



# Mister Sandman, bring me good marks! On the relationship between sleep quality and academic achievement



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## ABSTRACT

There is growing evidence that health factors affect tertiary education success in a causal way. This study assesses the effect of sleep quality on academic achievement at university. To this end, we surveyed 804 students about their sleep quality by means of the Pittsburgh Sleep Quality Index (PSQI) before the start of their first exam period in December 2013 at Ghent University. PSQI scores were merged with course marks in this exam period. Instrumenting PSQI scores by sleep quality during secondary education, we find that increasing total sleep quality with one standard deviation leads to 4.85 percentage point higher course marks. Based on this finding, we suggest that higher education providers might be incentivised to invest part of their resources for social facilities in professional support for students with sleep and other health problems.

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## 1. Introduction

For decades, economists have been studying the determinants of academic attainment. Seminal studies such as Black et al. (2005), Vardardottir (2013) and Leos-Urbel et al. (2013) have identified prior accumulated human capital, the costs and returns of higher education, social background characteristics and gender as key determinants in explaining outcomes in higher education.

Recently, academics have also focused on the role of health factors on academic achievements. For instance Ding et al. (2009), García-Gómez et al. (2013), Fletcher (2014), Sabia (2007), Balsa et al. (2011) and Pieterse (Forthcoming) identify a negative relationship between poor general health, health shocks, ADHD, body weight, alcohol usage and maltreatment respectively on the one hand and academic performance on the other hand. In addition, Bharadwaj et al. (2013) reveal a positive relationship between early health interventions and academic achievement.

A neglected factor in the economic literature on academic achievements is sleep quality. From a theoretical point of view, a

positive relationship between sleep quality and academic performance can be expected. Based on research within medicine and biology, we know that night's rest is essential to helping maintain mood, attention, motivation, memory and cognitive performance. While asleep, the brain integrates new knowledge and forms new associations (see, e.g., AlDabal and BaHammam, 2011; Alvaro, 2014; Beebe, 2011; Buckhalt et al., 2007; Gais and Born, 2004; Louca and Short, 2014; Meijer et al., 2000; Siegel, 2001; Vandekerckhove and Cluydts, 2010; Walker and Stickgold, 2004). From an empirical point of view, former contributions indeed found a positive relation between sleep quality and/or sleep duration and academic performance. Many studies report a positive association between opportune sleep habits and beneficial primary and secondary schooling outcomes such as reading, math and spatial ability test scores and school grades (see, e.g., Bruni et al., 2006; Dewald et al., 2010; Kelly et al., 2013; Meijer, 2008; Perkinson-Gloor, 2013; Short et al., 2013; Stea et al., 2014). In addition, randomised controlled trials have shown that interventions such as teaching behavioural sleep strategies and imposing minimum restrictions on sleep duration result in a positive effect on academic achievement in primary and secondary school (Beebe et al., 2010; Fallone et al., 2005; Quach et al., 2011, 2013; Randazzo et al., 1998; Sadeh et al., 2003). Last, some studies also report positive correlations between sleep quality or sleep duration on the one hand and grade

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point averages and exam passing probabilities on the other hand in tertiary education in China, Ethiopia, Germany and Portugal (Ahrberg et al., 2012; Genzel et al., 2013; Gomes, 2011; Lemma et al., 2014; Wong et al., 2012). In contrast, Eliasson et al. (2010) and Trockel et al. (2000) find no significant results in this respect in the United States (Washington DC and Utah). For a more in-depth review of former studies on the relationship between sleep habits and academic performance, we refer to Curcio et al. (2006), Shochat et al. (2014) and Taras and Potts-Datema (2005).

In this study, we empirically test the relationship between sleep quality, sleep duration and academic achievement. To this end, we survey first-year university students on their sleep habits, by means of the Pittsburgh Sleep Quality Index (Buysse et al., 1989), before the start of their first exam period at university. In addition, these students are surveyed on general social background and health characteristics. The resulting dataset is merged with their academic achievement in terms of course marks in their first exam period. Our research question is then answered by exploring 2SLS estimations on the gathered data. To be able to correctly identify the influence of sleep quality on academic achievement, the respondents' sleep quality is instrumented by their sleep quality during secondary education.

Our contribution to the aforementioned academic literature is threefold. First, we contribute to the recent string of articles – a series characterised, as mentioned before, by mixed findings – on the effect of sleep behaviour on academic performance among university students. Second, we are innovative in studying the effect of both sleep quality and sleep duration on academic performance at university within one empirical framework. Third, as reviewed by Curcio et al. (2006), most non-experimental studies on sleep quality and academic performance present correlation and simple (linear or mediation) regression analyses. Thereby, as we will argue in Section 3, their results cannot be given a causal interpretation. In the present study we explicitly take into account the endogeneity of sleep quality with respect to academic performance by means of the mentioned data gathering and statistical analysis method.

## 2. Data

### 2.1. Data gathering

Our dataset was constructed by merging survey data on first-year university students' sleep quality and further individual characteristics with their first university exam marks.

In December 2013, we conducted a survey on the students present at the start of the last lecture of the first-semester courses of Economics and Introduction to Accountancy at Ghent University in Belgium. These courses are part of the first year Bachelor programs of (Business) Economics – the first-year study program is the same for the Bachelor of Science in Economics and the Bachelor of Science in Business Economics at Ghent University – and Commercial Sciences respectively, but are also taken by some students of other programs. The total number of students enrolled in the course of Economics (Introduction to Accountancy) in 2013 was 685 (638). 394 (410) of them attended the last lecture of the course. The fact that the attendance rate was only about 58% (64%) should not pose a problem of external validity as it is unlikely that the relationship between sleep quality and academic achievement would be different between attenders and non-attenders. These students were asked to fill out a paper-and-pencil questionnaire.

This questionnaire comprised five sections. A first section was dedicated to general questions about the subject's social-economic background characteristics (age, gender, parental education, household composition, nationality, language at parental home,

living place, prior educational attainment, relationship status and general health). These characteristics are used in our analysis to explain both sleep quality (see, e.g. Hale et al., 2013, for recent evidence on the relationship between social background and sleep quality) and academic achievement.

In a second section, we surveyed quality of sleep by means of the validated Pittsburgh Sleep Quality Index (Buysse et al., 1989). This question module measures sleep quality (in broad sense) during the previous month. The PSQI contains 19 self-rated questions yielding seven PSQI submeasures: sleep duration, sleep disturbance, sleep latency, day dysfunction due to sleepiness, sleep efficiency, overall perceived sleep quality and need of medicines to sleep. Each component is scored from 0 to 3. For instance, the PSQI submeasure of sleep duration, the most important submeasure in the context of the present study, is based on question 4 of the Pittsburgh Sleep Quality Index: "During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.)" The answer on this question is then scored as follows: PSQI submeasure of sleep duration score 0 for a sleep duration of at least seven hours; score 1 for a sleep duration of at least six (but lower than seven) hours, score 2 for a sleep duration of at least five (but lower than six) hours and score 3 for a sleep duration lower than five hours.

Summing up all submeasures yields a total PSQI score between 0 and 21, with higher scores indicating lower sleep quality. A total PSQI score greater than 5 is classified as poor quality sleep. The official Dutch translation of the PSQI was requested from Dr. Buysse and a user agreement was signed. The reader will notice that although the 'Quality' in PSQI refers to a qualitative measure of sleep, some components have a rather quantitative point of view. We will come back to this issue in Section 4 when we focus on the particularly explanatory power of the two PSQI submeasures of sleep duration and overall perceived sleep quality.

In a third section of our survey we additionally let the students rate the sleep quality of their parents ("How would you rate your mother's/father's sleep quality?") and their sleep quality during secondary education ("How would you rate your overall sleep quality during secondary education?") on a five-point Likert scale (going from "very good" to "very bad"). In addition, we asked whether or not they suffered from congenital medical problems affecting their sleep quality. These variables are important for our econometric analysis being predictors for sleep quality that cannot be determined by university outcomes.

In a fourth section, the students had to fulfil the validated Depression Anxiety Stress Scales (DASS-21) questionnaire. The Dutch translation of the DASS-21 questionnaire was downloaded from [www.psy.unsw.edu.au/dass/](http://www.psy.unsw.edu.au/dass/). DASS-21 is a set of three self-report scales designed to measure the negative emotional states of depression, anxiety and stress. Each of the three DASS-21 scales contains 7 items that are to be rated on a four-point Likert scale leading to a score between 0 and 21. The higher the score on these scales, the higher the emotional problems. Depression, anxiety and stress are regularly reported to be associated with both sleep quality (see, e.g., Breslau et al., 1996; Eller et al., 2006) and academic achievements (see, e.g., Andrews and Wilding, 2004; Eisenberg et al., 2009). Hence the importance of including them as control variables in our analysis.

In a last section, the students were asked whether they agreed with the fact that their survey answers would be merged with their first-semester exam marks by a third party. This clause was prepared in collaboration with the Chairman of the Board of Examiners of the Faculty of Economics and Business of Ghent University. In total, 382 (352) of the students in the course of Economics (Introduction to Accountancy) gave us the permission to use their survey answers together with their exam marks for our research aims.

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