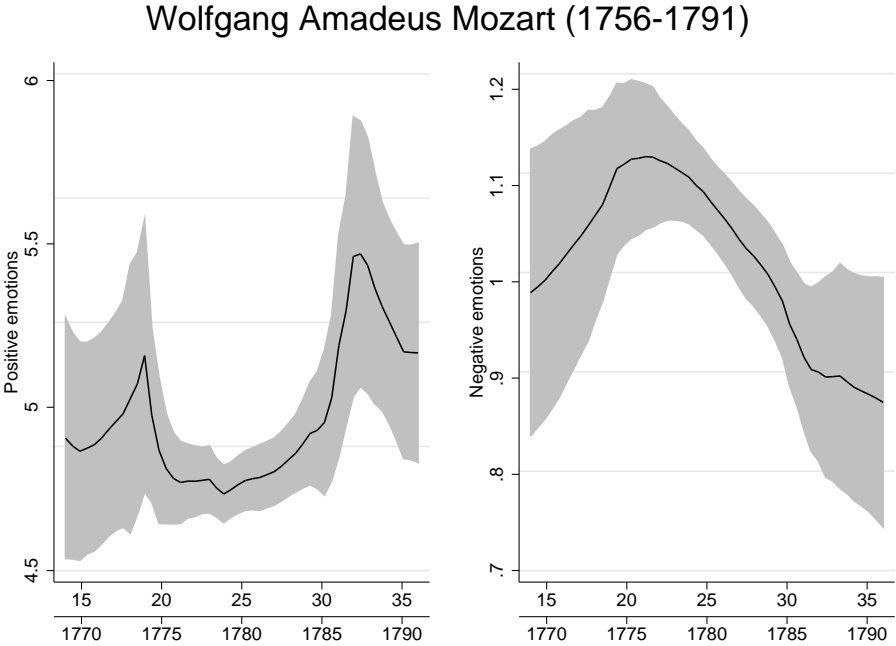


Figure 1: Positive and negative emotions of Wolfgang Amadeus Mozart
Note: The depicted prediction is based on a local polynomial regression method with an Epanechnikov kernel, and it is presented along with a 95% confidence interval.

Ludwig van Beethoven (1770-1827)

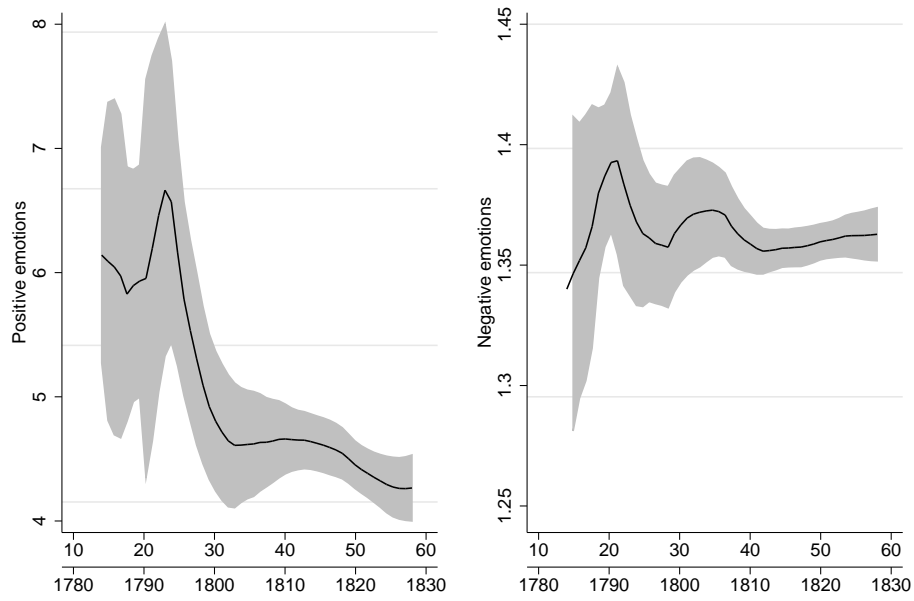


Figure 2: Positive and negative emotions of Ludwig van Beethoven
Note: See figure 1.

Franz Liszt (1811-1886)

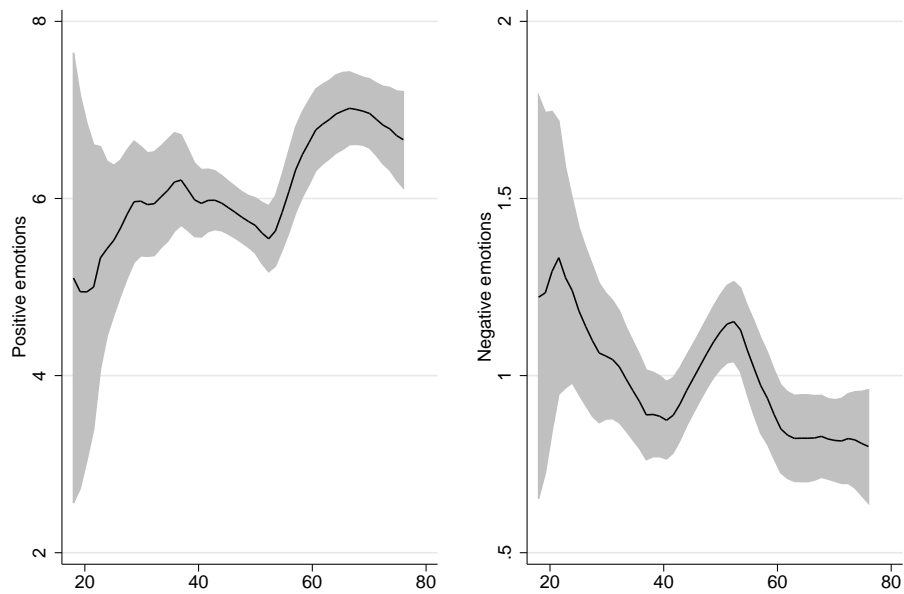


Figure 3: Positive and negative emotions of Franz Liszt
Note: See figure 1.

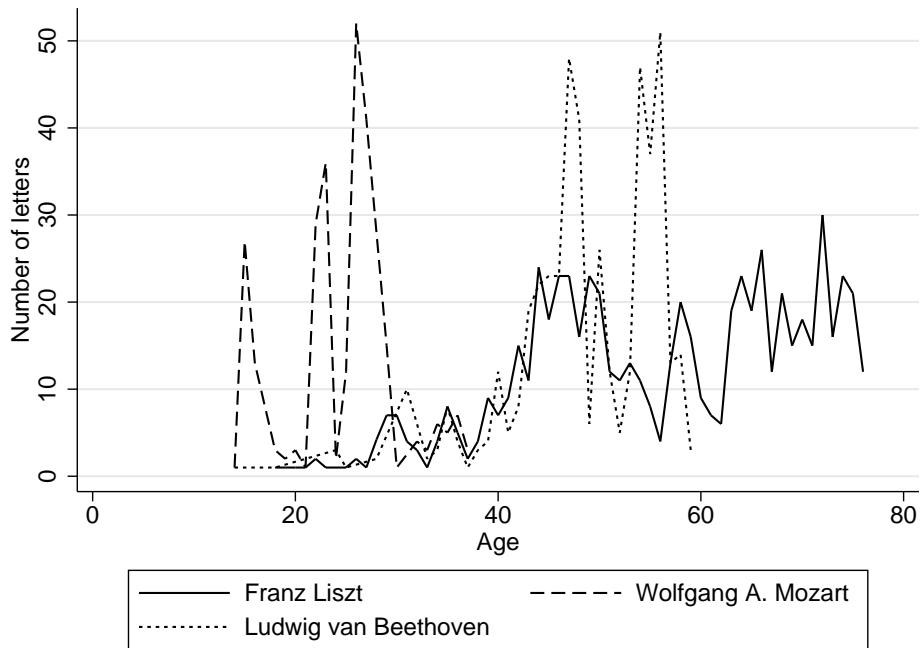


Figure 4: Number of letters by age

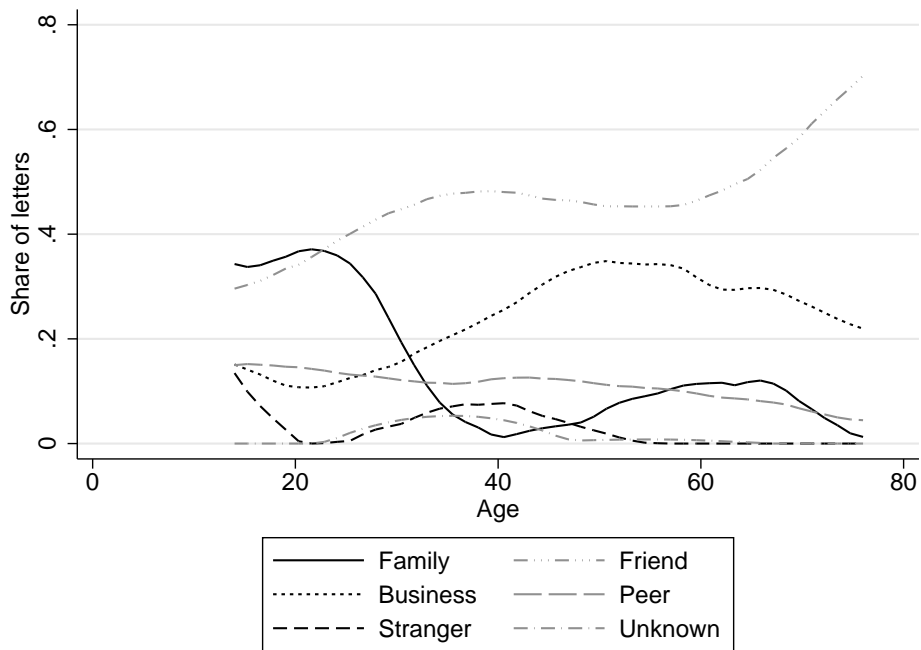


Figure 5: Share of letters by type of addressee and age

9 Appendix

A Data

This research is constructing and using unique indices on positive and negative emotions. The indices have been obtained by availing of the text analysis software Linguistic Inquiry and Word Count (LIWC). This data appendix explains in more detail how the software works and discusses its internal reliability and external validity. This is followed by a presentation of the non-emotional variables that have been obtained for the composers covered.

A.1 Introduction and assessment of LIWC

LIWC is a text analysis application that has been developed in order to provide an efficient and effective method for studying various emotional, cognitive, and structural components present in verbal and written speech samples. At the center of the text analysis strategy is an on-purpose built dictionary that consists of almost 4,500 words and word stems. Each word or word stem defines one or more word categories or subdictionaries. For example, the word *cried* is part of five word categories: sadness, negative emotion, overall affect, verb, and past tense verb. Hence, if it is found in the target text, each of these five subdictionary scale scores will be incremented. As in this example, many of the LIWC categories are arranged hierarchically. All anger words, by definition, will be categorized as negative emotion and overall emotion words. Note, too, that word stems can be captured by the LIWC system. For example, the dictionary includes the stem "*happi**" which allows for any target word that matches the first five letters to be counted (including happiness, happier and happiest).

The selection of words defining the LIWC categories involved multiple steps (Pennebaker and Francis, 1996; Pennebaker et al., 2007). The initial word collection within each category was conducted and, for example, within the psychological processes category, the emotion or affective subdictionaries were based on words from several sources: common emotion rating scales (e.g., the Positive and Negative Affect Schedule, commonly used in psychology), Roget's Thesaurus, and standard English dictionaries.

Following the creation of preliminary category word lists, a group of independent judges have been evaluating the word selection. In the development of the first LIWC program, the judges were instructed to focus on both the inclusion and exclusion of words in each LIWC dictionary scale list. In the first rating phase, the judges indicated whether each word in the category list should or should not be included in a particular category. They were also instructed to include additional words they felt should be included in the category. The dictionary has been further extended by drawing on over several hundred thousand text files made up of several hundred million words from both written and spoken language samples. Examining the 2000 most frequently used words, another group of independent judges individually and collectively agreed which words and word categories were appropriate for inclusion.

The LIWC software has then been tested extensively for its internal reliability and external validity. These tests include a range of cross-checks using expert opinions and have been carried out over a range of different types of texts, including personal writing, blogs, novels, science articles, or orally communicated texts. Pennebaker et al. (2007) also show that the LIWC software performs well for historically written texts. Based on 209 novels published in English between 1700 and 2004, the authors detect a match of 84% with the dictionary vocabulary. This is indistinguishable from the mean dictionary match of 83% for all studied contemporary types of texts.²⁴ Moreover, Tausczik and Pennebaker (2010) provide an overview of 121 recently published articles that use LIWC and conclude that the presented empirical results demonstrate the ability of LIWC to detect meaning in a wide variety of settings, including to show emotionality.

The categories of the software include linguistic processes, psychological processes, personal concerns and spoken categories. Out of the psychological processes, the software provides the category affective processes and includes the sub-categories positive and negative emotions, which are primary used in this research.²⁵ The software does not allow to further disentangle positive emotions however, negative emotions can be disaggregated into anxiety, anger and sadness. Table 6 provides an overview of these categories along with examples and the number of words in each category.²⁶

LIWC variable	Examples of words	Words in category
Affective processes	Happy, cried, abandon	915
Positive emotion	Love, joyful, nice	406
Negative emotion	Hurt, grief, nervous	499
Anxiety	Worried, fearful, nervous	91
Anger	Hate, kill, annoyed	184
Sadness	Crying, grief, sad	101

Table 6: LIWC variables within the psychological processes category

²⁴In the underlying study, the match between the LIWC dictionary and the vocabulary used in the letters written by composers is 81.8%, hence in a similar high range.

²⁵The psychological processes category provides indicators also for social processes, biological processes, cognitive processes, perceptual processes and relativity. Social processes and biological processes (i.e., sexual words) are used in some robustness tests, whereas the latter three concepts do not appear to be related to the objectives of the paper and are not exploited. The paper avails also of the personal concerns category and uses measures for financial concerns and death-related concerns.

²⁶Note that the three categories do not add up to the 499 words associated with negative emotions, as there are other negative emotion words that are not anxiety, anger, or sad words (e.g., guilt, shame). Similarly, there are some emotional words that are emotional but not explicitly positive or negative (e.g., emotional).

A.2 Data on music composers

Background information on each composer is obtained primary from [Grove Music Online \(2013\)](#).²⁷ The chosen dictionary is "a critically organized repository of historically significant information" ([Grove Music Online, 2013, preface](#)) and is regarded as the leading source for music research.

Most of the collected variables reflect the socio-economic situation of a composer and are therefore measured at the date when a letter was written. These variables include age, tenured employment, touring, being married or living in cohabitation, and experiencing health problems. These are the factors that have potentially an effect on well-being while they last and their duration is typically known. For example, it is usually established when a composer took on a tenured position, which allows to link the variable to the letters written during that employment. The variable death of a relative is one that may have a particularly lasting effect on the composer and, therefore, it is recorded over a 12-month period after the death has occurred.

Another variable measuring an incident, rather than a state, is the output variable - number of compositions written in a given time period. The output data set is obtained in reliance on ratings made by experts. In particular, I use "The Dictionary of Composers and Their Music", written by two prominent musicologists - [Gilder and Port \(1978\)](#). The compendium is an acknowledged selection of the most influential classical works and has often been used to measure composers' productivity (e.g., [Simonton, 1991](#)). The authors of the dictionary aim to provide a dictionary "of lasting value as a permanent reference (...) [that contains] (...) complete factual information about who wrote what, and when" ([Gilder and Port, 1978, preface](#)). The dictionary contains a comprehensive list of important works for a number of prominent composers, including the date of completion. [Gilder and Port \(1978\)](#) provide also a brief description of the type of work, which makes it possible to select out in a robustness test theatrical compositions (i.e., opera, ballet, or other theater forms), as those require typically longer production times (see [Appendix G](#) for further details and discussion).

The variable can be measured in several ways. In the baseline specifications, it is coded as the number of important works composed in the year after a letter has been written. In [Appendix G](#) it is shown that the results hold also for variations of this time interval, albeit remain the strongest for the specification where output is measured over one year.

B Exemplary letters

This appendix presents two exemplary letters for each of the composers. One of the letters is likely written in a positive mood, while the other in a negative mood. Words associated with positive emotions are marked in **bold blue**, while those

²⁷In few cases additional biographical sources have been used if the information found in [Grove](#) was not precise enough (e.g., the exact date of an incident was not provided).

associated with negative emotions are underlined red. I present for each letter the resulting metric for positive and negative emotions as well as the word count.²⁸ The well-being indices are calculated automatically by the software as the number of words that are associated with positive (or negative) emotions divided by the word count of a letter and normalized by 100.

Mozart to his sister (letter #15):

Naples, June 16, 1770.

*I AM **well**, **lively** and **happy** as ever, and as **glad** to travel. I made an excursion on the Mediterranean. I **kiss** mamma's hand and Nannerl's a thousand times, and am your son, Steffl, and your brother, Hansl.*

Positive emotions: 11.9. **Negative emotions:** 0. Word count: 42.

Mozart to his sister (letter #36):

Milan, Sept. 21, 1771.

*I AM **well**, God be **praised!** I can't write much. 1st, I have nothing to say. 2d, my fingers **ache** from writing. I often whistle an air, but no one responds. Only two arias of the Serenata are still wanting, and then it will be finished. I have no longer any fancy for Salzburg; I am **afraid** I might go **mad** too. Wolfgang*

Positive emotions: 2.99. **Negative emotions:** 4.48. Word count: 67.

Beethoven to Dr. Wegeler (letter #8):

Vienna, May 1797.

*God speed you, my **dear friend!** I owe you a letter which you shall shortly have, and my newest music besides, I am going on **well**; indeed, I may say every day **better**. Greet those to whom it will give **pleasure** from me. Farewell, and do not forget your Beethoven.*

Positive emotions: 9.43. **Negative emotions:** 0. Word count: 53.

Beethoven to Zmeskall (letter #109):

April 26, 1813.

*Lobkowitz will give me a day on the 15th of May, or after that period, which seems to me **scarcely better** than none at all; so I am almost disposed to give up all idea of*

²⁸To facilitate the overview, letters of about 100 words or shorter are replicated (these are shorter than the average letter of 338 words). For the sake of space the letters are not paragraphed appropriately.

a concert. But the Almighty will no doubt prevent my being utterly ruined. Yours, Beethoven.

Positive emotions: 1.85. **Negative emotions:** 3.7. Word count: 54.

Liszt to Sophie Menter (letter #348):

My **dear Friend**, My few days' stay at your fairy-like castle Itter in Tyrol will remain a magic memory. When you have signed the Petersburg Conservatorium contract let me know. You know, indeed, that I very much approve of this turn and fixing of your **brilliant** artistic career. It requires no excessive obligations, and will be an **advantage** to you. **Friendly** greetings to the New School from your **faithful admirer** and **friend**, F. Liszt

Weimar, September 13th, 1884

I am here till the end of October. Later on I shall visit my **friends** Geza Zichy and Sandor Teleky in Hungary.

Positive emotions: 9.0. **Negative emotions:** 0. Word count: 100.

Liszt to Adelheid Von Schorn (letter #324):

If you were here, my **dear friend**, you would perhaps find means to put into some sort of order the hundreds of letters that rain upon me from everywhere. These **bothers** and **burdens** of the amiability with which I am **credited** are becoming insupportable, and I really long, some **fine** day, to **cry** from the housetops that I beg the public to consider me as one of the most disagreeable, whimsical and disobliging of men. To our cordial meeting at Weimar in the early days of April. Ever your very **affectionate** and **grateful** F. Liszt

Budapest, February 14th, 1883

Positive emotions: 6.06. **Negative emotions:** 4.04. Word count: 99.

C The effect of income and further tests

This appendix presents several tests of the reliability of the obtained LIWC variables. Consistent information on income for the composers covered is not available. In an attempt to shed light on the role of income, I present two approaches that provide tentative evidence indicating that the well-being indices perform as one would expect. First, I use information on the intensity with which a composer was writing in each letter about financial (money-related) concerns, based on a variable that is automatically calculated by the LIWC software. Columns 1 and 2 in Table 7 report the baseline model 1 extended by the measure of financial concerns. The coefficient

of interest is negative and significant, which implies that when a composer is more concerned about money his positive emotions dwindle.

Second, I utilize rare data on the income of Mozart, available for the years from 1781 to 1791 (Baumol and Baumol, 1994). The real income variable is provided in forints, the currency of the lands of the House of Habsburg, and has a mean of 1550.3 (st. dev. 894.8). Given the very few observations, I estimate only a simple OLS-model, where I regress either of Mozart’s well-being indices on the income measure, an output indicator and age variable. Columns 3 and 4 show the results, which imply a weak positive association between income and positive emotions, suggesting an improved emotional state with higher income. The association with positive emotions is further visualized in Figure 6.

The results presented in this section imply tentatively, albeit consistently, that an improvement in the financial situation of the composer is conducive to his positive emotions. This is in line with the theory.

	(1)	(2)	(3)	(4)
	Positive emotions	Negative emotions	Positive emotions	Negative emotions
	OLS	OLS	Only Mozart OLS	Only Mozart OLS
financial concerns	-0.256** (0.104)	0.0157 (0.0399)		
output	0.0544** (0.0251)	0.00499 (0.00959)	0.0139 (0.302)	0.0285 (0.0486)
income			0.00146* (0.000642)	3.51e-05 (0.000103)
Observations	1,432	1,432	10	10
R-squared	0.144	0.054	0.492	0.302
Composer FE	✓	✓		
Age FE	✓	✓	✓	✓
Addressee FE	✓	✓		
Background controls	✓	✓		

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Table 7: Financial situation and well-being

Notes: Columns 1 and 2 include a wide set of background controls as introduced in model 1 and presented in Table 3. The age controls are estimated with a quartic age polynomial in columns 1 and 2 and with a linear age variable in columns 3 and 4.

In an attempt to further test the reliability of the LIWC variables, I estimate additional models regressing potentially relevant LIWC variables on the set of variables available for composers. Table 8 summarizes the coefficients. Column 1 shows the correlates of the financial concerns variable. As observed above, the variable is negatively correlated with positive emotions, but there is also a negative association with

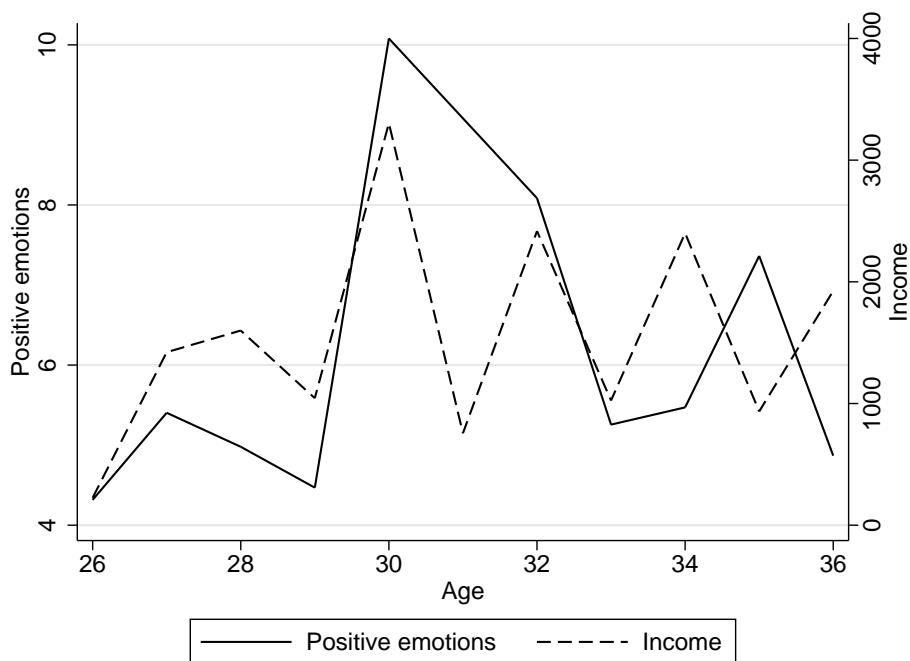


Figure 6: Mozart’s positive emotions and income, 1781-1791
Sources: See text.

tenured employment: composers were writing less about money-related concerns if they were tenured.

Columns 2 and 3 estimate models for the death-related concerns variable, which is another personal concerns indicator. Both specifications deliver a very strong positive association with the incidence of death of a relative. Column 4 presents an estimation for the variable measuring the intensity of writing about social processes. The variable measures the occurrence of words related to family, friends, and humans. This estimation indicates that positive emotions are positively related to social processes, while negative emotions exhibit the opposite relationship. Being married or living in cohabitation increases this measure, while illness appears to be detrimental. Column 5 uses the sexual sub-category, as an example of the biological processes category. The measure increases with positive emotions and also when a composer was married or living in cohabitation, whereas with tenure, it decreases. While these estimations are experimental and not based on rigorous economic theory, the emerging results are intuitively plausible and consistent with the overall findings presented in the paper.

D Robustness of the IV identification

A potential violation of the exclusion restriction of the model presented in equations 2 and 3 is related to the possibility of a change in the financial situation of the composer due to the death of a family member. For example, it is possible that the composer

	(1)	(2)	(3)	(4)	(5)
	Financial	Death	Death	Social	Sexual
	concerns	concerns	concerns	words	words
	OLS	OLS	OLS	OLS	OLS
positive emotions	-0.0164** (0.00678)		-0.0114*** (0.00371)	0.324*** (0.0329)	0.0417*** (0.00438)
negative emotions	0.00329 (0.0178)		0.0448*** (0.00972)	-0.242*** (0.0864)	0.00343 (0.0115)
death of relative	0.209 (0.158)	0.326*** (0.0863)	0.289*** (0.0865)	-0.121 (0.769)	-0.136 (0.102)
output	-0.00762 (0.00639)		0.00164 (0.00350)	-0.00907 (0.0311)	-0.00375 (0.00413)
tenure	-0.0938** (0.0471)		0.00542 (0.0257)	0.128 (0.229)	-0.0748** (0.0304)
touring	0.0220 (0.0793)		-0.0197 (0.0434)	0.00755 (0.385)	0.00275 (0.0512)
marriage (or cohabitation)	0.00993 (0.0661)		-0.0144 (0.0362)	0.611* (0.321)	0.0993** (0.0427)
illness	0.126 (0.159)		0.0191 (0.0809)	-2.584*** (0.719)	0.0118 (0.0955)
# letters	0.00145 (0.00161)		-0.000280 (0.000880)	0.00281 (0.00782)	0.00177* (0.00104)
Observations	1,432	1,432	1,432	1,432	1,432
R-squared	0.025	0.022	0.047	0.201	0.133
Composer FE	✓	✓	✓	✓	✓
Age FE	✓	✓	✓	✓	✓
Addressee FE	✓	✓	✓	✓	✓

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Testing the text analysis method

Note: The age controls are estimated with a quartic age polynomial.

experienced a negative shock to his finances if the father, who was typically the main income earner of a household, deceased. Therefore, I reestimate the model by excluding the death of the father from the list of unexpected deaths (Table 1). It can be seen in columns 1 and 2 of Table 9 that both the first- and second-stage results imply very similar coefficients as the baseline specification, now measured with somewhat greater precision.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Negative emotions OLS	Output IV	Financial concerns OLS	Income OLS	Negative emotions OLS	Output IV	Negative emotions OLS	Output IV
	Father deaths excluded							
negative emotions		2.916*** (0.977)				2.438** (0.972)		1.328* (0.780)
death of relative (father deaths excluded)	1.025*** (0.250)							
death of relative			0.204 (0.158)	3.528 (3,864)	0.884*** (0.235)		0.884*** (0.248)	
positive emotions					-0.0321*** (0.0101)	0.142*** (0.0478)		
Observations	1,432	1,432	1,432	11	1,432	1,432	1,432	1,432
R-squared	0.034	0.093	0.021	0.161	0.039		0.043	
Composer FE	✓	✓	✓		✓	✓	✓	✓
Age FE	✓	✓	✓	✓	✓	✓	✓	✓
Addressee FE	✓	✓	✓		✓	✓	✓	✓
Background controls	✓	✓	✓		✓	✓	✓	✓
Decade FE							✓	✓
City FE							✓	✓

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Robustness of the identification

Note: Age effects are captured with a fourth order age polynomial, with the exception of column 4 where the first order age variable is used.

Another way to study whether a death in the family impacts the financial situation of a composer is to look at the extent to which he was writing about money-related concerns. The financial concerns variable is provided by the LIWC software and is similarly based on the occurrence of predefined words. Column 3 reports the association between the death of any family relative and the intensity with which the composer was writing about financial concerns: the correlation is insignificant.²⁹ Alternatively, using the only available records on income, which are available for the years from 1781 to 1791 of Mozart’s life (see Appendix C), one can study the effect of income fluctuations directly. Column 4 summarizes the OLS results for a simple specification that only includes an age variable. The emerging coefficient of interest is insignificant. These tests provide some indication that financial concerns or income are not correlated with death of a family member.

Next, positive and negative emotions are shown in this paper to be correlated. One may thus want to test whether and how positive emotions are related to negative emotions *and* output. Columns 5 and 6 present the baseline IV-specification with the addition of positive emotions. It can be viewed that negative emotions drive causally output, also if one accounts for positive emotions.

Finally, I further include a set of time controls to deal with any unobserved differences arising over time (decade fixed effects) and controls for the city where the letter has been written to account for any unobserved differences arising over space (city fixed effects). Even in these very strong specifications (columns 7 and 8), the main findings of the paper remain robust.

E Lifetime well-being indices

This appendix provides a discussion of the introduced well-being indices in relation to corroborating evidence found in the biographies of the composers.

E.1 Wolfgang Amadeus Mozart (1756-1791)

Wolfgang Amadeus Mozart was born in 1756 in Salzburg. The young Mozart together with his family made a number of journeys across Europe in the years from 1763 to 1773. During that time, Mozart’s prodigious talents, shown in his performances and early compositions, in combination with his good-natured modesty brought him the greatest praise. Mozart’s days as a child prodigy and exciting touring were, however, over in 1773, once he arrived back to Salzburg and began his tenure at the court. This appears to be reflected in the sudden turn of his positive emotions (Figure 1).

Serving at the court of the newly elected Prince-Archbishop Hieronymus Colloredo turned out to be quite tedious, partly due to a range of new reforms introduced

²⁹Similarly, no significant relationship was found between the death of a family member and any of the other labor market measures (not reported).

by the ruler that negatively affected the local cultural life. Over the next years, Colloredo gradually eliminated opportunities for music composition, by closing the university theatre (the nearest Salzburg equivalent to an opera), restricting performances of instrumental music at the cathedral or curtailing concerts at the court. These reforms, in connection with a policy of promoting Italian musicians, led to increasing dissatisfaction among local artists and also affected the well-being of the Mozart family. The Mozarts became increasingly irritated by the difficult personality of Colloredo and in an attempt to leave Salzburg, Amadeus was looking for employment opportunities in Vienna and Italy, although with no success to his written applications. By then some of the European nobility regarded Mozart's family as "useless people" who go "about the world like beggars" (Beales, 2008). The change in Mozart's reception in Europe and his constrained prospects at the court were likely factors leading to the worsening of his moods.

In 1777 he was dismissed by Colloredo and set out to southern Germany in search of better opportunities. His services were refused in Munich and later in Mannheim. There he met Aloysia Lange, a woman whom Mozart fell in love with; however, his father forbade him to continue the journey with her. Instead, the composer was ordered to travel to Paris, a city that he never grew to like, partly due to French music, which he detested, but also due to being mistreated by some of the patrons (Angemuller, 1982). Moreover, his mother got severely ill and died later in 1778. This family tragedy further worsened Mozart's relationship with his father (Halliwell, 1998) and culminated in a peak of his negative emotions as well as a low of his positive emotions.

From now on, Mozart's life began slowly to take a turn for the better. Later in the year, Mozart returned to Salzburg, as he was offered a post as court organist at an increased salary and generous leave. In 1780 the composer received a commission to write a major opera for Munich. After a successful premiere in 1781, which warmed the relationship with Mozart's father somewhat, he decided to continue his endeavours as a freelancer in Vienna. During a series of concerts and commissioned compositions, his reputation was increasing steadily and soon he had established himself as the finest keyboard player in Vienna. In 1782 also his private life was enriched when he got happily married to Constanze Weber (Eisen et al., 2013), who gave birth to their first child a year later.

During the early 1780s most of Mozart's important works were written. It was also a time of intense delivering of public and private performances. However, the composer quickly noticed that his publications delivered him the greatest financial gains, and so he shifted his attention to producing for publication, rather than delivering performances (Hunter, 1999). 1786 saw a successful premiere of his opera work *Le Nozze di Figaro*. In addition to his diverse freelancing activities as a composer and an occasional performer, he took on an appointment at the Viennese court. These years are associated with a continuous increase in positive emotions and a fall in negative ones.

In 1787 his father died, which perturbed Mozart and led to the ultimate breakdown of the Salzburg Mozart family. This is visible in another turn of Mozart's positive

emotions and a break in the downward trend of negative emotions. The following years he spent teaching, performing, and composing, however faced a decreasing demand for his services after his novelty value waned in Vienna (Moore, 1989). At the end of 1791 Mozart unexpectedly caught a fever and died a few days later.

E.2 Ludwig van Beethoven (1770-1827)

Ludwig van Beethoven was born in Bonn in 1770. His mother died in 1787, and later a series of events reduced the ability of Beethoven's father to support the family. To counter the deteriorating financial situation of the family, young Beethoven was forced to take over some of his father's professional duties for half of the salary. In accordance, one could cautiously observe a decline of the positive emotions, while the negative feelings increased.

In 1792 Beethoven moved to Vienna in order to receive tuition from Haydn. Demand for music in the Austrian capital was remarkably high, and the domicile aristocracy spent fortunes on the indulgence of their taste. Beethoven, who arrived from Bonn as the court organist and had some contacts with aristocratic circles, benefited from that demand. In the 1790s he successfully published some of his works, making a decent profit, and kept on receiving increasingly prestigious commissions (Kerman et al., 2013). His positive emotions peaked in this period, and his negative moods were in a steady decline.

Around the turn of 1800, Beethoven made the appalling discovery that he was going deaf. The illness affecting his hearing had an impact on not only Beethoven's professional but perhaps even more his social life. According to contemporaries, the deafening composer was "leading a very unhappy life, and was at variance with Nature and his Creator" (Kerman and Tyson, 1997). This period corresponds with a temporary increase in negative emotions and the lowest extent of positive feelings, which from then on remained fairly stable over the next 15 years.

Beethoven's financial problems became resolved once he obtained a generous offer from the court in Vienna in 1809, which even covered accidents and old age, hence serving as an insurance policy and a pension. Perhaps this somewhat decreased his negative emotions. Soon afterwards the composer was considering marriage and proposed to a woman, however turned down. Kerman and Tyson (1997) regard the beginning of 1812 as a turning-point in Beethoven's emotional life, when he gave up hope of getting married and apparently became depressed. In 1815 Beethoven's brother died and appointed him guardian of his nine-year-old child. The relationship with young Karl developed violently over the years and culminated in the boy's attempted suicide in 1826, which left Beethoven in shatters and aged him. His positive emotions reached the lowest point of his life, while negative emotions appeared to be slightly increasing. The composer died in 1827.

E.3 Franz Liszt (1811-1886)

The Hungarian composer Franz Liszt was born in Raiding in 1811. In 1827 Liszt's father succumbed to typhoid fever and died, leaving the family in financial difficulties and the 16-year-old boy as the sole breadwinner, which forced him into teaching duties. He fell in love with one of his pupils, Caroline de Saint-Cricq, but was rejected by her family and banned from their house, which ultimately led to Liszt's nervous breakdown (Walker et al., 2013). Those events correspond with a lifetime peak of his negative emotions and a low in his positive emotions.

At the age of 22 Liszt met Countess Marie d'Agoult and embarked on a close relationship with her for the next 12 years. In 1835 they had their first daughter and two more children in later years. The years from 1839 to 1847 are denoted as *The Glanzzeit* in Liszt's career, when his career as a pianist unfolded, and he gave over 1000 recitals in a wide range of European countries. Over this happy period, the positive emotions increased, while negative dropped.

In 1847 he met the second great love of his life, Princess Carolyne von Sayn-Wittgenstein, and a year later moved with her to Weimar to take on employment at the court. The 13-year long stay in Weimar resulted in some of his best works; however, a range of life difficulties took its toll on Liszt's well-being. In this period Liszt got drawn into a fierce discourse between "progressive" and "conservative" forces in nineteenth-century music. Much of the critique of the "War of the Romantics" was aimed at Liszt's person or creations, and he faced hostile demonstrations after performances.

Liszt's tenure in Weimar was further affected by a significant evolution in his private life. His relationship with Carolyne was never official, as she was already married. The couple engaged in a 13-year long fight to secure an annulment, however failed, eventually giving up all hope of having their marriage approved. In addition, Liszt lost his son in 1859 and his elder daughter in 1862. These years made Liszt old and burnt out (Gregorovius, 1893, p.201) and correspond with a sharp increase in negative emotions as well as a drop in positive ones.

The anguished composer entered a two-year retreat at a monastery and received the tonsure in 1865. From then on for the rest of his life, he would be known as "Abbé Liszt". The composer apparently regained his emotional balance, reflected in a steady decrease of negative emotions. Liszt's intensive travels between Rome, Weimar and Budapest in his older age, were financed from own means, and since he often refused any remuneration, those activities strained his already precarious financial situation. This might have contributed to a slight decrease in positive emotions. He died at the age of 75.

F The determinants of writing patterns

This appendix provides a brief analysis of the writing patterns of letters by the composers covered. The motivation for this section is twofold. First, the analysis presented here is another test of the validity of the text analysis method and the constructed dataset. Even if the interpretation cannot be easily based on economic theory, it can be assessed whether the coefficients are plausible. Second, this section relates to the (non-economic) literature on the history of written correspondence. For an overview of theoretical issues concerning letters and a review of applied research using historical letters refer to [Dossena and van Ostade \(2008\)](#).

The results are summarized in [Table 10](#). Column 1 reports OLS estimates for a model explaining the word count of each letter. Composers write longer letters if their positive emotions are low or negative emotions high. They also write longer if they have produced more compositions or during tenured employment, but shorter when they are touring or married (or in cohabitation). Death of a relative is associated with a large increase in word length.

Column 2 shows a model explaining the annual patterns of the letters writing frequency, that is the number of letters written in a given year.³⁰ Composers write fewer letters in years when their positive emotions are high or when they are ill, whereas the writing frequency is higher in years when they compose more, or are married (or living in cohabitation).

Next, I use information on the type of addressee and estimate the probability of writing to a specific receiver. For this reason I aggregate letters written to family members or friends into a personal writing category, and letters written to business associates, fellow composers, or strangers into a professional category. Columns 3 and 4 of [Table 10](#) report the estimated probit marginal effects. A composer is less likely to write to relatives or friends if he feels well, and more likely if his negative emotions are high. The opposite results are disclosed in correspondence to professional acquaintances: positive emotions are more likely to be communicated, while negative emotions are restrained.

Since endogeneity is an issue in this setting, these results indicate one of the two following possibilities. The composer writes more often to people close to him, such as family members or friends, if he feels unwell, possibly in an attempt to share his negative emotions, whereas he avoids communicating with professional partners, when he feels low. Alternatively, these results could simply indicate that the composer is more restrictive in expressing his negative moods (or more conservative in his language use) in professional correspondence, while being more expressive and open about his feelings with family and friends.

³⁰Note that this estimation exploits the annual variation in the writing intensity by considering only positive outcomes. Substituting missing values with zeros is not a suitable strategy, as in years when no letter has been written, we miss observations for a number of explanatory variables, including emotional indicators.

	(1) Word count per letter OLS	(2) #letters OLS	(3) personal (family or friend) Probit	(4) professional (business or peer or stranger) Probit
positive emotions	-21.12*** (2.740)	-1.393** (0.580)	-0.0130*** (0.00499)	0.0114** (0.00492)
negative emotions	12.22* (7.200)	-0.381 (2.319)	0.0361*** (0.0138)	-0.0359*** (0.0135)
output	8.048*** (2.530)	0.652** (0.328)	0.0243*** (0.00568)	-0.0146*** (0.00566)
tenure	43.50** (19.01)	-3.250 (2.311)	-0.00453 (0.0374)	-0.0158 (0.0378)
touring	-136.0*** (32.13)	7.170 (5.843)	-0.0265 (0.0615)	0.0169 (0.0601)
marriage (or cohabitation)	-175.1*** (26.78)	5.636* (3.256)	-0.152*** (0.0565)	0.145** (0.0577)
death of relative	452.0*** (63.97)	1.406 (9.106)	-0.0270 (0.135)	0.0225 (0.133)
illness	-80.64 (58.56)	-16.30*** (5.321)	-0.100 (0.116)	0.0669 (0.111)
Observations	1,432	113	1,432	1,432
R-squared	0.354	0.508	0.113	0.0950
Composer FE	✓	✓	✓	✓
Age FE	✓	✓	✓	✓
Addressee FE	✓	✓		

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 10: Length and number of letters and type of addressee
Note: Columns 1 and 2 report OLS coefficients. Columns 3 and 4 report probit marginal effects.

G Timing of the effect

The output variable measures the number of works composed over a year. This appears to be a long enough time window to observe the creation of most works and yet sufficiently short to reliably link the creation of a composition with the emotional state of a composer. This is especially true if one considers that the composers covered have an average productivity of 3.97 works per year suggesting very high annual production rates and rather short production times. With the composition of about four works annually on average, the writing of a single piece lasted typically less than a year; this is also supported with anecdotal evidence found in the biographies.

Nonetheless, a concern might be theatrical productions, such as opera, ballet, or other theater forms. Those typically large and complex pieces may require more time to compose.³¹ In a robustness test this potential bias is examined by excluding all theater works. The emerging results are summarized in columns 1 and 2 of Table 11 and imply consistent coefficients that are estimated now with somewhat greater precision.

	(1)	(2)	(3)	(4)	(5)	(6)
	Output (theater works excluded)		Output over 2 years		Output over 3 years	
	OLS	IV	OLS	IV	OLS	IV
negative emotions	0.0637 (0.0729)	2.668*** (1.033)	0.0865 (0.123)	2.792* (1.505)	0.0702 (0.0932)	2.077* (1.133)
Observations	1,432	1,432	1,432	1,432	1,432	1,432
R-squared	0.178		0.308		0.247	
Composer FE	✓	✓	✓	✓	✓	✓
Age FE	✓	✓	✓	✓	✓	✓
Addressee FE	✓	✓	✓	✓	✓	✓
Background controls	✓	✓	✓	✓	✓	✓

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11: Creativity and negative emotions: The timing of the effect

One may also want to measure output over a period longer than one year in order to explore the eventual presence of any long-lasting effects. Therefore, I conduct a set of estimations where output is measured over a two or three year period. The OLS-correlation coefficients are shown in columns 3 and 5 of Table 11, while columns 4 and 6 show the IV estimations. The IV-coefficient for the output measured over two years is statistically indistinguishable from the baseline coefficient (i.e., column 6 of Table 4), while the precision of estimation decreases (p -value deteriorates from 0.013 to 0.063). The coefficient for output measured over three years decreases in size and also further in significance. There is no statistically significant association found for lagged values of the dependent variable (not reported). These results suggest that the output increase due to negative emotions is rather short-term and does not last longer than a year, and imply further that output does not fall in the following year below average.

³¹Typically, most of the large works were finished within one year. It is further possible that the unhappy composer was able to add the final touch to a piece, which made it outstanding, and is thus recognized in the underlying output database.