

The effects of sleep deprivation on economic activity have received surprisingly scant attention. **Joan Costa-i-Font** and **Sarah Flèche** use data on 14,000 families in the UK to investigate the link between mothers' employment outcomes and their quality of sleep, measured by how often they are woken by their children at night.

Economics of a good night's sleep



The number of hours the average person sleeps has been progressively declining over the past few decades, yet we have largely ignored its effects on economic activity and economic performance. This is surprising given what is known about the importance of a good night's sleep for our emotional wellbeing. But sleep is not just a matter of time: sleep quality also has an important influence on our cognitive functions. Sleep deprivation – for example, as a result of frequent interruptions from young children – can have significant effects on an individual's economic performance.

Our research explores the impact of sleep deprivation on people's employment rates, number of hours worked, household income and job satisfaction. We analyse data on a representative sample of children born in and around Bristol in the early 1990s – the Avon Longitudinal Study of Parents and Children, known among respondents and their parents as 'Children of the 90s'.

Sleep is conditioned by a 'social clock' in addition to the 'natural clock' of circadian rhythms. Nowadays, work schedules often encompass accessing computers and smart phones till late at night, which adds to natural changes in temperature, light and noise. But sleep deprivation resulting from differences in child-related sleep patterns is an effect above and beyond parents' ability to keep themselves and their children to a sleep routine. Indeed, growing parental involvement and parental sharing in child-raising duties makes child-related sleep deprivation a significant source of variation in adult sleep.

What economics has found about sleep

Seminal work by Biddle and Hamermesh (1990) develops a model of time allocation that includes sleep. They use a cross-section of US time use survey data and estimate that a one hour increase in paid work reduces sleep by 10 minutes; more generally, they reveal the effect of the opportunity cost of sleep on wages. Hamermesh et al (2008) examine how cues such as TV programmes and sunlight affect sleep.

Other studies focus on the labour market effects of sleep. Kamstra et al (2000) find an influence of sleep on

Sleep deprivation has a strong negative effect on labour market performance

financial market performance. Bonke (2012) explores effects on productivity. Antillón et al (2014) examine the effect of unemployment on sleep and find evidence of sleep patterns being correlated negatively with the business cycle at a macroeconomic level. Ásgeirsdóttir and Ólafsson (2015) find a positive relationship between sleep duration and employment. But none of these studies develop a causal link between sleep quality and employment.

Only one previous study takes account of the fact that work is as likely to influence sleep as sleep is to influence labour market outcomes. Gibson and Shrader (2016) do this by using the short- and long-term sunset time. They estimate the short-term effect of a reduction of one hour's sleep on wages to be 1.5% and the long-term effect to be 5%. Like Biddle and Hamermesh, they analyse US time use data, but make use of variations in sleep resulting from time zones that can be regarded as 'exogenous', and hence their results can be interpreted in more 'causal' terms.

The problem with this study is that the researchers rely on location-level variations, where changes in sleep do not vary across individuals living in the same location, for example, time zones. This means that their estimates should not be interpreted as individual effects, since they potentially

include spillovers across people who live in the same location. The advantage of our approach is that we use individual variations in sleep quality, which are driven by changes in children's sleep duration and the number of times they wake up at night.

Findings from the 'Children of the 90s'

We rely on a representative UK cohort study that follows a sample of 14,000 families from a child's birth to age 25. The dataset contains records of mothers since pregnancy and, crucially for our study, it has the advantage of including a rich set of measures of both parental and child sleep alongside a set of other variables to be employed as controls and employment outcomes.

For example, it contains very precise information about the child's quality of sleep, including whether the child wakes up at night, sleep time and day sleep, as well as child sleeping routines and environmental triggers of sleep quality. We can then relate these measures to objective and subjective measures of parental sleep quality, including average sleep duration, and whether the parents feel that they had enough sleep.

Another advantage of this dataset is that the data provides information on both maternal and paternal employment characteristics, including employment status, number of hours worked, job satisfaction and income for parents on a longitudinal basis.

Our study finds that sleep deprivation has a strong negative effect on labour market performance. Figures 1 and 2 show the association between two employment outcomes – both the probability of mother's employment and her household income – on the number of times the child wakes up at night for a sample of 10,000 children. In both cases, there is a strong negative relationship.

Consistently, our main finding confirms that the relationship between sleep and employment outcomes works through two channels. First, children's sleep quality is a major driver of parental sleep quality; and second, parental sleep quality is strongly correlated with parental employment and working-time decisions.

Our estimates of the effect of parental sleep on economic performance are substantial. We find that improving a mother's average nightly sleep duration by

When their children wake them, parents are less likely to work, work shorter hours and earn less

Figure 1:
The relationship between a mother's probability of being in work and the number of times her child wakes up at night

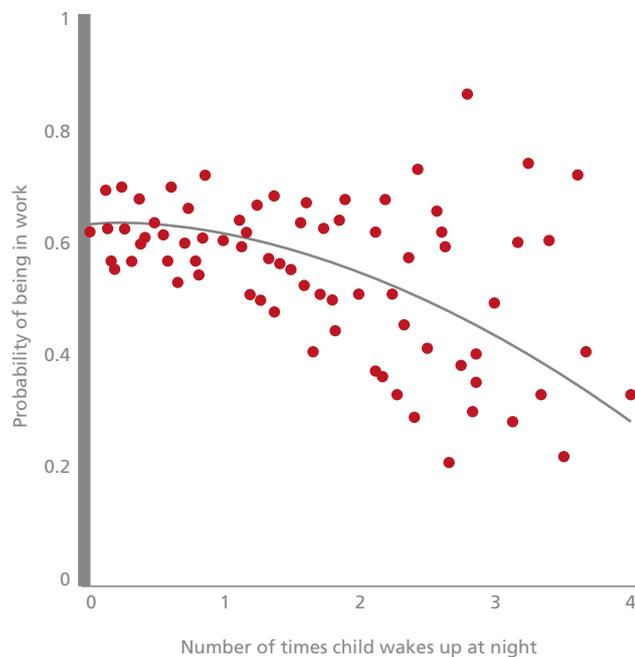
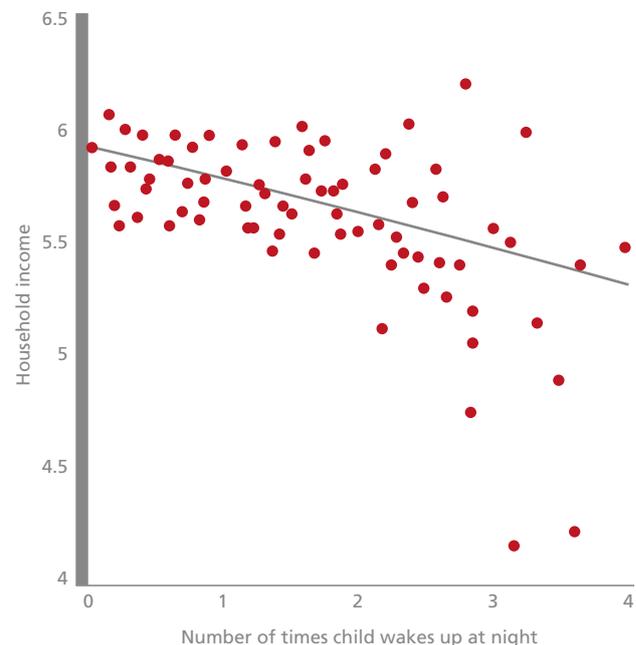


Figure 2:
The relationship between household income and the number of times a child wakes up at night



one hour increases employment by four percentage points, the number of hours worked by 7%, household income by 10-11% and job satisfaction by 0.01 points.

To our knowledge, this is the first study that finds a link between children's sleep quality and their parents' economic performance. The average effects mask substantial heterogeneity: for example, fathers are somewhat less affected by children's sleep problems.

But while low-skilled mothers experience a large decrease in employment and the number of hours worked when facing sleep deprivation, the probability of high-skilled mothers working is not so much affected when children wake up at night. This result might indicate that part of the effect of sleep deprivation can be accommodated by the greater job flexibility available to skilled workers.

The implications of our study include the need to consider sleep in employment policies rather than simply maximising hours of work. In addition, it might be desirable to offer greater flexibility to accommodate changes in children's sleep patterns, as well as some form of compensation for parents of younger children for loss of employment.

This article summarises 'Parental Sleep and Employment: Evidence from a British Cohort Study' by Joan Costa-i-Font and Sarah Flèche. CEP Discussion Paper No 1467 (<http://cep.lse.ac.uk/pubs/download/dp1467.pdf>).

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Further reading

Marina Antillón, Diane Lauderdale and John Mullahy (2014) 'Sleep Behavior and Unemployment Conditions', *Economics and Human Biology* 14: 22-32.

Tinna Laufey Ásgeirsdóttir and Sigurður Páll Ólafsson (2015) 'An Empirical Analysis of the Demand for Sleep: Evidence from the American Time Use Survey', *Economics and Human Biology* 19: 265-74.

Jeff Biddle and Daniel Hamermesh (1990) 'Sleep and the Allocation of Time', *Journal of Political Economy* 98(5): 922-43.

Jens Bonke (2012) 'Do Morning-type People Earn More than Evening-type People? How Chronotypes Influence Income', *Annals of Economics and Statistics* 105-6: 55-72.

Matthew Gibson and Jeffrey Shrader (2016) 'Time Use and Productivity: The Wage Returns to Sleep' (http://acsweb.ucsd.edu/~jgshrade/pdfs/sleep_productivity.pdf).

Daniel Hamermesh, Caitlin Knowles Myers and Mark Poccock (2008) 'Cues for Timing and Coordination: Latitude, Letterman, and Longitude', *Journal of Labour Economics* 26(2): 223-46.

Lisa Kamstra, Mark Kramer and Maurice Levi (2000) 'Losing Sleep at the Market: The Daylight Saving Anomaly', *American Economic Review* 90(4): 1005-11.

Effects of sleep disruption caused by children are particularly strong for low-skilled mothers