

UNIVERSITY OF MINNESOTA

# Sleepless Nights or Sleeping Through It

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The Impact of the “Great Recession” and Being  
Unemployed for US Sleep Patterns

**Rachelle F Hill**

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## **Abstract**

According to the National Bureau of Economic Research (NBER), a recession gripped the global economy from December of 2007 to June of 2009, but for many the “Great Recession” continued through 2010. Given that sleep is increasingly linked to health, in this study I examine the impacts of both the overall economic climate accompanying the Great Recession and actual job loss on 1) time spent sleeping, 2) the odds of reporting sleeplessness, and 3) the odds of reporting a sleep disruption. To address this question, I draw on data from the American Time Use Survey (ATUS) to examine sleep patterns before and during the recessionary years while also investigating the impact of being unemployed and of differences in the state-level unemployment rate. Results indicate that respondents who are unemployed sleep longer and are more likely to report sleeplessness than the employed. Living in areas with higher levels of unemployment is related to lower odds of having a sleepless episode but increases the odds of a sleep disruption. Those interviewed during the recession are more likely to sleep more than 9 hours, report sleeplessness and less likely to report a sleep disruption, compared to respondents who were interviewed before the recession began.

## **Introduction**

The “Great Recession” and its impacts on communities, families, and individuals has become a focal point of popular and academic discussion and many (e.g. Aguiar, Hurst, and Karabarbounis 2011; Condon 2010; Eckholm 2010; Morrill and Pabilonia 2011) are beginning to consider its effects on individuals, including mental and physical health outcomes. Research on prior economic downturns has identified both expected and unexpected relationships between the economic environment, being unemployed and health (Brenner and Mooney 1983; Catalano and Dooley 1983; Fenwick and Tausig 1994; Grandner et al. 2010; Hyypä, Kronholm, and Alanen 1997; Jahoda, Lazarsfeld, and Zeisel 1971; Pearlin et al. 1981; Ruhm 2003, 2005, 2007; Tausig and Fenwick 1999). However, the unique circumstances of this prolonged and particularly severe recession have made it a fruitful object of investigation and many questions remain. Moreover, new types of data, such as the American Time Use Survey (Abraham et al. 2011), have become widely available, expanding the opportunities to explore the temporal effects of the Great Recession. Given that, adequate sleep (sleeping between 7 and 9 hours) is increasingly being shown as key to health (e.g. Alvarez and Ayas 2004; Bonnet and Arand 2003; Gallicchio and Kalesan 2009; Taylor, Lichstein, and Durrence 2003). Investigating possible effects of recessions and in particular the unemployment it spawned on sleep duration and sleep quality would contribute to our understanding of its broader implications. In light of this, I examine whether sleep patterns are associated with the recessionary time period, the unemployment rate, and/or actually being unemployed. Looking at a representative sample of the U.S. population between 23 and 55 years old, I find that those who are unemployed or out of the labor force tend to sleep longer and are more likely to report sleeplessness. Similarly, respondents surveyed in the years after the onset of the recession (2008-2010) are more likely to sleep more than 9 hours on the

diary day and to report sleeplessness. Individuals living in areas with high unemployment are more likely to experience a sleep disruption. However, poor economic conditions are not always associated with worse sleep outcomes. Living in areas of high unemployment is also associated with lower odds of reporting sleeplessness and respondents who were interviewed during the recession have lower odds of reporting a sleep disruption.

## **Background**

The consequences of sleep have drawn a great deal of attention in recent years, as scholars have investigated the role of sleep for individuals' health outcomes, finding that sleep deprivation, sleeping longer hours, and poor sleep quality are all important predictors of poor health more generally. Sleep deprivation has been shown to be related to (both future and current) obesity (Gangwisch et al. 2005; Patel 2009; Patel and Hu 2008; Patel et al. 2006), diabetes for men (Mallon, J.-E. Broman, and J. Hetta 2005), coronary heart disease for women (Ayas et al. 2003), hypertension for men (Gangwisch et al. 2006), and mortality for men (Kojima et al. 2000), women (Patel et al. 2004) and for both men and women (Heslop et al. 2002; Youngstedt and Kripke 2004; Kripke et al. 1979, 2002). Longer sleep durations (e.g. greater than 8 hours) have been shown to be related to coronary heart disease for women (Ayas et al. 2003) and men (Burazeri, Gofin, and Kark 2003), increased risk of strokes for men (Qureshi et al. 1997), and increased mortality for men (Kojima et al. 2000; Kripke et al. 1979), women (Patel et al. 2004) and for both men and women (Gale and Martyn 1998; Youngstedt and Kripke 2004; Kripke et al. 2002; Tamakoshi and Ohno 2004). Insomnia has been found to be related to heart disease for men (Mallon, J. E. Broman, and J. E. Hetta 2002) and mortality more generally (Pollak et al. 1990) while difficulty maintaining sleep have been found to be related to diabetes for men (Mallon et al. 2005). Sleep problems have also been linked to mental health. Shorter

sleep durations have been linked to depression (Chang et al. 1997; Kaneita et al. 2006) as have longer sleep durations (Kaneita et al. 2006), insomnia (Chang et al. 1997; Bixler et al. 1979; Ford and Kamerow 1989; Breslau et al. 1996; Livingston, Blizard, and Mann 1993) and sleep disruptions (Chang et al. 1997). However, such indicators of sleep quality are not randomly distributed across the U.S. population. Rather, patterns of sleep are related to many social factors, such as gender (e.g. Maume, Sebastian, and Bardo 2010), age and parental status (e.g. Krueger and Friedman 2009), spouse's employment status (e.g. Hale 2005), and education (e.g. Kronholm et al. 2006). Yet, it is unclear how sleep is related to the economic climate.

Generally, being unemployed and recessions have attracted a great deal of attention because of their potential long-reaching effects for individuals, families, and communities (e.g. Brenner and Mooney 1983; Elder 1974; Fagin and Little 1984; Ruhm 2000; Xu and Kaestner 2010) but there is little evidence related to sleep outcomes. Scholars have raised questions about the importance of being unemployed and recessions for mental and physical health since the Great Depression but have arrived at divergent results. Research has shown that both being unemployed and recessions more generally are related to negative impacts on mental health outcomes (e.g. Brenner and Mooney 1983; Pearlin et al. 1981; Ruhm 2003) while being positively related to morbidity and mortality (e.g. Ruhm 2003, 2007; Xu and Kaestner 2010). Yet, few studies have investigated the importance of recessions and unemployment for patterns of sleep (Hale 2005; Kronholm et al. 2006; Krueger and Friedman 2009; Aguiar et al. 2011; Hurd and Rohwedder 2010; Hyypä et al. 1997; Grandner et al. 2010) – a health behavior that has been linked to both mental and health outcomes as described above – and none investigate the effects of multiple aspects of the economic climate for sleep.

I extend the prior literature by examining the following research questions. First, what is the relationship between living in states with high unemployment rates and patterns of sleeping, including time spent sleeping, sleeplessness, and sleep disruptions? Second, what effect does recessionary time period (i.e. being asked about sleep patterns during the years of the Great Recession as opposed to prior years) have on patterns of sleeping? Third, how does being unemployed (both recent and longer term) relate to patterns of sleeping? Lastly, what are the combined effects of living in states with high unemployment, being interviewed in a recessionary time period, and actually being unemployed for these measures of sleep?

This study builds on and extends prior research in three important ways. First, these analyses examine the effect of the *current economic climate* (the Great Recession) on sleeping patterns in the United States population. Though scholars (e.g. Aguiar et al. 2011; Hurd and Rohwedder 2010; Morrill and Pabilonia 2011) have begun to unpack the immediate and potential long-term effects of the Great Recession for the economic, social and physical well-being of the population, health behaviors such as sleep have not been investigated. This study will extend our knowledge of the potential health impacts, specifically for sleep, from this historic period. Second, I investigate the effects of three separate but intricately linked measures of the economic climate including being unemployed, recessionary time period, and the state-level unemployment rate. The majority of studies examining the effects of being unemployed and recessions use a single measure of economic strain as their independent variable. However, being unemployed and experiencing a recession are often experienced in tandem (Wheaton 1978). I theorize that being unemployed is likely to be experienced differently in areas of high unemployment than in areas of low unemployment. Similarly, living in an area with fairly recent high unemployment is likely to feel very different than in an area experiencing chronically high unemployment over a

period of years. Third, I draw on recent, underutilized, nationally representative time diary data from the American Time Use Survey (Abraham et al. 2011). This data offers a unique glimpse into the daily time use patterns of the United States population, including time spent sleeping.

### *Sleep, Unemployment and Recessions*

There are three studies that examine how recessions influence patterns of sleep (Aguiar et al. 2011; Hurd and Rohwedder 2010; Hyypä et al. 1997) but each have limitations that make drawing conclusions about the effects of the Great Recession on sleep difficult. The most recent study by Aguiar and colleagues (2011) is a working paper that uses data from the American Time Use Study to examine the reallocation of forgone work hours due to the Great Recession. The authors found that some of the ‘free’ hours resulting from changing work expectations were reallocated to sleep. Though this study helps us understand broader sleep patterns, it does not clarify how individual time use patterns are related to the wider economic climate because it examines how time is allocated at the *state-level*. More proximate causes like being unemployed are not examined or considered in tandem to the effects of the wider economic climate. Moreover, it is unclear if the recession is related to changes in sleep quality or if this increase in time spent sleeping is found at all levels of sleep time (e.g. does time increase from 6 to 8 hours or from 8 to 10 hours) which may have different implications for future health outcomes.

Another working paper by Hurd and Rohwedder (2010) using data from the American Life Panel surveys arrived at similar results. The authors found a reduction in trouble sleeping from November 2008 to April 2010 as well as a decrease in the percentage reporting trouble sleeping for respondents who became unemployed (and an increase for respondents who were unemployed that become employed). Despite the unique quality of this data (i.e. monthly longitudinal data spanning the recession) this study is unable to examine the prevalence of

trouble sleeping before the recession began. As such, it is not clear how patterns of sleep are different during the recession or if the improvement in sleep problems for the unemployed is simply a reflection of the unique time period coupled with being unemployed. Also, the results shown are descriptive aggregate level changes rather than individual changes controlling for other factors. Therefore, it is unclear how demographic characteristics or other important predictors of sleep are related to sleep quality.

Hyypa and colleagues (1997) examine the effects of the 1990's recession on sleep using a Finnish population-level and longitudinal dataset. Comparing sleep quality (e.g. insomnia, excessive sleep, and satisfaction with sleep) before the recession with sleep quality after the recession, the authors found that the recession itself did not influence sleep quality for the broader sample. However, the authors did find that those respondents who became unemployed between waves were more likely to report insomnia as well as increased fatigue and use of hypnotics across time when compared to the employed. However, this study is limited because of its focus on Finland and timing before and after the recession. Though this is an important study for understanding the effects of recessions for sleep outcomes, it is unclear if different patterns would result in the United States due to national and cultural differences. Also, the data is collected before and after the recessionary time period. As such, it is unclear how sleep differed during the recession itself. Changes in sleep during the recession (in particular during sustained periods of economic downturns) may result in longer-term health concerns even if sleep patterns return to normal following the conclusion of the recession. Finally, Hyypa and colleagues (1997) draw on self-report survey questionnaires focused on health and the economic climate. Time diary data may provide more reliable information regarding time allocation because



individuals are not required to make broad generalizations about their sleep patterns but instead are asked to report on their activities for the prior day.

In addition to the above work that examines the effects of recessions for sleep and sleep quality, some studies have examined how work hours or job characteristics influence patterns of sleep (Grandner et al. 2010; Hale 2005; Kronholm et al. 2006; Krueger and Friedman 2009; Sekine et al. 2006). Population level examinations of sleep have found that working long hours are related to increased odds of sleeping fewer hours and an decreased odds of sleeping more hours (Hale 2005; Kronholm et al. 2006; Krueger and Friedman 2009) while not working is related to increased odds of sleeping more than 9 hours as well as sleeping less than 5 hours (Krueger and Friedman 2009). In addition, being employed was related to fewer sleep complaints (such as trouble falling asleep, staying asleep and sleeping too much) while being unemployed was related to more complaints in the 2006 Behavioral Risk Factor Surveillance System (Grandner et al. 2010). Work characteristics have been found to influence sleeping as well. In a Japanese study of local government employees, psychosocial stress at work, short or long work hours, and shift work were each related to poor sleep quality (Sekine et al. 2006).

#### *Mental and Physical Health Effects of Recessions and Unemployment*

The evidence on the mental and physical health effects of being unemployed and economic downturns is largely mixed and counterintuitive. Many scholars have argued and shown that being unemployed and periods of economic decline result in mental and physical health declines broadly, arguing that reduced resources and increased economic uncertainty increases stress which results in health declines (Brenner and Mooney 1983; Fagin and Little 1984; Fenwick and Tausig 1994; Jahoda et al. 1971; Kessler, Turner, and House 1989; Pearlin et al. 1981; Ruhm 2003; Tausig and Fenwick 1999). Yet, others have found the reverse, arguing

that healthy behaviors are time intensive and that with reduced work hours (either through being unemployed or declining demand by employers) comes an increased supply of time to spend on healthy behaviors (Ruhm 2003, 2005, 2007; Xu and Kaestner 2010).

A potential explanation for these divergent conclusions may be the multiple measures used to capture the single construct of economic strain. Often framed in similar ways (e.g. the effects of recessions and economic change), much of this research draws on different measures of economic strain including being unemployed, the unemployment rate, and a recessionary time period. This prior body of work assumes a singular effect of economic downturns whether it is brought on by a unique time period, the surrounding community, or individual resources. This is problematic because different measures of the economic climate may have different effects and may interact with one another to influence their effects on health outcomes. As such, the different effects of the recession may in fact reflect their varied measurement and their intersecting nature rather than qualitatively different outcomes.

#### *Negative Effects of Being Unemployed and Recessionary Time Periods*

During the 30's and 40's in the United States and Europe, the economic environment was understood to be an important predictor of mental health. In one of the first comprehensive studies of community wide economic decline, Jahoda and colleagues (1971) examined the impact of job loss (by the male breadwinner) on the family in the small Austrian community of Marienthal in 1931. The authors identified widespread psychological problems. Though the entire community was experiencing severe financial strains, community members with fewer financial resources were the most likely to be described as having a "broken" outlook and motivation. Coupled with the wider depressed economic climate of the community, being unemployed was found to be an important predictor of mental health. One component of their

study was a self-reported time diary that asked participants to list the activities of each hour of the day while they were awake (Jahoda et al. 1971). They found that unemployed men were particularly impacted by the absence of the structure of time that work provided as they lost the form of their workdays and their sense of purpose. Those individuals able to establish structure in their time (as measured through activities in their time diaries) rather than be overwhelmed by the expanse of free time experienced fewer negative outcomes. This was evident in the participants' ambivalence towards the large periods of unspoken for time that they regularly confronted.

Research utilizing data collected during the 1970's supported these earlier findings. Tausig and Fenwick (1999) found an increase in distress and dissatisfaction following the 1974-75 recession that they attributed to changing job characteristics (i.e. job restructuring). They point out that this relationship is one way in which employees are influenced by recessions in addition to becoming unemployed (see also Fenwick and Tausig 1994). Respondents who were unemployed between waves also reported increased distress. Similarly, Pearlin and colleagues (1981) examine job transitions (e.g. layoffs) in an effort to develop the theory of the stress process. In data collected in the 1970's the authors find a pathway between negative job transitions (including becoming unemployed) and depression. In the mid 1980's, Kessler and colleagues (1989) investigated this theoretical claim further by examining the change in distress for those transitioning to employment after being unemployed. The authors find that being unemployed is related to increased levels of distress compared to the employed, but that distress returns to levels similar to the employed after finding new employment.

In light of these findings, I hypothesize the following (all hypotheses are shown in Table 1):

*H1:* Being interviewed during the recessionary time period (i.e. 2008-2010) will be related to sleeping more than the recommended 7 to 9 hours, more sleeplessness, and more sleep disruptions.

*H2:* Being unemployed will be related to sleeping more than the recommended 7 to 9 hours, more experiences of sleeplessness, and more sleep disruptions.

### *Positive Effects of the High Unemployment Rates*

In contrast to these negative relationships, other scholars have found that unemployment rates have a positive effect for physical health or, conversely, improvements in the economy as captured by unemployment rate estimates are related to declines in physical health (Ruhm 2003, 2007). Ruhm (2003, 2007) examines several data sources from the 1970's onwards and argues that with reductions in the unemployment rate there are declines in physical health. Using data from 1972 to 1981, Ruhm (2003) finds that various aspects of physical health such as cancer or arthritis increase in frequency in the U.S. population when the state level employment rates decline. This finding was most consistent for groups that were assumed to be most strongly tied to the labor market such as employed individuals under the age of 65 or men. These findings were supported in subsequent analysis that examines the relationship between state level unemployment and heart disease in data from 1979 to 1998 (Ruhm 2007).

In addition to an association between physical health conditions and periods of low unemployment, there is also evidence that health behaviors vary by the broader economic climate with healthful behaviors being more prevalent during times of higher rates of unemployment. Ruhm (2005) found that respondents living in areas with higher state level unemployment rates were more likely to participate in healthy behaviors. Drawing on data from 1987 to 2000, he found that respondents from states and time periods with higher levels of unemployment reported smoking less (reductions primarily by heavy smokers), lower BMI, and

more episodes of exercise (primarily reductions in complete inactivity). Similarly, Xu and Kaestner (2010) find that periods of economic growth as measured by community levels of work hours and wages are associated with more smoking, less physical activity, and fewer visits to physicians. Moreover, community-level estimates of work hours and wages are related to increased consumption of cigarettes and reduced likelihood of exercise.

In light of these findings, I hypothesize the following:

*H3: Higher rates of state-level unemployment will be related to adequate sleep, less sleeplessness, and fewer sleep disruptions.*

However, not all results are as clear in their implications. During the most recent economic crisis, data has shown that the high levels of economic strain experienced by families have resulted in mixed changes in mental health outcomes. Drawing on the American Life Panel fielded by RAND Labor and Population, scholars show that more than a third of households have experienced financial strain between November 2008 and April 2010 (39% reported experiencing unemployment, negative equity on their house, or having been behind in their house payments) (Hurd and Rohwedder 2010). During the Great Recession, the authors find increasing trends in happiness across the full sample. In contrast to the findings described above, respondents who became unemployed reported declines in life dissatisfaction and depression compared to when they were employed. However, this data was collected after the recession began and it is unclear how happiness, life satisfaction, and depression changed with the declining economic climate. It is possible that happiness improved following an initial decline that occurred around the time the recession began rather than improving because the recession made people happier. Similarly, the unemployed may evaluate their position differently during the recession than before. However, this data does not allow such comparisons. In addition, the results are drawn from descriptive comparisons rather than multivariate methods and as such it is

difficult to determine how the sample composition (e.g. gender, age, parental status, etc.) may influence the results as well as how being unemployed, the recessionary time period, and the unemployment rate may intersect.

The contradictory effects of the recessionary time period, unemployment rate, and being unemployed demonstrate the importance of considering the intersecting nature of each. Few studies have considered the effects of being unemployed in a time and place with high unemployment and how that may be experienced differently than being unemployed in a time and place with low unemployment. Many studies have examined the effects of high unemployment rates (e.g. Ruhm 2005, 2007), being unemployed (e.g. Fagin and Little 1984; Pearlin et al. 1981), and even the experience of being unemployed in a time or place with high unemployment (e.g. Elder 1974; Jahoda et al. 1971). However, the effects of being unemployed during broader economic downturns in comparison to periods of economic growth is unclear. One may expect that being unemployed during a period of economic growth or in areas with low unemployment rates have negative consequences as the unemployed compare themselves with other employed family, friends, and neighbors and place blame on themselves for their individual position. In contrast, being unemployed during a period of economic contraction and in areas with high unemployment rates may have neutral consequences. Instead of comparing themselves to individuals who appear successful in the job market, the unemployed may readily find other unemployed comparisons. Moreover, media attention on low job growth and high unemployment rates may reinforce a sense that their individual employment status is a reflection of the broader economic climate rather than their own personal failings. Similarly, living in areas with high unemployment during an economic recession may magnify individuals' negative assessments of the broader economic climate. As such, I expect the following:

*H4:* Living in an environment of high unemployment or during an economic recession moderates the negative effects of actually being unemployed on sleep outcomes. Specifically, being unemployed in conjunction with higher unemployment rates and/or during the recessionary time period (i.e. 2008-2010) will not be related to sleeping more or less than the recommended amount and will be related to lower odds of sleeplessness and lower odds of sleep disruptions compared to the employed living in areas with lower unemployment rates and/or being interviewed before the recession (i.e. 2003-2007).

*H5:* Higher unemployment rates in conjunction with being interviewed during the recessionary time period (i.e. 2008-2010) will operate as a magnifier of sleep outcomes. Specifically, respondents living in areas with high unemployment during the recession will be related to sleeping more or less than the recommended amount, greater odds of sleeplessness, and greater odds of sleep disruptions compared to the living in areas with lower unemployment rates and being interviewed before the recession (i.e. 2003-2007).

Based on the limitations of prior research and the potential importance of the largest recession following the Great Depression, I utilize a unique dataset to examine the multiple relationships between sleep and the economic climate. Specifically, I use the pooled cross-sectional samples from the ATUS from 2003 to 2010 to examine the differences in the amount of time spent sleeping, the odds of a sleep disruption, and the odds of sleeplessness by being unemployed, the recessionary time period, and state-level unemployment rates. This study seeks to examine the effects of being unemployed, living in recessionary times (2008 through 2010), the unemployment rate, and their combined effects on time spent sleeping and sleep quality on an average day.

## **Data & Methods**

### *Data*

The following analyses draw on data from the American Time Use Survey (ATUS) produced by the U.S. Census Bureau and made available by the Minnesota Population Center (Abraham et al. 2011). The ATUS has been fielded continually since 2003 and is a nationally representative sample of diary days for the noninstitutionalized US population. I use data spanning the Great Recession (2003 to 2010) to examine patterns of sleep. The analytic sample is

limited to respondents most impacted by employment and the recession – working-aged respondents between 23 and 55 whose diary days are Monday through Friday<sup>1</sup>.

The ATUS uses time diary methods to collect data for respondents regarding their daily activities from 4:00 AM the morning prior to the survey day until 3:59 AM of the survey day. Respondents are asked what activity they engaged in, how much time they spent doing this activity (down to the minute), who they were with, if they provided secondary childcare during this activity, and their mode of transport if traveling between locations. Diary days span the four seasons, days of the week, and holidays. These data are extremely rich and capture participation, duration, and sequence of activities. Time use researchers have established the reliability of the data and have found it to be more accurate than stylized survey questions<sup>2</sup> when attempting to measure time use (Juster and Stafford 1985; Juster, Ono, and Stafford 2003; Robinson 1997). It is also less expensive than experiential sampling methodology, while being no less accurate for most activities.

ATUS respondents are randomly selected from all adults over the age of 15 from recently participating households of the Current Population Survey (CPS). Respondents are eligible for participation in the ATUS two to five months following their last month in the CPS (U.S. Bureau of Labor Statistics 2009). The CPS targets the civilian, non-institutionalized population in the United States and households are selected for participation using the Census Bureau's listing operation (U.S. Census Bureau 2006). The CPS sample is a stratified multi-stage cluster sample. The ATUS sampling strategy maintains these characteristics but eliminates the oversampling

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<sup>1</sup> Weekends are excluded in the following analyses due to the unique time use patterns present on weekend days when compared to weekday diaries. Results from models including only weekdays, only weekends, and all diary days were compared and qualitative differences in the findings made it clear that combining the analyses would mask important differences in sleep patterns across the two types of days. Instead, I focus on weekday diaries in order to understand the changing effects of work for the majority of the population that primarily work Monday through Friday.

<sup>2</sup> Survey questions that ask respondents the total time spent engaged in an activity during a set time period.



within smaller states and makes residents across states equally likely to be selected (U.S. Bureau of Labor Statistics 2009). CPS is a longitudinal design where households are included in the sample for four months, are excluded from the sample for eight months, and complete another four months in the CPS before they are eligible to participate in the ATUS. Due in part to the prior time commitment to participate in the CPS, the ATUS response rate is lower than other nationally representative surveys<sup>3</sup> (U.S. Bureau of Labor Statistics 2009). Sample weights assure the final sample is nationally representative after accounting for oversampling of minority groups, households with children, and the number of adults per household; differing response rates by demographic group; and the oversampling of weekend days in comparison to weekdays. Because the survey is completed over the phone, the population lacks effective coverage of respondents without phones or with intermittent service in the sampling frame (Davern et al. 2004).

### *Variables*

#### *Measuring Sleep*

The five dependent variables in the analyses are total time spent sleeping, reporting a disruption between sleep episodes, reporting sleeplessness, and the amount of time spent in sleeplessness. The total time spent sleeping is summed to a single measure of sleep time across the diary day beginning *after* the first episode of the day and ending after the last episode is complete including mid-day sleep episodes or naps. Because the diary day starts at 4:00 AM, many respondents report a partial sleep episode as their first activity episode (i.e. truncated by the 4:00 AM diary start time). In light of this, I exclude the first sleep episode if it is the first activity of the diary day. In contrast, the full duration of the last sleep episode of the diary day is

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<sup>3</sup> The response rate ranged between 52.5% in 2007 to 57.8% in 2003 (U.S. Bureau of Labor Statistics 2009).

included regardless of whether or not it is complete by 3:59 AM (i.e. it is not truncated at 3:59 AM). As such, I am able to measure a complete sleep cycle over a 24-hour period even though the diary day begins and ends in the middle of many respondents' sleep episodes. Once the total time spent sleeping is calculated, time spent sleeping is divided into three categories based on the recommended amount of sleep (7 to 9 hours each day) as suggested by the National Sleep Foundation and the Centers for Disease Control and Prevention. Respondents are coded as either sleeping less than, more than, or the recommended 7 to 9 hours each day.

Sleep disruptions are identified based on the sleep episodes described above in the total sleep measure (again excluding the first episode of the diary day if it is sleep). Each transition from sleep to another activity and (eventually) back to sleep during the night hours (between 10pm and 6:00am) is counted as a sleep disruption. Daytime sleep disruptions are included for those respondents who report working during night hours (between 10:00pm and 6:00am). A disruption can capture insomnia (waking for some period during which a respondent intends to be sleeping) as well as sleep disruptions that are caused by others such as caring for a child. Despite the potential qualitative differences in sleep disruptions (Maume et al. 2010), the end result is similar – a broken sleep pattern. Respondents who experienced a sleep disruption were coded as 1 while those who did not were coded as 0 and a total count of all sleep disruptions is the sum of all eligible sleep disruptions on the diary day.

Sleeplessness is a separate time use category that captures difficulty sleeping. The coding lexicon from the ATUS provides examples such as “counting sheep,” “insomnia,” “lying awake,” and “tossing and turning” in their description of sleeplessness (U.S. Bureau of Labor Statistics 2011). Respondents who report an episode (or more) of sleeplessness are coded as 1 for

sleeplessness and all others are coded as 0. The duration of all sleeplessness episodes are summed across the diary day to get the total time spent in sleeplessness.

### *Measures of the Economic Climate*

Though much of the prior scholarly work has focused primarily on either a particular time period or the state or local unemployment rate, these approaches seem limited in the more complex economic environment of the Great Recession. Figure 1 illustrates the diversity of unemployment rate estimates across time and space. The x-axis represents time during which time diary data from the ATUS is available while the y-axis represents the unemployment rate as estimated by the U.S. Bureau of Labor Statistics. The first vertical line marks the beginning of the recession as determined by the National Bureau of Economic Research (National Bureau of Economic Research 2010) while the second vertical line marks its conclusion. As you can see the unemployment rate by state increased during the recession and continued to stay high following its conclusion. Moreover, the variation across states within each particular month appears to increase during the recession as compared to the years before the recession. Lastly, the duration of this recession is notably longer than recent recessions leading to comparisons between the current economic environment and the Great Depression. In light of these unique characteristics, it is more fitting to examine the effect of both the recessionary time period and the state-level unemployment for time spent sleeping.

The state-level unemployment rate is used to capture the local economic climate for the smallest geographic identifier available in the ATUS (i.e. states). The measure is constructed by merging the monthly state-level unemployment rates from the U.S. Bureau of Labor Statistics to the ATUS dataset. In order to capture both the recent conditions and the immediate projections that would concurrently influence time use choices, I construct a three-month rolling average of

the state-level unemployment rate for each respondent that includes the month prior, during, and following the date of ATUS participation.

The recessionary time period captures both the broader economic climate of insecurity characterizing the Great Recession and the duration of exposure. The effect of the time period is captured by comparing respondents in the ATUS prior to the economic downturn (2003 to 2007) to respondents in the ATUS reporting in 2008, 2009, or 2010. The recessionary years (2008-2010) are separated to identify how the initial experience of the recession may vary from prolonged exposure (e.g. 2008 versus 2010) as well as the varying levels of severity experienced during that time period. The time period prior to the recession (2003 to 2007) is the comparison group.

Job loss is captured from the longitudinal nature of the CPS and ATUS datasets. The CPS is the sampling frame for potential ATUS respondents and as such, respondents' households have participated in eight waves of the CPS approximately two to five months before being invited to participate in the ATUS. Participants of the CPS are asked about their current employment status throughout their participation in the survey as well as the rest of the individuals in their household. Upon entry into the ATUS, respondents are asked if their employment situation has changed since their prior CPS participation. These data allow me examine differences across respondents who are unemployed (both recently and longer-term), employed, and out of the labor force. Detailed employment status is captured by three dichotomous variables including recent job loss (1=employed at CPS and unemployed at ATUS), being unemployed longer-term (1=unemployed at CPS and ATUS), not in the labor force (1=out of the labor force at ATUS). Respondents who are employed at the time of the ATUS are the comparison group.

### *Measures of Socio-demographic Context*

Socio-demographic characteristics are important predictors of sleep outcomes as well. Socio-demographic measures included in this analysis are gender, life stage, spouse/partner's employment status, and education. Gender is measured as a dichotomous variable where 1 = women and 0 = men. Life stage captures both age and parental status. Respondents are categorized into three groups including those who are 45 or younger without children, parents of children under the age of 18, and respondents older than 45 without children in the home. Spouse/partner's employment status captures both the presence of a spouse or partner in the household and their participation in the labor force. Respondents are grouped into four categories including respondents without a spouse or partner in the home, respondents whose spouse/partner is employed full-time, respondents whose spouse/partner is employed part-time, and respondents whose spouse/partner is not working (reference group). Education is divided into three groups including respondents with a high school degree or less, respondents with some college or an associate's degree, and respondents with a college degree or more.

### *Analytic Strategy*

In order to investigate the variation in sleep patterns, I begin by examining the bivariate differences in sleep outcomes by respondent's employment status, recessionary time period, and state-level unemployment rate. Next I use multivariate methods to examine associations across detailed employment status, the recessionary time period, state-level unemployment rate, and socio-demographic characteristics with sleep patterns. Each of the multivariate models is first estimated with only the economic climate variables – a standard measure of employment status (employed, unemployed, and out of the labor force), time period, and unemployment rate. Next, I investigate the effects of the timing of becoming unemployed by replacing the standard measure

of employment status with the more detailed measure that includes the recent versus long-term unemployed as well as being out of the labor force. Next, I include socio-demographic characteristics (i.e. gender, life stage, spouse/partner's employment status, and education) with other controls in the model. Controls in the model that are not shown in the tables or the discussion are race, immigrant status, metropolitan status, region, season, and holiday. Lastly, interactions between being unemployed, recessionary time period, and state-level unemployment rate are tested in each model. I begin by first testing each of the two-way interactions (which includes the main and interaction effects) and then testing each of the three-way interactions (which includes the main effects, two-way interaction effects, and three-way interaction effects). Only significant interactions are described in the results. Time spent sleeping is analyzed using multinomial logistic regression to compare those who sleep less than 7 hours or more than 9 hours with those who sleep the recommended 7 to 9 hours on the diary day. Logistic regression is used to analyze the odds of experiencing sleep disruptions and sleeplessness. Because time in sleeplessness and the number of sleep disruptions are not normally distributed, the values are logged prior to model estimation. Once logged, time in sleeplessness and number of sleep disruptions are estimated using ordinary least squares regression.

## **Results**

Table 2 includes descriptive statistics for the analytic sample, including time spent sleeping, sleep disruptions, and sleeplessness. In the ATUS sample, the majority of the respondents spend between 7 and 9 hours sleeping each diary day (47.5%). Approximately a quarter of the sample spends less than 7 hours sleeping (25.8%) and approximately a quarter of the sample spends more than 9 hours sleeping on the diary day (26.8%). Despite the prominence that sleeplessness and difficulty sleeping plays in the American popular media, sleeplessness is

only reported on 4.3% of the diary days. However, the average number of minutes experiencing sleeplessness is substantial – 72 minutes – for those who do report difficulty sleeping. Similarly, few respondents report disrupted sleep patterns. Only 2.3% of working-aged respondents report multiple episodes of sleep during the evening hours.<sup>4</sup> Moreover, those respondents that do experience broken sleep rarely report more than one disruption while sleeping with the average number of sleep disruptions per night being 1.18 for those who report a sleep disruption.

Prior research has shown that particular characteristics like age, gender, and parental status are linked with certain sleep patterns (e.g. Kronholm et al. 2006; Krueger and Friedman 2009; Maume et al. 2010). For example, parents, and mothers in particular, experience more sleep disruptions while older individuals experience more sleeplessness. Figures 2 through 9 examine the distribution of sleep patterns by gender, parental status, and age. Figure 2 shows the time spent sleeping by the age of the respondent. Here we see that across age groups sleeping less than 7 hours increases from the youngest age group to the oldest while sleeping more than 9 hours decreases (statistically significant at  $p < .001$ ). There is also a statistically significant difference across the age groups for sleeplessness (shown in Figures 3 and 4). Respondents between 46 and 55 were more likely to report experiencing sleeplessness ( $p < .01$ ) and to spend more time in sleeplessness ( $p < .05$ ) than younger respondents<sup>5</sup>.

Differences in the amount of time spent sleeping across gender and parental status are shown in Figure 6. Here we see that fathers are more likely to report sleeping less than 7 hours than are mothers and those without children and mothers are less likely to report sleeping less than 7 hours than those without children ( $p < .05$ ). At the other end of the spectrum, mothers are more likely to sleep more than 9 hours than are both groups of men (women without children are

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<sup>4</sup> Or during day time sleep hours if the respondent reports working during the night hours.

<sup>5</sup> No significant differences were found for the proportion of respondents reporting a sleep disruption and the sum total.

more likely than fathers) whereas fathers are least likely to report sleeping more than 9 hours ( $p < .05$ ). Figure 7 shows the differences in both the proportion of respondents reporting sleep disruptions and sleeplessness. As expected, women, in particular mothers, are more likely to report a sleep disruption ( $p < .01$ ) and women are more likely to report sleeplessness than are fathers ( $p < .01$ ). Women without children spend more time in sleeplessness than fathers but no other differences are statistically significant (Figure 8). There are no statistically significant differences across the number of sleep disruptions by gender and parental status.

### *Bivariate Results*

Differences in the distributions of sleep patterns across the years before and during the Great Recession are shown in Table 3. Significantly more respondents slept less than 7 hours before the recession when compared to 2010. Fewer respondents slept the recommended number of hours (7-9 hours) in 2009 than when compared to before the recession or 2008. Sleeping more than 9 hours was significantly different early (2003-2007 and 2008) compared to later in time (2009 and 2010). A smaller percentage of respondents reporting prior to the recession (26%) and in 2008 (25.7%) slept more than 9 hours in comparison to 2009 (29.8%) and 2010 (28.4%). Sleeplessness was significantly different across the years before and during the recession. The percentage of working-aged respondents reporting sleeplessness was greater in 2008 (5%) and 2009 (5.6%) than before the recession (3.9%). Moreover, the percentage of respondents reporting sleeplessness was significantly lower in 2010 (4.4%) than in 2009 (5.6%). However, those respondents that did report sleeplessness before the recession, spent more time in sleeplessness on average than did respondents in 2010 (74 minutes versus 67 minutes). Sleep disruptions were also distributed differently across time periods. The percentage of working-aged respondents who reported a sleep disruption before the recession (2.7%) was statistically significantly greater



than the percentage reporting them in 2008 (1.8%), 2009 (1.4%) or 2010 (1.6%). The number of sleep disruptions was not significantly different across the time period. Taken together, the recessionary years, in particular 2009, are consistently different than the years prior.

Differences in the distributions of sleep patterns across state-level unemployment rates are shown in Table 4. In order to assess these differences, I constructed three groups of respondents based on the unemployment rate: (1) respondents whose state-level unemployment rate is more than one standard deviation below the average unemployment rate are referred to as living in low unemployment areas, (2) respondents whose state-level unemployment rate is within one standard deviation of the average unemployment rate are referred to as living in average unemployment areas, and (3) respondents whose state-level unemployment rate is more than one standard deviation above the mean are referred to as living in high unemployment areas. The percentage of respondents sleeping less than 7 hours on the diary day was statistically significantly different across the three groups. A smaller proportion of respondents living in low unemployment areas (23.7%) sleep less than 7 hours in comparison to those living in average (26%) or high unemployment areas (27.7%). A reverse pattern was evident for respondents sleeping more than 9 hours (30.3% versus 26.1% and 25.2%). In other words, individuals living in low unemployment areas were more likely to sleep more than 9 hours on the diary day when compared to the high and average unemployment rate areas. The percentage of respondents reporting a sleep disruption was significantly higher in areas with average unemployment (2.4%) when compared to areas with low unemployment (1.6%). A similar pattern was evident for the number of sleep disruptions. In sum, respondents living in areas with low unemployment are more likely to sleep more than 9 hours than the other groups and less likely to reporting a sleep

disruption. No significant differences were evident by unemployment rate and the proportion of respondents reporting sleeplessness or time in sleeplessness.

Respondents' own employment status is also a key determinant in working-aged respondents' sleep patterns and is shown in Table 5. A greater percentage of employed respondents report sleeping less than 7 hours on the diary day than the unemployed or those not in the labor force. More than a quarter of employed respondents (27.4%) report sleeping fewer than 7 hours while the proportion of recently unemployed, the long-term unemployed, and those not in the labor force range from 17.6% to 19.3%. Though a greater percentage of employed respondents sleep fewer than the recommended hours each night, a greater percentage of employed respondents report sleeping the recommended 7 to 9 hours on the diary day as well (49.7% compared to 39.8%, 38.5%, and 38.2%). In contrast, a larger proportion of the unemployed and those not in the labor force sleep more than 9 hours on the diary day than do the employed (42.6% of the recently unemployed, 42.3% of the long-term unemployed, and 42.5% of those not in the labor force in comparison to 22.9% of the employed). Experiencing sleeplessness varies significantly across employment status. A lower percentage of the employed report sleeplessness (3.9%) when compared to the long-term unemployed (6.4%) and those not in the labor force (6%). However, average time spent in sleeplessness is smallest for the long-term unemployed. A greater proportion of those not in the labor force and a smaller proportion of the recently unemployed report a sleep disruption. Overall, Table 5 demonstrates that though the employed may be more likely to sleep less than 7 hours they are also least likely to sleep more than 9 hours and experience sleeplessness. In contrast, the long-term unemployed are more likely to report sleeping longer and to report sleeplessness and/or a sleep disruption.

Taken together these results illustrate the contrasting implications respondents' employment status and the Great Recession have for sleep. The employed are more likely to sleep less than 7 hours and to report a sleep disruption (when compared to the recently unemployed) whereas the unemployed are more likely to sleep more than 9 hours and to report sleeplessness (specifically the long-term unemployed compared to the employed). The recessionary years are related to sleeping more than 9 hours, increased likelihood of sleeplessness, and a decreased likelihood of a sleep disruption in the bivariate results. In contrast, the unemployment rate appears to have opposite effects. Respondents living in low unemployment areas are more likely to sleep more than 9 hours while being less likely to report a sleep disruption.

#### *Multivariate Models Predicting Time Spent Sleeping*

The findings from the multinomial logistic regression predicting time spent sleeping are shown in Table 6 and compare sleeping less than 7 hours or more than 9 hours with sleeping the recommended number of hours (7 to 9 hours). The coefficients have been transformed into relative risk ratios to aid in interpretation. Relative risk ratios are similar to odds ratios in that values below one reduce the risk of being in the group of interest while values above one increase that risk. Also, relative risk ratios are multiplicative. Model 1 in Table 6 includes the respondent's standard employment status, year, and state-level unemployment rate. Neither being unemployed nor the recessionary years are significant predictors of sleeping less than the recommended 7 hours a night. However, the state-level unemployment rate is significantly related to sleeping less than 7 hours a night. Each percentage point increase in the state level unemployment rate is related to a 3% decrease in the risk of sleeping less than 7 hours. That is, in states with an unemployment rate of 9%, the risk of sleeping less than 7 hours 6% lower than

respondents living in states with 4% unemployment. The unemployment rate and recessionary time period are not related to sleeping more than 9 hours on the diary day. In contrast, being unemployed or out of the labor force are significantly related to sleeping more than 9 hours. The unemployed have 131% greater relative risk of sleeping more than 9 hours while those not in the labor force have 141% greater relative risk. Model 2 in Table 6 includes a more detailed employment status that captures the length of time being unemployed. Here we see that both the recently unemployed (unemployed in the last two to five months) and longer-term unemployed (unemployed at ATUS and CPS) are significantly more likely to sleep more than 9 hours. The recently unemployed have 129% greater relative risk, the long-term unemployed have 132% greater relative risk, and those not in the labor force have 141% greater relative risk of sleeping more than 9 hours on the diary day when compared to the employed. Though the results are similar for Models 1 and 2, I include the more detailed measure of employment status as a means of integrating the timing of becoming unemployed.

Model 3 in Table 6 includes the socio-demographic characteristics with the economic climate variables. Here we see that sleeping less than 7 hours on the diary day is no longer related to the state-level unemployment rate. Instead controlling for gender, life stage, spouse/partner's employment status, and education mediates that relationship. Sleeping less than 7 hours on the diary day is negatively related to being a woman and positively related to being older than 45 without children at home, having a spouse or partner who works part-time, having some college or an associate's degree, and having a high school degree or less. Sleeping more than 9 hours on the diary day remains significantly more likely for the recently unemployed (101% greater relative risk), the long-term unemployed (101% greater relative risk), and those not in the labor force (126% greater relative risk) even after controlling for an individual's socio-

demographic characteristics. The state-level unemployment rate is not significantly related to sleeping more than 9 hours while the recessionary time period becomes significant once I control for the socio-demographic characteristics. Respondents participating in the survey in 2009 have 16% greater relative risk of sleeping more than 9 hours. In addition to the economic climate measures, the socio-demographic characteristics significantly predict sleeping more than 9 hours. Being a parent of a child under 18, being older than 45 without children at home, and having a spouse/partner who is employed full-time are negatively related to the relative risk of sleeping more than 9 hours. In contrast, being a woman, having a high school degree or less, or some college or an associate's degree are related to increased odds of sleeping more than 9 hours. Interactions testing the two-way and three-way moderating effects of being unemployed, the recessionary time period, and the unemployment rate were not statistically significant predictors of time spent sleeping (interaction models are shown in Appendix A).

#### *Multivariate Models Predicting Sleep Disruptions*

The associations between economic strain and sleep disruptions are shown in the logistic regression models reported in Table 7. Again the coefficients are shown in the exponentiated form as odds ratios to aid in their interpretation. Model 1 includes the state-level unemployment rate, recessionary time period, and standard employment status. Here we see that the recessionary time period and being out of the labor force are significantly related to the odds of experiencing a sleep disruption. The odds of experiencing a sleep disruption 36% lower in 2008, 57% lower in 2009, and 54% lower in 2010 than before the recession. Though being unemployed is not related to sleep disruptions, respondents who are out of the labor force have 91% greater odds of reporting a sleep disruption on the diary day than do the employed. Model 2 of Table 7 includes the more detailed measure of employment status. Being unemployed, regardless of the

timing, remains insignificant. In Model 3 I include the more detailed measure of employment status as a means of integrating the timing of becoming unemployed and for increased comparability between models estimating sleep outcomes.

Model 3 in Table 7 includes the socio-demographic characteristics when estimating the odds of experiencing a sleep disruption in addition to the economic climate measures. After controlling for an individual's socio-demographic characteristics the effect of the unemployment rate becomes significant at the .05 level. Each percentage point increase in the unemployment rate increases the odds of experiencing a sleep disruption by 7%. The effects of the time period change only slightly (33%, in 2008, 58% in 2009, and 55% in 2010). The effect of being out of the labor force declines in this larger model but continues to be related to increased odds of reporting a sleep disruption and increases the odds of experiencing a sleep disruption by 64%. In addition to the economic climate measures, the socio-demographic characteristics are also significantly related to experiencing sleep disruptions. Women have greater odds of reporting a sleep disruption as do parents of children under 18, respondents over age 45 without children at home, and respondents with a high school degree or less. Interaction models testing the two-way and three-way moderating effects of being unemployed, the recessionary time period, and the unemployment rate did not converge and are therefore not included (shown in Appendix B). Models predicting the logged number of sleep disruptions are also not shown due to their lack of significant findings (shown in Appendix E).

#### *Multivariate Models Predicting Sleeplessness*

The associations between economic climate and respondents' reports of sleeplessness are shown in Table 8. Model 1 includes the relationships between the standard employment status, the recessionary time period, and the unemployment rate for the odds of reporting sleeplessness.

In contrast to the model predicting sleep disruptions, the state-level unemployment rate is related to a decrease in the odds of sleeplessness while time period is related to an increase. Each additional percentage point of the state-level unemployment rate is related to 10% decrease in the odds of experiencing sleeplessness. The odds of experiencing sleeplessness is greater in 2008, 2009, and 2010 (40%, 118%, 74% respectively) than prior to the Great Recession. Being unemployed is related to 67% greater odds of sleeplessness while those not in the labor force have 60% greater odds. Model 2 in Table 8 includes the more detailed measure of employment status. Being unemployed longer-term (at the CPS and the ATUS) is related to 70% increased odds of reporting sleeplessness while become unemployed more recently is related to 62% greater odds.

Model 3 in Table 8 includes the socio-demographic characteristics in addition to the economic climate variables. Being unemployed at the CPS and the ATUS, being out of the labor force, time period, and the state-level unemployment rate continue to be related to reporting sleeplessness while recently becoming unemployed is no longer significant. Each additional percentage point of the unemployment rate reduces the odds of sleeplessness by 9% while the recessionary time period increases the odds of sleeplessness by 37% in 2008, 110% in 2009, and 66% in 2010. Being unemployed longer-term is related to 60% greater odds of reporting sleeplessness. Few of the socio-demographic characteristics are statistically significant predictors of sleeplessness. Respondents with some college or an associate's degree have 25% greater odds of reporting sleeplessness.

Interaction models testing two- and three-way interactions showed significant interactions between the recessionary time period and being unemployed, as well as between the unemployment rate and the recessionary time period for sleeplessness (full models are available

in Appendix C)<sup>6</sup>. To aid in interpretation, predicted probabilities are calculated for each significant interaction effect (for explanation see Buis 2010). Each of the variables not shown in the figures is held at the mean to calculate the predicted probabilities shown in Figures 10 and 11. Figure 10 illustrates the statistically significant interaction relationships between being unemployed and the recessionary time period (statistically insignificant relationships are not shown). In general, the recently unemployed (less than 5 months) have a lower probability of reporting sleeplessness in 2008 and 2009 when compared to the employed before the recession. In contrast, the longer-term unemployed before the recession and those not in the labor force in 2008 have a greater probability of sleeplessness than the employed before the recession. Figure 11 shows the interacting relationships between the unemployment rate and the time period. Here we see that before the recession, the probability of reporting sleeplessness decreases as the unemployment rate increases. Though there is a similar pattern in 2009, the downward trend is not as steep and is higher throughout. Such interacting effects show the importance of timing for the effects of recently becoming unemployed and higher state-level unemployment rates.

#### *Multivariate Models Predicting Time Experiencing Sleeplessness*

The associations between the logged time spent in sleeplessness and the economic strain variables are shown in Table 9. Model 1 in Table 9 includes the relationships for standard employment status, the recessionary time period, and the unemployment rate. Here we see that the state-level unemployment rate is related to less time spent in sleeplessness. Though being unemployed is not statistically significantly related to the number of minutes in sleeplessness, being out of the labor force is and increases the amount of time in sleeplessness. The recessionary time period is also related to spending more time in sleeplessness with the largest

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<sup>6</sup> Three-way interactions were not sufficiently informative to be included in this model as only one three-way interaction coefficient was statistically significant.



effect being in 2009. Model 2 in Table 9 includes the detailed employment status capturing length of time being unemployed. Neither being unemployed in the last 2 to 5 months nor being unemployed longer-term are statistically significant predictors of time in sleeplessness. Again, I include the more detailed measure of employment status in Model 3 to integrate the timing of becoming unemployed and to maintain comparability between models estimating sleep outcomes.

Model 3 in Table 9 includes the socio-demographic characteristics in addition to measures of economic climate. When controlling for the socio-demographic context, the effects of being out of the labor force, the unemployment rate, and the recessionary time period decrease slightly but remain significant. A few of the socio-demographic characteristics are significant predictors of the logged amount of time in sleeplessness as well. Women and respondents older than 45 without children spend more time in sleeplessness when compared to men and those under 45 without children. Interaction models testing the two-way and three-way moderating effects of being unemployed, the recessionary time period, and the unemployment rate are not informative and are therefore not shown (shown in Appendix D).

## **Discussion**

Investigating the sleeping patterns of working-aged respondents during the Great Recession, I find that being unemployed, the recessionary time period, and the unemployment rate are important predictors for many if not all of my indicators of sleep. Specifically, I find that the state-level unemployment rate is related to the time spent sleeping, the odds and time spent in sleeplessness, and the odds of a sleep disruption. The state-level unemployment rate does not maintain its significance in the models predicting time spent sleeping once the socio-demographic characteristics and controls are included but remains (or becomes, as is the case in

the sleep disruption model) significant once these same controls are included in the sleeplessness and sleep disruption models. Contrary to my hypotheses, the direction of the relationships between the state-level unemployment rate and sleep outcomes are not consistent and therefore only partially support H1. Higher rates of unemployment are related to increased odds of a sleep disruption as I hypothesized. In contrast, higher rates of unemployment are related to lower odds and less time in sleeplessness as well as a lower risk of sleeping less than 7 hours. These results point to the possibility that sleep disruptions and sleeplessness reflect different indicators of health.

The recessionary time period is less consistently related to sleep patterns in the United States. Each year of the recessionary time period is related to an increase in the odds of and time spent in sleeplessness but is related to a decrease in the odds of reporting a sleep disruption<sup>7</sup>. Only the coefficient for 2009 was significant in the model predicting sleep time after each of the socio-demographic characteristics and controls were included. Across the sleep models, the largest effect was evident for 2009 in comparison to the other recessionary years potentially demonstrating the “peak” of the health effects related to the Great Recession. Similar to the relationships between unemployment rate and sleep outcomes mentioned above, the direction of the relationships between the recessionary time period and my sleep outcomes was not consistent and, therefore, my results only partially support H2. The recessionary years increased the odds and time spent in sleeplessness as well as increased the risk of sleeping more than 9 hours while these same years decreased the odds of a sleep disruption. Again, these results raise the possibility that sleep disruptions represent a different aspect of sleep behaviors than do

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<sup>7</sup> Time spent sleeping is not related to the recessionary time period even in the models limited to that variable. However, time spent sleeping is significantly different across years in the bivariate analyses shown in Table 3.

sleeplessness and time spent sleeping that may be differentially related to changes in the economic climate.

Being unemployed (both recently and longer-term) and out of the labor force increases the relative risk of sleeping more than 9 hours and increases the odds of sleeplessness while being unemployed is not related to the odds of a sleep disruption or the time spent in sleeplessness. These relationships hold even after I include the socio-demographic characteristics and the other control variables (with the exception of being unemployed between 2 and 5 months for the predicted odds of sleeplessness). These results partially support H3.

Next, I investigate the interacting effects of the economic climate. Overall, I found few significant relationships. Becoming unemployed in the 2 to 5 months prior to participating in the ATUS during the recessionary years of 2008 and 2009 was related to lower probabilities of reporting sleeplessness than the employed before the recession. In contrast, the declining probability of reporting sleeplessness had a smaller slope in 2009 than did the probability before the recession. These results are partial evidence for H5 and H6. However, these relationships were not found in the models predicting a sleep disruption or time spent sleeping. Moreover, only two-way interactions were evident in my models, potentially due to the relatively small number of cases reporting sleeplessness and sleep disruptions.

## **Conclusion**

In some respects the sleeping patterns of the U.S. working-age population during the Great Recession are better than before the recession. The odds of reporting a sleep disruption decreased across the time period and each percentage point increase in the state-level unemployment rate was associated with a reduction in the odds and time spent in sleeplessness. These results are in line with some of the more recent literature on the economy and physical

health (Ruhm 2003, 2007), which finds that with high unemployment rates and recessions come improvements in the physical health of the population. Yet, in contrast to these findings, unemployed working-aged respondents and those not in the labor force are more likely to sleep more than the recommended 7 to 9 hours and more likely to report sleeplessness. Those reporting during the recession are more likely to sleep more than 9 hours and report sleeplessness as well as spend more time in sleeplessness than those reporting before the recession. Lastly, increases in the unemployment rate are related to increased odds of reporting a sleep disruption. Overall, a struggling economic climate appears to be related to more negative sleep outcomes for the U.S. population.

The combined effect of being unemployed, the recessionary time period, and state-level unemployment rate illustrates how the experience of economic uncertainty varies based on multiple aspects of the economic climate. In particular, the lower probability of sleeplessness for the unemployed during the recession is evidence that individuals assess their position in the job market based on the broader economic climate (as shown by Wheaton 1978). If the broader economic climate is poor, someone who is unemployed is less likely to lose sleep over his/her situation. However, the relationship between the unemployment rate and recessionary time period is different. Though, the unemployment rate reduces the probability of sleeplessness generally, the effect is not as strong in 2009 as it is prior to the recession. This pattern may instead reflect the difficulty of living in a state with high unemployment during a year in which it is uncertain when or how things may improve.

These results highlight the importance of understanding and integrating studies of being unemployed and recessions. The Great Recession is more than simply a reflection of the unemployment rate tied to a particular location but is also reflected in the more dispersed and

general experience of the time. Media and modes of social networking distribute information regarding the current economic climate regardless of local boundaries and, as such, influence individuals more widely. As people are continually reminded of the stagnant (or declining) economy their assessment of their own priorities and subsequent decisions will likely change. For example, the odds of reporting sleeplessness increased in 2008 and again in 2009 but declined in 2010. This trend may show that stress due to the recession peaked in 2009 and began recede when the general populace realized that we would continue to move forward even with a weaker than expected economy. Moreover, how people experience the recession and being unemployed are related. Becoming unemployed is experienced differently when media coverage and general conversations highlight the stagnant versus growing economy. Studies examining the effects of one or the other fail to consider this nuance and simplify a complex interaction. For example, being unemployed when unemployment is commonplace is less stressful than being unemployed when everyone around you is employed. As such, it is problematic to generalize research that focuses on the unemployment rate during a period of relative prosperity or on the unemployed during a recession to circumstances that are not similarly situated. Instead, research must consider the constellation of characteristics that reflect the economic climate.

This study is an important contribution to our understanding of the effect of the broader economic climate and being unemployed on sleep. Few studies are able to examine the impact of economic changes on sleep patterns. The availability and timing of the American Time Use Study makes such analyses possible. However, these analyses have limitations. First and most importantly, it is not possible to ascertain change using this data. The continual fielding of the ATUS allows for pooled cross-sectional analyses but it is impossible to know how individuals change their behaviors across time or economic context. Despite this limitation, I am not aware

of any longitudinal studies that can look at health behaviors across time with such detail and with time diary data. Second, though time diary data has been found to be a more accurate measure than typical stylized time use measures, the ATUS is a self-reported diary and it is therefore possible that individuals' are subject to bias or inaccurate recall. In particular, some measures, such as sleep disruptions, maybe more easily omitted from a diary if respondents believe it to be inconsequential or short-lived. Lastly, time spent sleeping, sleeplessness, and sleep disruptions can only be captured on a single diary day. It is impossible to determine from these data how such measures of sleep are related to health outcomes concretely or how these behaviors vary across a respondent's week, month, or year.

Despite such limitations, these findings demonstrate the importance of the economic climate and being unemployed for the health of the US population as well as illustrate the importance of extending our knowledge on this topic. It is intriguing that declines in the national economy are related to some negative indications of physical health as well as some positive indications. However, future research should investigate why this is the case and what long-term implications such sleep patterns may have. For example, what role does the workplace have in recreating these sleep patterns if any? That is, does the uncertainty of one's current employment potentially caused by economic declines more generally lead to poor sleep behaviors? Or is it peripheral behavioral changes (e.g. changing commuting patterns, decreased eating outside the home, etc.) that play an important role in sleep patterns during recessions and after becoming unemployed? Moreover, long-term longitudinal analyses will need to examine the persistence of such findings. Does being unemployed or the Great Recession have long-term health implications that we have yet to identify? Armed with such knowledge, scholars and policy

makers may be better able to address changes in health during periods of economic bust as well as boom.

## Tables & Figures

**Table 1. Hypotheses**

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*Economic Climate*

- H1 Being interviewed during the recessionary time period (i.e. 2008-2010) will be related to sleeping more than the recommended 7 to 9 hours, more sleeplessness, and more sleep disruptions.
- H2 Being unemployed will be related to sleeping more than the recommended 7 to 9 hours, more experiences of sleeplessness and more sleep disruptions.
- H3 Higher rates of state-level unemployment will be related to adequate sleep, less sleeplessness, and fewer sleep disruptions.

*Moderating Influence of Multiple Experiences of Economic Climate*

- H4 Living in an environment of high unemployment or during an economic recession moderates the negative effects of actually being unemployed on sleep outcomes. Specifically, being unemployed in conjunction with higher unemployment rates and/or during the recessionary time period (i.e. 2008-2010) will not be related to sleeping more or less than the recommended amount and will be related to lower odds of sleeplessness and lower odds of sleep disruptions compared to the employed living in areas with lower unemployment rates and/or being interviewed before the recession (i.e. 2003-2007).
- H5 Higher unemployment rates in conjunction with being interviewed during the recessionary time period (i.e. 2008-2010) will operate as a magnifier of sleep outcomes. Specifically, respondents living in areas with high unemployment during the recession will be related to sleeping more or less than the recommended amount, greater odds of sleeplessness, and greater odds of sleep disruptions compared to the living in areas with lower unemployment rates and being interviewed before the recession (i.e. 2003-2007).



**Table 2. Selected characteristics of the US civilian, non-institutionalized populations: Sample limited to respondents aged 24 to 55 from weekday diaries, 2003-2010 ATUS.**

|  | Rate/Mean | N/SE  |
|--|-----------|-------|
| <b>Dependent Variables</b>                           |           |       |
| Sleep Hours  |           |       |
| <i>Short Sleep (less than 7 hours)</i>               | 25.80%    | 11167 |
| <i>Optimal Sleep (7-9 hours)</i>                     | 47.50%    | 21209 |
| <i>Long Sleep (more than 9 hours)</i>                | 26.80%    | 11842 |
| Sleeplessness  |           |       |
| <i>Percent Reporting Sleeplessness</i>               | 4.30%     | 1816  |
| <i>Time in Sleeplessness</i>                         | 72.30     | 78.31 |
| Breaks in Sleep                                      |           |       |
| <i>Percent Reporting Breaks</i>                      | 2.30%     | 1066  |
| <i>Number of Breaks per Day</i>                      | 1.18      | 0.48  |
| <b>Economic Climate</b>                              |           |       |
| Detailed Employment Status                           |           |       |
| <i>Employed</i>                                      | 80.50%    | 26812 |
| <i>Unemployed – 2 to 5 months</i>                    | 2.00%     | 592   |
| <i>Unemployed - at ATUS &amp; CPS</i>                | 3.00%     | 939   |
| <i>Out of Labor Force</i>                            | 14.60%    | 5185  |
| Three Month Rolling Average Unemployment By State    | 6.27      | 2.14  |
| Year   |           |       |
| 2003-2007  | 62.00%    | 22050 |
| 2008   | 12.70%    | 3690  |
| 2009   | 12.60%    | 3875  |
| 2010   | 12.70%    | 3913  |
| <b>Socio-demographic Characteristics</b>             |           |       |
| Female   | 50.70%    | 18673 |
| Life Stage   |           |       |
| <i>45 or Younger without Children</i>                | 29.10%    | 6916  |
| <i>Parent of Child under 18</i>                      | 49.30%    | 20200 |
| <i>Older than 45 without Children</i>                | 21.60%    | 6412  |
| Gendered Life Stage                                  |           |       |
| <i>Men under 45 without Children</i>                 | 16.70%    | 3767  |
| <i>Father of Child under 18</i>                      | 22.70%    | 8320  |
| <i>Men over 45 without Children</i>                  | 9.90%     | 2768  |
| <i>Women under 45 without Children</i>               | 12.40%    | 3149  |
| <i>Mother of Child under 18</i>                      | 26.50%    | 11880 |
| <i>Women over 45 without Children</i>                | 11.80%    | 3644  |
| Marital or Partner Status/Spouse's Employment Status |           |       |
| <i>Spouse/Partner is Not Employed</i>                | 14.60%    | 4365  |
| <i>Spouse/Partner Employed Part-Time</i>             | 7.10%     | 2304  |
| <i>Spouse/Partner Employed Full-Time</i>             | 45.20%    | 14413 |
| <i>No Spouse or Partner</i>                          | 33.10%    | 11706 |
| Education  |           |       |
| <i>High School Diploma or Less</i>                   | 32.50%    | 12180 |
| <i>Some College or Associate's Degree</i>            | 26.60%    | 9727  |
| <i>College Degree or More</i>                        | 40.90%    | 11621 |

**Table 3. Bivariate Relationships between Sleep Behaviors and Year of the Recession**

|                              | Before the Recession <sup>a</sup> |                     | 2008 <sup>b</sup> |                     | 2009 <sup>c</sup> |                     | 2010 <sup>d</sup> |                     |
|------------------------------|-----------------------------------|---------------------|-------------------|---------------------|-------------------|---------------------|-------------------|---------------------|
|                              | %/Mean                            | N/(S.E.)            | %/Mean            | N/(S.E.)            | %/Mean            | N/(S.E.)            | %/Mean            | N/(S.E.)            |
| <b>Sleep Hours</b>           |                                   |                     |                   |                     |                   |                     |                   |                     |
| <i>Less than 7 hours</i>     | 26.30%                            | 7,433 <sup>d</sup>  | 26.10%            | 1,282               | 24.70%            | 1,225               | 23.90%            | 1,227 <sup>a</sup>  |
| <i>Between 7 and 9 hours</i> | 47.70%                            | 13,979 <sup>c</sup> | 48.20%            | 2,370 <sup>c</sup>  | 45.50%            | 2,391 <sup>ab</sup> | 47.60%            | 2,469 <sup>ab</sup> |
| <i>More than 9 hours</i>     | 26.00%                            | 7,512 <sup>cd</sup> | 25.70%            | 1,330 <sup>cd</sup> | 29.80%            | 1,506 <sup>ab</sup> | 28.40%            | 1,494 <sup>ab</sup> |
| <b>Sleeplessness</b>         |                                   |                     |                   |                     |                   |                     |                   |                     |
| <i>% Reporting</i>           | 3.90%                             | 1034 <sup>bc</sup>  | 5.00%             | 261 <sup>a</sup>    | 5.60%             | 273 <sup>ad</sup>   | 4.40%             | 248 <sup>c</sup>    |
| <i>Total Time</i>            | 74.09                             | 86.45 <sup>d</sup>  | 68.69             | 58.51               | 73.77             | 74.86               | 67.05             | 63.11 <sup>a</sup>  |
| <b>Sleep Disruptions</b>     |                                   |                     |                   |                     |                   |                     |                   |                     |
| <i>% Reporting</i>           | 2.70%                             | 801 <sup>bcd</sup>  | 1.80%             | 102 <sup>a</sup>    | 1.40%             | 78 <sup>a</sup>     | 1.60%             | 85 <sup>a</sup>     |
| <i>Number of Disruptions</i> | 1.19                              | 0.50                | 1.13              | 0.34                | 1.13              | 0.44                | 1.15              | 0.42                |

Note: Superscript denotes significance of P<.05 or smaller.

**Table 4. Bivariate Relationships between Sleep Behaviors and Rolling Average of Unemployment Rate**

|                              | Low Unemployment<br>(More than One<br>Standard Deviation<br>Smaller than the Mean<br>Unemployment Rate) <sup>a</sup> |                     | Average Unemployment<br>(Within One Standard<br>Deviation of the Mean<br>Unemployment Rate) <sup>b</sup> |                     | High Unemployment<br>(More than One<br>Standard Deviation<br>Greater than the Mean<br>the Unemployment<br>Rate) <sup>c</sup> |                    |
|------------------------------|--|---------------------|--|---------------------|--|--------------------|
|                              | %/Mean   | N/(S.E.)            | %/Mean   | N/(S.E.)            | %/Mean   | N/(S.E.)           |
| <b>Sleep Hours</b>           |  |                     |  |                     |  |                    |
| <i>Less than 7 hours</i>     | 23.70%   | 1,622 <sup>bc</sup> | 26.00%   | 8,447 <sup>a</sup>  | 27.70%   | 1,098 <sup>a</sup> |
| <i>Between 7 and 9 hours</i> | 46.00%   | 3,171 <sup>b</sup>  | 47.90%   | 16,074 <sup>a</sup> | 47.10%   | 1,964              |
| <i>More than 9 hours</i>     | 30.30%   | 2,040 <sup>bc</sup> | 26.10%   | 8,747 <sup>a</sup>  | 25.20%   | 1,055 <sup>a</sup> |
| <b>Sleeplessness</b>         |  |                     |  |                     |  |                    |
| <i>% Reporting</i>           | 4.90%  | 339                 | 4.20%  | 1294                | 4.40%  | 183                |
| <i>Total Time</i>            | 69.85  | 74.07               | 72.57  | 81.16               | 74.93  | 64.54              |
| <b>Sleep Disruptions</b>     |  |                     |  |                     |  |                    |
| <i>% Reporting</i>           | 1.60%  | 109 <sup>b</sup>    | 2.40%  | 852 <sup>a</sup>    | 2.20%  | 105                |
| <i>Number of Disruptions</i> | 1.11   | 0.39 <sup>b</sup>   | 1.19   | 0.49 <sup>a</sup>   | 1.13   | 0.46               |

Note: Superscript denotes significance of P<.05 or smaller.

**Table 5. Bivariate Relationships between Sleep Behaviors and Employment Status**

|                              | Employed <sup>a</sup> |        | Recently Unemployed <sup>b</sup> |        | Long-Term Unemployed <sup>c</sup> |               | Out of the Labor Force <sup>d</sup> |        |               |        |        |                |
|------------------------------|-----------------------|--------|----------------------------------|--------|-----------------------------------|---------------|-------------------------------------|--------|---------------|--------|--------|----------------|
|                              | %/Mean                | S.E./N | %/Mean                           | S.E./N | %/Mean                            | S.E./N        | %/Mean                              | S.E./N |               |        |        |                |
| Sleep Hours                  |                       |        |                                  |        |                                   |               |                                     |        |               |        |        |                |
| <i>Less than 7 hours</i>     | 27.40%                | 9,467  | <sup>bcd</sup>                   | 17.60% | 137                               | <sup>a</sup>  | 19.20%                              | 251    | <sup>a</sup>  | 19.30% | 1,312  | <sup>a</sup>   |
| <i>Between 7 and 9 hours</i> | 49.70%                | 17,622 | <sup>bcd</sup>                   | 39.80% | 311                               | <sup>a</sup>  | 38.50%                              | 506    | <sup>a</sup>  | 38.20% | 2,770  | <sup>a</sup>   |
| <i>More than 9 hours</i>     | 22.90%                | 8,177  | <sup>bcd</sup>                   | 42.60% | 316                               | <sup>a</sup>  | 42.30%                              | 496    | <sup>a</sup>  | 42.50% | 2,853  | <sup>a</sup>   |
| Sleeplessness                |                       |        |                                  |        |                                   |               |                                     |        |               |        |        |                |
| <i>% Reporting</i>           | 3.90%                 | 1325   | <sup>cd</sup>                    | 6.20%  | 41                                |               | 6.40%                               | 59     | <sup>a</sup>  | 6.00%  | 391    | <sup>a</sup>   |
| <i>Total Time</i>            | 66.36                 | 63.48  | <sup>cd</sup>                    | 65.17  | 57.88                             | <sup>d</sup>  | 61.86                               | 45.69  | <sup>ad</sup> | 94.78  | 116.44 | <sup>abc</sup> |
| Sleep Disruptions            |                       |        |                                  |        |                                   |               |                                     |        |               |        |        |                |
| <i>% Reporting</i>           | 2.00%                 | 760    | <sup>bd</sup>                    | 1.00%  | 8                                 | <sup>ad</sup> | 1.90%                               | 28     | <sup>d</sup>  | 3.80%  | 270    | <sup>abc</sup> |
| <i>Number of Disruptions</i> | 1.15                  | 0.43   | <sup>d</sup>                     | 1.13   | 0.35                              |               | 1.29                                | 0.76   |               | 1.26   | 0.56   | <sup>a</sup>   |

Note: Superscript denotes significance of P<.05 or smaller.

**Table 6. Multinomial Logistic Regression Models Predicting Time Spent Sleeping, ATUS 2003-2010.**

|  | <b>Model 1</b>             |     |       |                            |     |       |
|--|----------------------------|-----|-------|----------------------------|-----|-------|
|  | Sleeping Less than 7 Hours |     |       | Sleeping More than 9 Hours |     |       |
|  | RRR                        |     | SE    | RRR                        |     | SE    |
| <b>Economic Climate</b>                              |                            |     |       |                            |     |       |
| State Level Unemployment Rate                        | 0.971                      | *   | 0.012 | 1.019                      |     | 0.012 |
| Time Period  |                            |     |       |                            |     |       |
| 2003-2007 (ref.)                                     |                            |     |       |                            |     |       |
| 2008   | 0.998                      |     | 0.051 | 0.977                      |     | 0.051 |
| 2009   | 1.112                      |     | 0.076 | 1.089                      |     | 0.071 |
| 2010   | 1.042                      |     | 0.075 | 0.980                      |     | 0.069 |
| Detailed Employment Status                           |                            |     |       |                            |     |       |
| Employed (ref.)                                      |                            |     |       |                            |     |       |
| Unemployed - 2 to 5 Months                           |                            |     |       |                            |     |       |
| Unemployed - at ATUS & CPS                           |                            |     |       |                            |     |       |
| Out of Labor Force                                   |                            |     |       |                            |     |       |
| Employment Status                                    |                            |     |       |                            |     |       |
| Employed (ref.)                                      |                            |     |       |                            |     |       |
| Unemployed   | 0.876                      |     | 0.075 | 2.310                      | *** | 0.161 |
| Out of Labor Force                                   | 0.918                      |     | 0.044 | 2.409                      | *** | 0.095 |
| <b>Socio-demographic Characteristics</b>             |                            |     |       |                            |     |       |
| Female   |                            |     |       |                            |     |       |
| Life Stage   |                            |     |       |                            |     |       |
| 45 or Younger without Children (ref.)                |                            |     |       |                            |     |       |
| Parent of Child under 18                             |                            |     |       |                            |     |       |
| Older than 45 without Children                       |                            |     |       |                            |     |       |
| Marital or Partner Status/Spouse's Employment Status |                            |     |       |                            |     |       |
| No Spouse or Partner                                 |                            |     |       |                            |     |       |
| Spouse/Partner Employed Full-Time                    |                            |     |       |                            |     |       |
| Spouse/Partner Employed Part-Time                    |                            |     |       |                            |     |       |
| Spouse/Partner is Not Employed (ref.)                |                            |     |       |                            |     |       |
| Education  |                            |     |       |                            |     |       |
| High School Diploma or Less                          |                            |     |       |                            |     |       |
| Some College or Associates                           |                            |     |       |                            |     |       |
| College Degree or More (ref.)                        |                            |     |       |                            |     |       |
| Constant   | 0.652                      | *** | 0.043 | 0.407                      | *** | 0.027 |

Notes: Model 1 N=44,218, Model 2 N=44,218, Model3 N=42,978. \* p<.05, \*\* p <.01, \*\*\* p<.001. Controls are added in Model 2. Controls include race, immigrant status, region, metropolitan area, and season.

**Table 6 cont. Multinomial Logistic Regression Models Predicting Time Spent Sleeping, ATUS 2003-2010.**

|  | Model 2                    |     |       |                            |     |       |
|--|----------------------------|-----|-------|----------------------------|-----|-------|
|  | Sleeping Less than 7 Hours |     |       | Sleeping More than 9 Hours |     |       |
|  | RRR                        |     | SE    | RRR                        |     | SE    |
| <b>Economic Climate</b>                              |                            |     |       |                            |     |       |
| State Level Unemployment Rate                        | 0.971                      | *   | 0.012 | 1.019                      |     | 0.012 |
| Time Period  |                            |     |       |                            |     |       |
| 2003-2007 ( <i>ref.</i> )                            |                            |     |       |                            |     |       |
| 2008   | 0.998                      |     | 0.051 | 0.977                      |     | 0.051 |
| 2009   | 1.112                      |     | 0.076 | 1.089                      |     | 0.071 |
| 2010   | 1.042                      |     | 0.075 | 0.980                      |     | 0.069 |
| Detailed Employment Status                           |                            |     |       |                            |     |       |
| <i>Employed (ref.)</i>                               |                            |     |       |                            |     |       |
| <i>Unemployed - 2 to 5 Months</i>                    | 0.809                      |     | 0.115 | 2.290                      | *** | 0.254 |
| <i>Unemployed - at ATUS &amp; CPS</i>                | 0.922                      |     | 0.096 | 2.324                      | *** | 0.202 |
| <i>Out of Labor Force</i>                            | 0.918                      |     | 0.044 | 2.409                      | *** | 0.095 |
| Employment Status                                    |                            |     |       |                            |     |       |
| <i>Employed (ref.)</i>                               |                            |     |       |                            |     |       |
| <i>Unemployed</i>                                    |                            |     |       |                            |     |       |
| <i>Out of Labor Force</i>                            |                            |     |       |                            |     |       |
| <b>Socio-demographic Characteristics</b>             |                            |     |       |                            |     |       |
| Female   |                            |     |       |                            |     |       |
| Life Stage   |                            |     |       |                            |     |       |
| <i>45 or Younger without Children (ref.)</i>         |                            |     |       |                            |     |       |
| <i>Parent of Child under 18</i>                      |                            |     |       |                            |     |       |
| <i>Older than 45 without Children</i>                |                            |     |       |                            |     |       |
| Marital or Partner Status/Spouse's Employment Status |                            |     |       |                            |     |       |
| <i>No Spouse or Partner</i>                          |                            |     |       |                            |     |       |
| <i>Spouse/Partner Employed Full-Time</i>             |                            |     |       |                            |     |       |
| <i>Spouse/Partner Employed Part-Time</i>             |                            |     |       |                            |     |       |
| <i>Spouse/Partner is Not Employed (ref.)</i>         |                            |     |       |                            |     |       |
| Education  |                            |     |       |                            |     |       |
| <i>High School Diploma or Less</i>                   |                            |     |       |                            |     |       |
| <i>Some College or Associates</i>                    |                            |     |       |                            |     |       |
| <i>College Degree or More (ref.)</i>                 |                            |     |       |                            |     |       |
| Constant   | 0.652                      | *** | 0.043 | 0.407                      | *** | 0.027 |

Notes: Model 1 N=44,218, Model 2 N=44,218, Model3 N=42,978. \* p<.05, \*\* p <.01, \*\*\* p<.001. Controls are added in Model 2. Controls include race, immigrant status, region, metropolitan area, and season.

**Table 6 cont. Multinomial Logistic Regression Models Predicting Time Spent Sleeping, ATUS 2003-2010.**

|  | <b>Model 3</b>             |       |                            |       |
|--|----------------------------|-------|----------------------------|-------|
|  | Sleeping Less than 7 Hours |       | Sleeping More than 9 Hours |       |
|  | RRR                        | SE    | RRR                        | SE    |
| <b>Economic Climate</b>                              |                            |       |                            |       |
| State Level Unemployment Rate                        | 0.979                      | 0.012 | 1.007                      | 0.013 |
| Time Period  |                            |       |                            |       |
| 2003-2007 (ref.)                                     |                            |       |                            |       |
| 2008   | 0.988                      | 0.051 | 0.974                      | 0.053 |
| 2009   | 1.082                      | 0.076 | 1.159                      | *     |
| 2010   | 0.977                      | 0.073 | 1.017                      | 0.076 |
| Detailed Employment Status                           |                            |       |                            |       |
| Employed (ref.)                                      |                            |       |                            |       |
| Unemployed - 2 to 5 Months                           | 0.786                      | 0.116 | 2.009                      | ***   |
| Unemployed - at ATUS & CPS                           | 0.835                      | 0.089 | 2.010                      | ***   |
| Out of Labor Force                                   | 0.939                      | 0.048 | 2.255                      | ***   |
| Employment Status                                    |                            |       |                            |       |
| Employed (ref.)                                      |                            |       |                            |       |
| Unemployed   |                            |       |                            |       |
| Out of Labor Force                                   |                            |       |                            |       |
| <b>Socio-demographic Characteristics</b>             |                            |       |                            |       |
| Female   | 0.840                      | ***   | 0.029                      | 1.127 |
| Life Stage   |                            |       |                            |       |
| 45 or Younger without Children (ref.)                |                            |       |                            |       |
| Parent of Child under 18                             | 1.078                      |       | 0.048                      | 0.736 |
| Older than 45 without Children                       | 1.169                      | **    | 0.061                      | 0.660 |
| Marital or Partner Status/Spouse's Employment Status |                            |       |                            |       |
| No Spouse or Partner                                 | 1.113                      |       | 0.077                      | 0.892 |
| Spouse/Partner Employed Full-Time                    | 1.021                      |       | 0.052                      | 0.808 |
| Spouse/Partner Employed Part-Time                    | 1.140                      | *     | 0.064                      | 1.064 |
| Spouse/Partner is Not Employed (ref.)                |                            |       |                            |       |
| Education  |                            |       |                            |       |
| High School Diploma or Less                          | 1.157                      | ***   | 0.046                      | 1.483 |
| Some College or Associates                           | 1.122                      | **    | 0.045                      | 1.720 |
| College Degree or More (ref.)                        |                            |       |                            |       |
| Constant   | 0.599                      | ***   | 0.061                      | 0.359 |

Notes: Model 1 N=44,218, Model 2 N=44,218, Model3 N=42,978. \* p<.05, \*\* p <.01, \*\*\* p<.001. Controls are added in Model 2. Controls include race, immigrant status, region, metropolitan area, and season.

**Table 7. Logistic Regression Models Predicting Experiencing a Sleep Disruption, ATUS 2003-2010.**

|   | Model 1 |           | Model 2 |           | Model 3 |           |
|---|---------|-----------|---------|-----------|---------|-----------|
|   | OR      | SE        | OR      | SE        | OR      | SE        |
| <b>Economic Climate</b>                   |         |           |         |           |         |           |
| State Level Unemployment                  | 1.054   | 0.029     | 1.053   | 0.029     | 1.067   | * 0.032   |
| Time Period                               |         |           |         |           |         |           |
| 2003-2007 ( <i>ref.</i> )                 |         |           |         |           |         |           |
| 2008                                      | 0.638   | ** 0.094  | 0.639   | ** 0.094  | 0.670   | ** 0.101  |
| 2009                                      | 0.433   | *** 0.078 | 0.432   | *** 0.078 | 0.424   | *** 0.078 |
| 2010                                      | 0.457   | *** 0.093 | 0.457   | *** 0.093 | 0.447   | *** 0.093 |
| Detailed Employment Status                |         |           |         |           |         |           |
| <i>Employed (ref.)</i>                    |         |           |         |           |         |           |
| <i>Unemployed - 2 to 5 months</i>         |         |           | 0.487   | 0.245     | 0.536   | 0.282     |
| <i>Unemployed - at ATUS &amp; CPS</i>     |         |           | 0.999   | 0.268     | 0.988   | 0.266     |
| <i>Out of Labor Force</i>                 |         |           | 1.906   | *** 0.176 | 1.636   | *** 0.165 |
| Employment Status                         |         |           |         |           |         |           |
| <i>Employed (ref.)</i>                    |         |           |         |           |         |           |
| <i>Unemployed</i>                         | 0.792   | 0.190     |         |           |         |           |
| <i>Out of Labor Force</i>                 | 1.906   | *** 0.176 |         |           |         |           |
| <b>Socio-demographic Characteristics</b>  |         |           |         |           |         |           |
| Female                                    |         |           |         |           | 1.761   | *** 0.174 |
| Life Stage                                |         |           |         |           |         |           |
| <i>45 or Younger without Child (ref.)</i> |         |           |         |           |         |           |
| <i>Parent of Child under 18</i>           |         |           |         |           | 1.656   | *** 0.226 |
| <i>Older than 45 without Child</i>        |         |           |         |           | 1.592   | ** 0.246  |
| Marital or Partner Status/Spouse's        |         |           |         |           |         |           |
| Employment Status                         |         |           |         |           |         |           |
| <i>No Spouse or Partner</i>               |         |           |         |           | 1.016   | 0.196     |
| <i>Spouse/Partner FTE</i>                 |         |           |         |           | 1.040   | 0.150     |
| <i>Spouse/Partner PTE</i>                 |         |           |         |           | 0.812   | 0.132     |
| <i>Spouse/Partner is Not Emp (ref.)</i>   |         |           |         |           |         |           |
| Education                                 |         |           |         |           |         |           |
| <i>High School Diploma or Less</i>        |         |           |         |           | 1.341   | ** 0.136  |
| <i>Some College or Associates</i>         |         |           |         |           | 1.180   | 0.122     |
| <i>College Degree or More (ref.)</i>      |         |           |         |           |         |           |
| Constant                                  | 0.019   | *** 0.003 | 0.019   | *** 0.003 | 0.007   | *** 0.002 |

Notes: Model 1 N=44,218, Model 2 N=44,218, Model 3 N=42,978. + p<.10, \* p<.05, \*\* p<.01, \*\*\* p<.001. Controls are added in Model 2. Controls include race, immigrant status, region, metropolitan area, and season.

**Table 8. Logistic Regression Models Predicting Experiencing Sleeplessness, ATUS 2003-2010.**

|  | Model 1 |     |       | Model 2 |     |       | Model 3 |     |       |
|--|---------|-----|-------|---------|-----|-------|---------|-----|-------|
|  | OR      |     | SE    | OR      |     | SE    | OR      |     | SE    |
| <b>Economic Climate</b>                  |         |     |       |         |     |       |         |     |       |
| State Level Unemployment                 | 0.903   | *** | 0.019 | 0.902   | *** | 0.019 | 0.912   | *** | 0.021 |
| Time Period                              |         |     |       |         |     |       |         |     |       |
| 2003-2007 (ref.)                         |         |     |       |         |     |       |         |     |       |
| 2008                                     | 1.402   | *** | 0.133 | 1.402   | *** | 0.133 | 1.371   | **  | 0.135 |
| 2009                                     | 2.188   | *** | 0.264 | 2.188   | *** | 0.264 | 2.100   | *** | 0.260 |
| 2010                                     | 1.739   | *** | 0.222 | 1.739   | *** | 0.222 | 1.664   | *** | 0.220 |
| Detailed Employment Status               |         |     |       |         |     |       |         |     |       |
| Employed (ref.)                          |         |     |       |         |     |       |         |     |       |
| Unemployed - 2 to 5 months               |         |     |       | 1.621   | *   | 0.388 | 1.547   |     | 0.387 |
| Unemployed - at ATUS & CPS               |         |     |       | 1.702   | **  | 0.313 | 1.604   | *   | 0.305 |
| Out of Labor Force                       |         |     |       | 1.599   | *** | 0.132 | 1.538   | *** | 0.135 |
| Employment Status                        |         |     |       |         |     |       |         |     |       |
| Employed (ref.)                          |         |     |       |         |     |       |         |     |       |
| Unemployed                               | 1.670   | *** | 0.248 |         |     |       |         |     |       |
| Out of Labor Force                       | 1.599   | *** | 0.132 |         |     |       |         |     |       |
| <b>Socio-demographic Characteristics</b> |         |     |       |         |     |       |         |     |       |
| Female                                   |         |     |       |         |     |       | 1.131   |     | 0.083 |
| Life Stage                               |         |     |       |         |     |       |         |     |       |
| 45 or Younger without Child (ref.)       |         |     |       |         |     |       |         |     |       |
| Parent of Child under 18                 |         |     |       |         |     |       | 1.036   |     | 0.102 |
| Older than 45 without Child              |         |     |       |         |     |       | 1.167   |     | 0.128 |
| Marital or Partner Status/Spouse's       |         |     |       |         |     |       |         |     |       |
| Employment Status                        |         |     |       |         |     |       |         |     |       |
| No Spouse or Partner                     |         |     |       |         |     |       | 0.975   |     | 0.144 |
| Spouse/Partner FTE                       |         |     |       |         |     |       | 0.950   |     | 0.110 |
| Spouse/Partner PTE                       |         |     |       |         |     |       | 1.093   |     | 0.140 |
| Spouse/Partner is Not Emp (ref.)         |         |     |       |         |     |       |         |     |       |
| Education                                |         |     |       |         |     |       |         |     |       |
| High School Diploma or Less              |         |     |       |         |     |       | 1.165   |     | 0.099 |
| Some College or Associates               |         |     |       |         |     |       | 1.254   | **  | 0.104 |
| College Degree or More (ref.)            |         |     |       |         |     |       |         |     |       |
| Constant                                 | 0.061   | *** | 0.007 | 0.061   | *** | 0.007 | 0.053   | *** | 0.012 |

Notes: Model 1 N=42,218, Model 2 N=42,218, Model 3 N=42,978. + p<.10, \* p<.05, \*\* p<.01, \*\*\* p<.001.  
 Controls are added in Model 2. Controls include race, immigrant status, region, metropolitan area, and season.

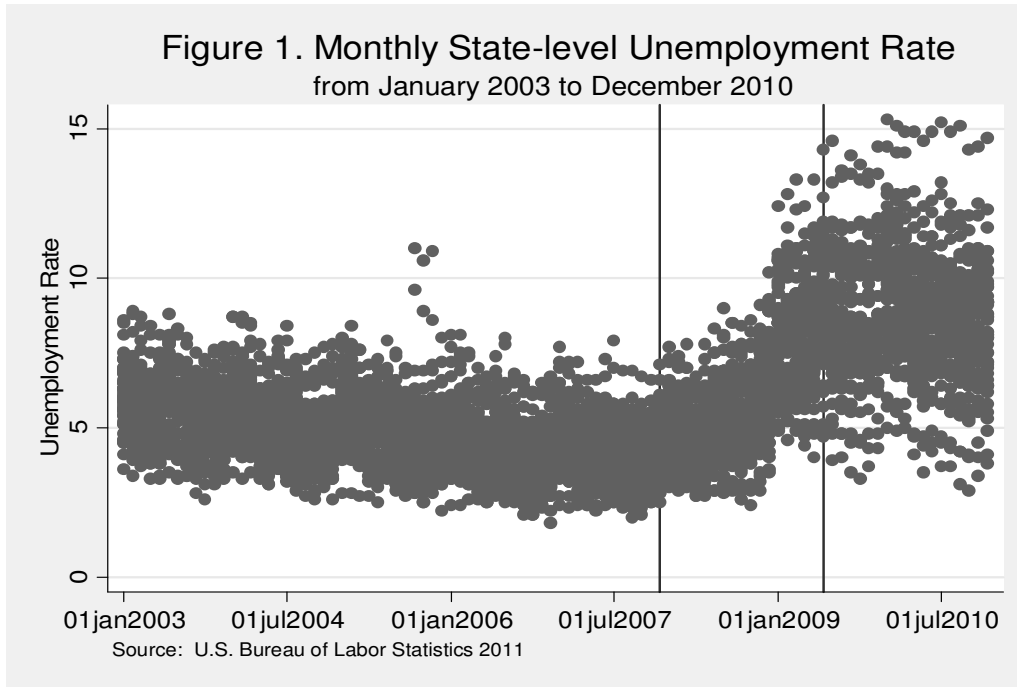


**Table 9. OLS Regression Models Predicting the Logged Time in Sleeplessness, ATUS 2003-2010.**

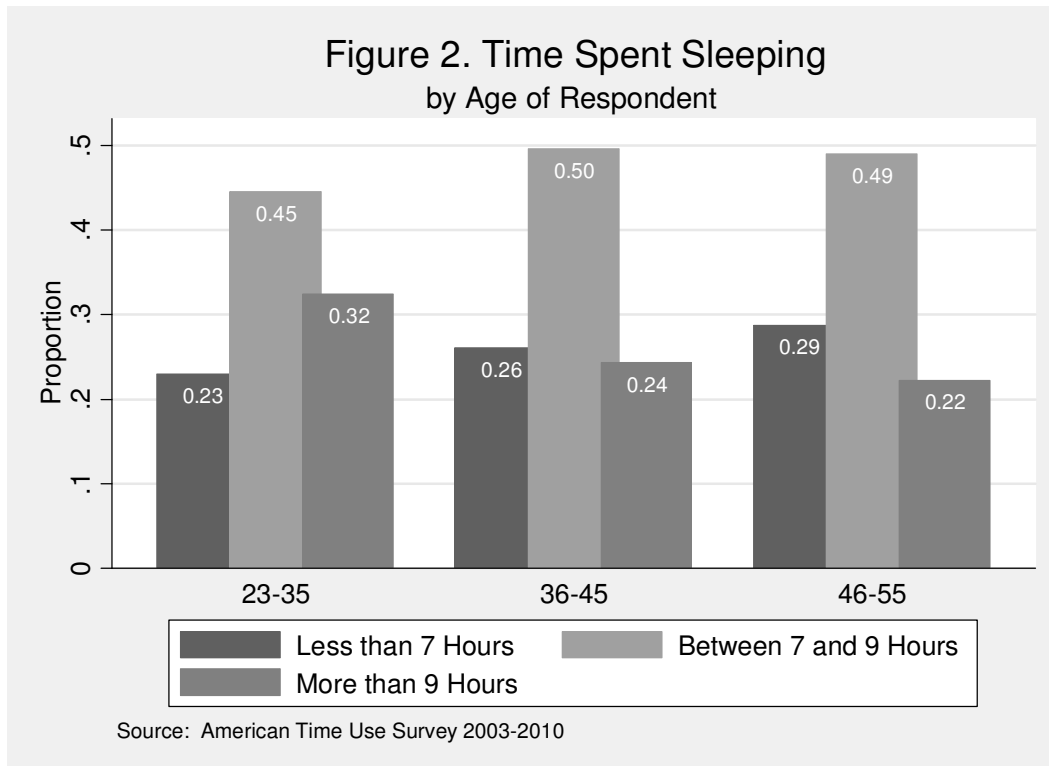
|   | Model 1 |     |       | Model 2 |     |       | Model 3 |     |       |
|---|---------|-----|-------|---------|-----|-------|---------|-----|-------|
|   | Coef.   |     | SE    | Coef.   |     | SE    | Coef.   |     | SE    |
| <b>Economic Climate</b>                   |         |     |       |         |     |       |         |     |       |
| State Level Unemployment                  | -0.152  | **  | 0.056 | -0.155  | **  | 0.055 | -0.091  | **  | 0.032 |
| Recessionary Time Period                  |         |     |       |         |     |       |         |     |       |
| 2003-2007 (ref.)                          |         |     |       |         |     |       |         |     |       |
| 2008                                      | 0.454   | *   | 0.181 | 0.466   | **  | 0.180 | 0.278   | *   | 0.113 |
| 2009                                      | 1.190   | **  | 0.421 | 1.217   | **  | 0.417 | 0.703   | **  | 0.242 |
| 2010                                      | 0.731   | *   | 0.297 | 0.750   | *   | 0.295 | 0.402   | *   | 0.182 |
| <b>Detailed Employment Status</b>         |         |     |       |         |     |       |         |     |       |
| Employed (ref.)                           |         |     |       |         |     |       |         |     |       |
| Unemployed - 2 to 5 Months                |         |     |       | 0.456   |     | 0.301 | 0.095   |     | 0.187 |
| Unemployed - at ATUS & CPS                |         |     |       | 0.584   |     | 0.321 | 0.107   |     | 0.179 |
| Out of Labor Force                        |         |     |       | 0.825   | **  | 0.252 | 0.434   | **  | 0.152 |
| <b>Employment Status</b>                  |         |     |       |         |     |       |         |     |       |
| Employed (ref.)                           |         |     |       |         |     |       |         |     |       |
| Unemployed                                | 0.512   |     | 0.307 |         |     |       |         |     |       |
| Out of Labor Force                        | 0.807   | **  | 0.255 |         |     |       |         |     |       |
| <b>Socio-demographic Characteristics</b>  |         |     |       |         |     |       |         |     |       |
| Female                                    |         |     |       |         |     |       | 0.136   | *   | 0.062 |
| <b>Life Stage</b>                         |         |     |       |         |     |       |         |     |       |
| 45 or Younger without Children (ref.)     |         |     |       |         |     |       |         |     |       |
| Parent of Child under 18                  |         |     |       |         |     |       | 0.048   |     | 0.066 |
| Older than 45 without Children            |         |     |       |         |     |       | 0.258   | **  | 0.088 |
| <b>Marital or Partner Status/Spouse's</b> |         |     |       |         |     |       |         |     |       |
| <b>Employment Status</b>                  |         |     |       |         |     |       |         |     |       |
| No Spouse or Partner                      |         |     |       |         |     |       | 0.002   |     | 0.111 |
| Spouse/Partner Employed Full-Time         |         |     |       |         |     |       | -0.013  |     | 0.073 |
| Spouse/Partner Employed Part-Time         |         |     |       |         |     |       | 0.104   |     | 0.080 |
| Spouse/Partner is Not Employed (ref.)     |         |     |       |         |     |       |         |     |       |
| <b>Education</b>                          |         |     |       |         |     |       |         |     |       |
| High School Diploma or Less               |         |     |       |         |     |       | 0.105   |     | 0.069 |
| Some College or Associates                |         |     |       |         |     |       | 0.175   |     | 0.092 |
| College Degree or More (ref.)             |         |     |       |         |     |       |         |     |       |
| Constant                                  | 5.412   | *** | 0.667 | 5.458   | *** | 0.660 | 4.320   | *** | 0.349 |

Notes: Model 1 N=1,816, Model 2 N=1,816, Model 3 N=1,754, Model 4 N=1,754, Model 5 N=1,754. + p<.10, \* p<.05, \*\* p<.01, \*\*\* p<.001. Controls include race, immigrant status, region, metropolitan area, season, and predicted probability of Sleeplessness calculated from the models shown in Appendix C.

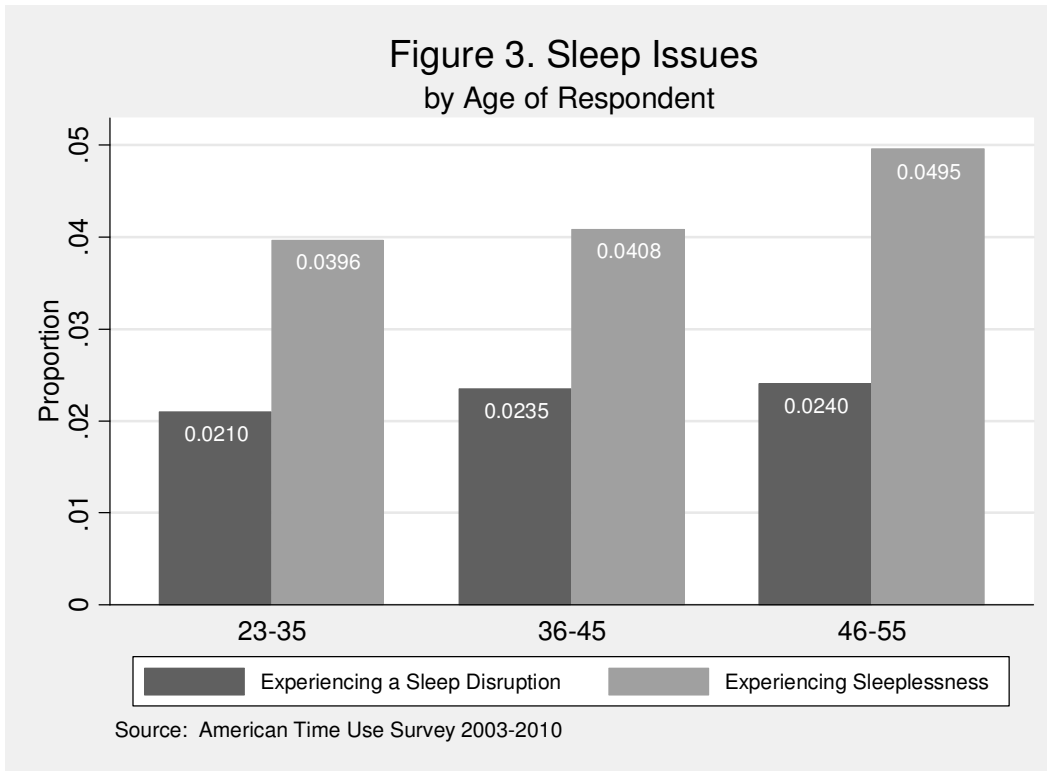
**Figure 1. Monthly State-level Unemployment Rate**



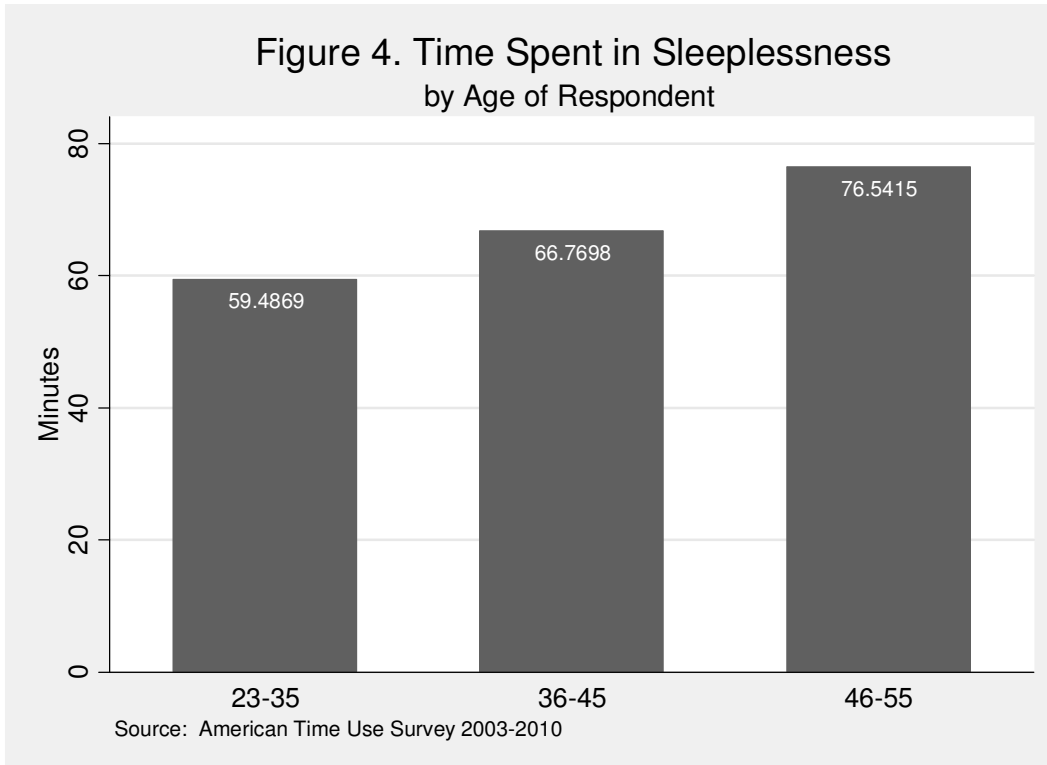
**Figure 2. Time Spent Sleeping by Age of Respondent**



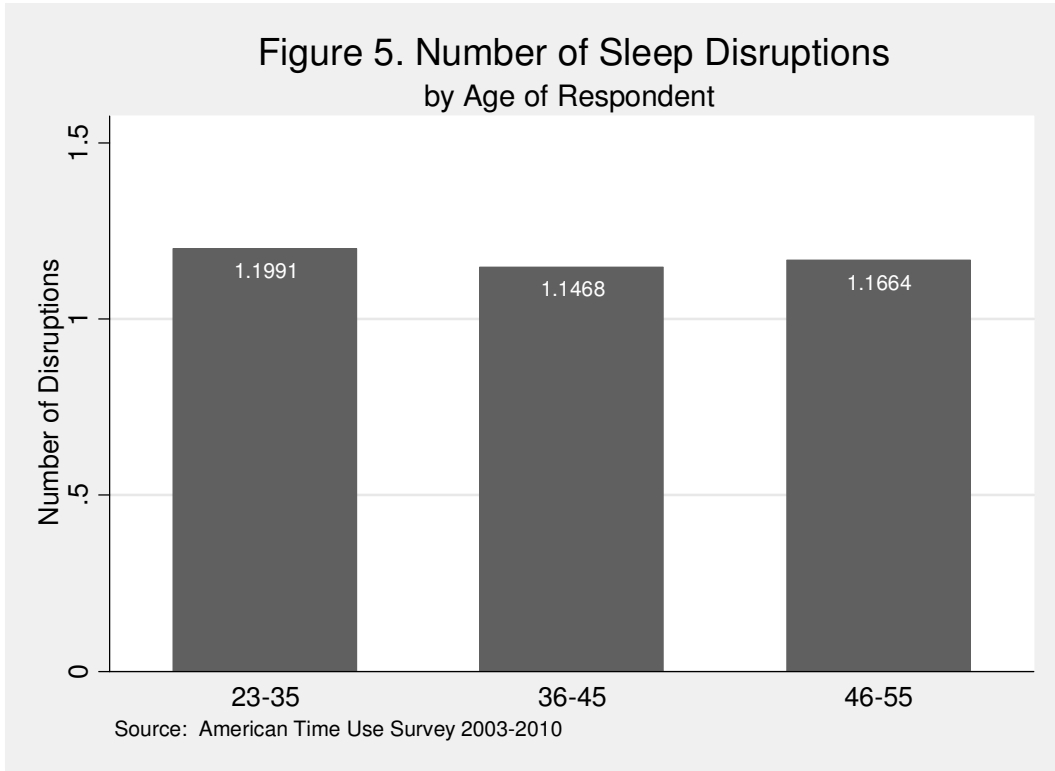
**Figure 3. Sleep Issues by Age of Respondent**



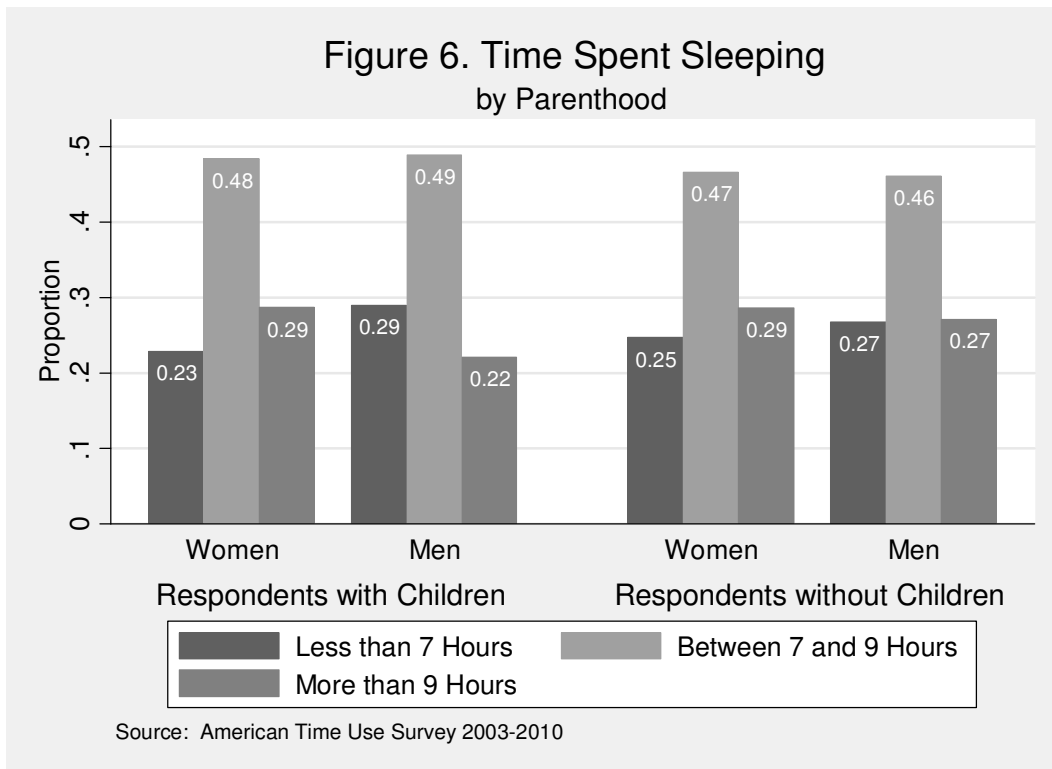
**Figure 4. Time Spent in Sleeplessness by Age of Respondent**



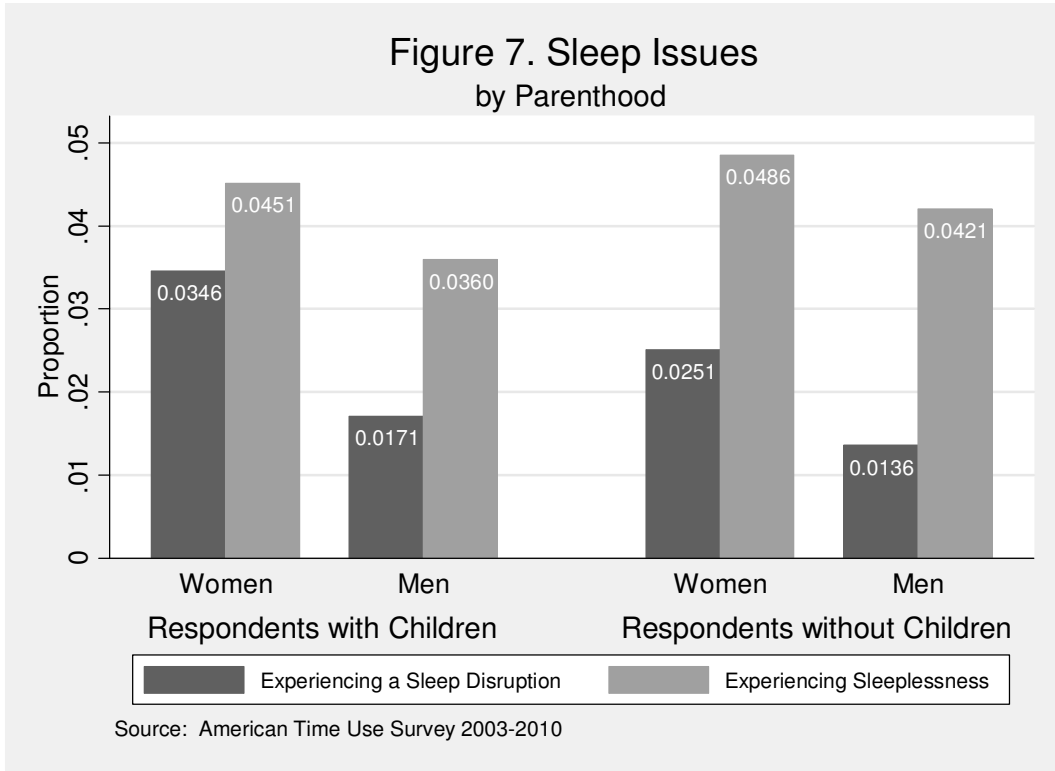
**Figure 5. Number of Sleep Disruptions by Age of Respondent**



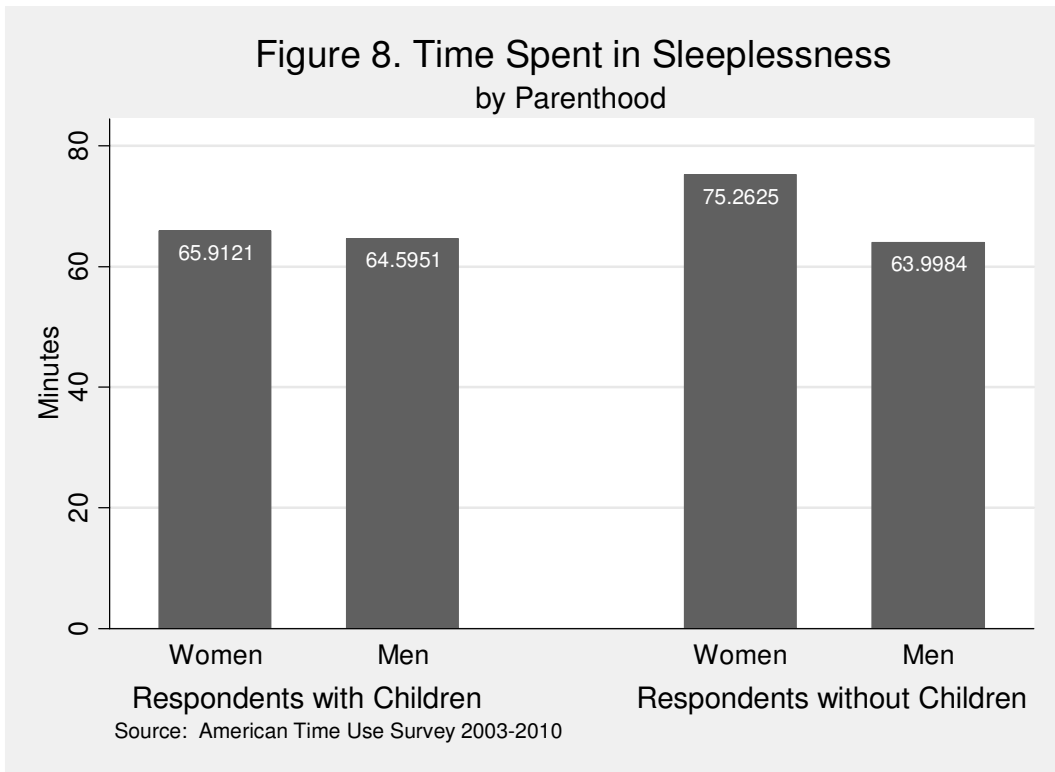
**Figure 6. Time Spent Sleeping by Parenthood**



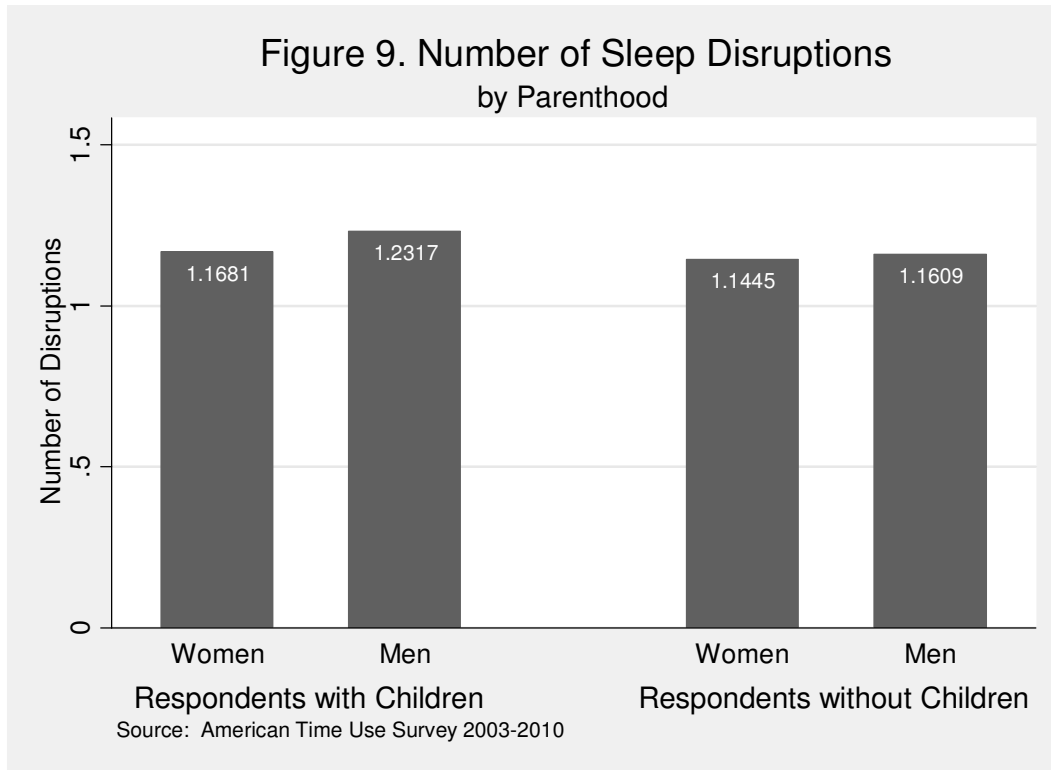
**Figure 7. Sleep Issues by Parenthood**



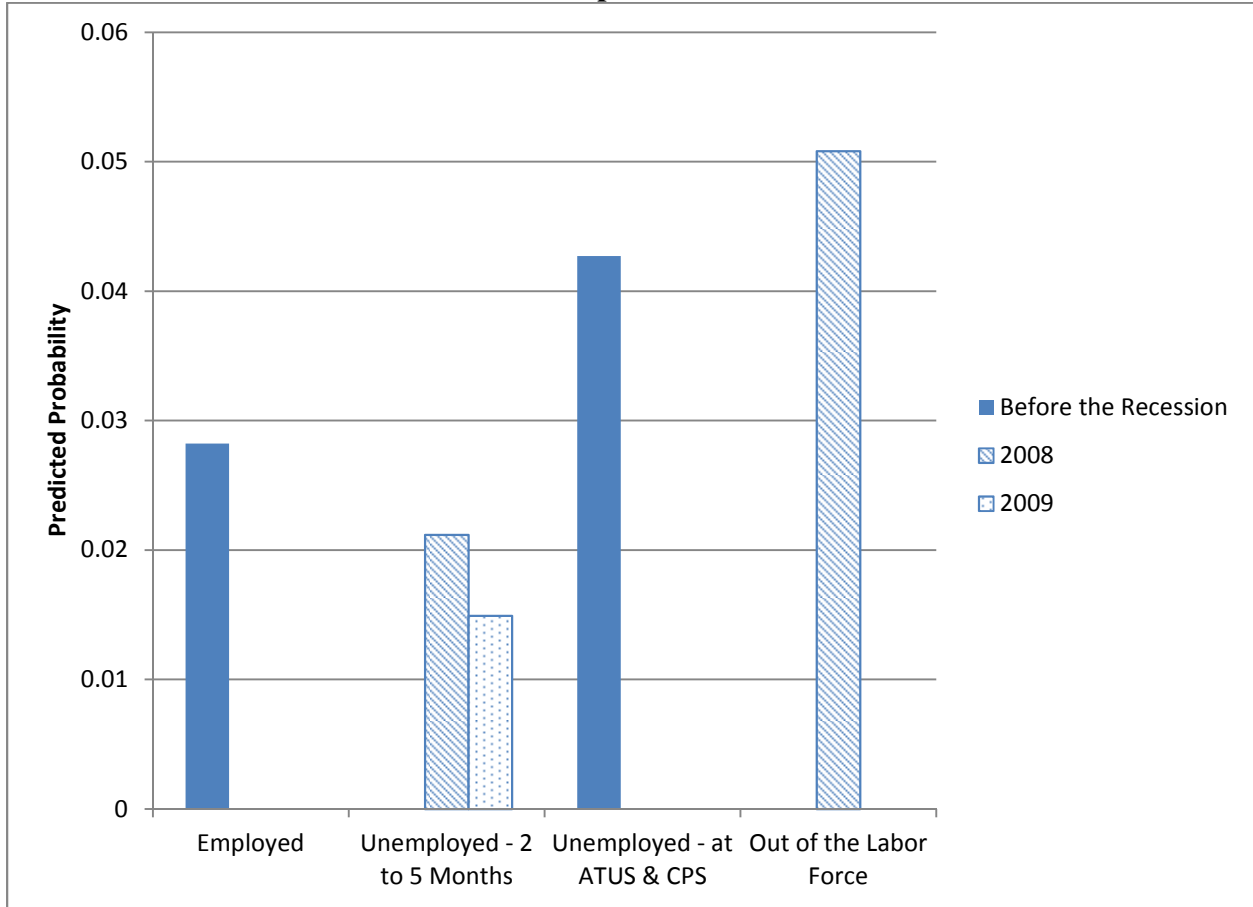
**Figure 8. Time Spent in Sleeplessness by Parenthood**



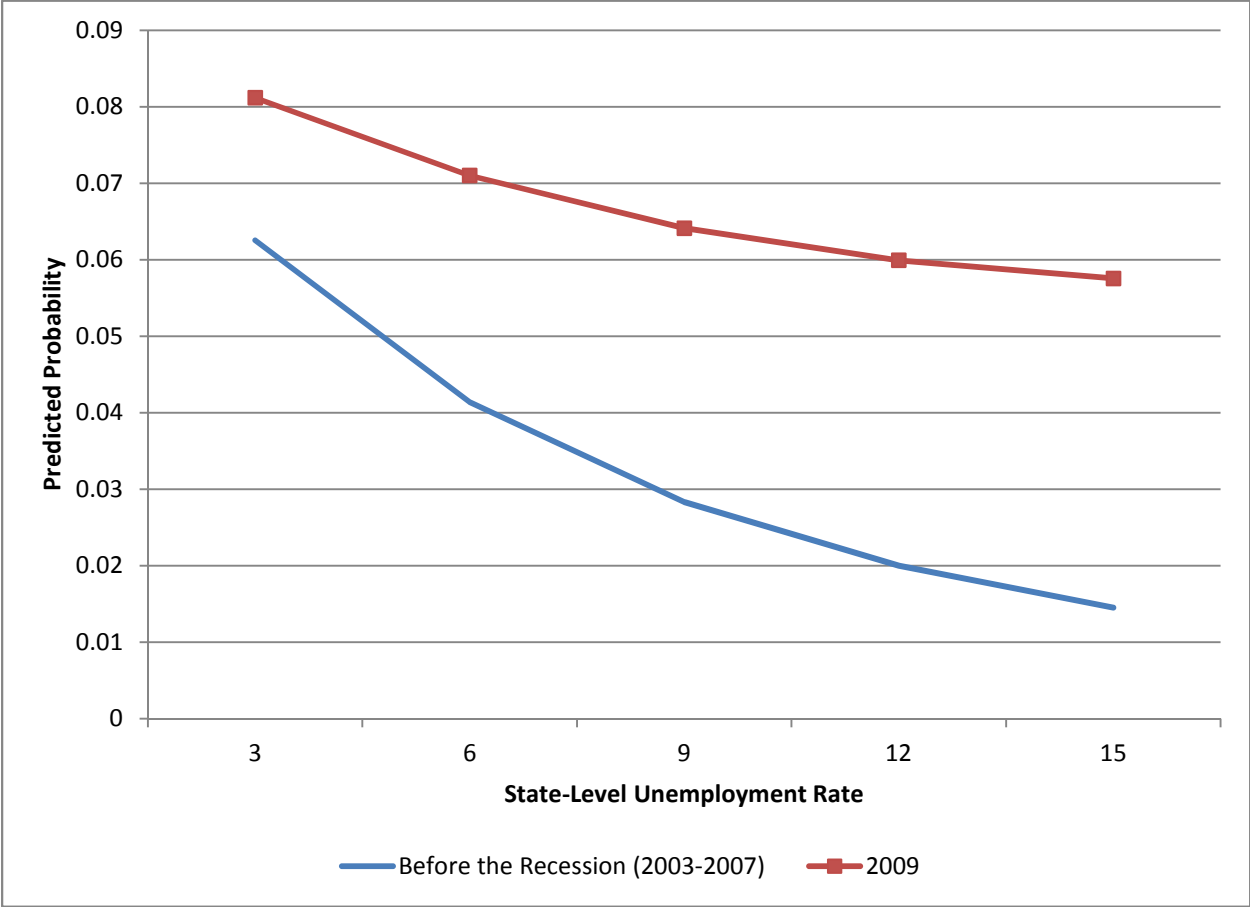
**Figure 9. Number of Sleep Disruptions by Parenthood**



**Figure 10. Moderating Effect of Being Unemployed and Recessionary Time Period for Sleeplessness**



**Figure 11. Moderating Effect of the Unemployment Rate and Recessionary Time Period for Sleeplessness**





## Appendices

### *Moderating Effects of Economic Climate*

#### **Appendix A. Multinomial Logistic Regression Models Predicting Time Sleeping with the Moderating Effects of Economic Climate, ATUS 2003-2010.**

|  | Model 4           |       |                   |       | Model 5           |       |                   |       |       |       |       |       |
|--|-------------------|-------|-------------------|-------|-------------------|-------|-------------------|-------|-------|-------|-------|-------|
|  | Less than 7 Hours |       | More than 9 Hours |       | Less than 7 Hours |       | More than 9 Hours |       |       |       |       |       |
|  | RRR               | SE    | RRR               | SE    | RRR               | SE    | RRR               | SE    |       |       |       |       |
| <b>Economic Climate</b>                      |                   |       |                   |       |                   |       |                   |       |       |       |       |       |
| State Level Unemployment Rate                | 0.909             | 0.089 | 0.982             | 0.083 | 2.106             | 1.887 | 3.728             | 3.034 |       |       |       |       |
| Time Period                                  |                   |       |                   |       |                   |       |                   |       |       |       |       |       |
| <i>2003-2007 (ref.)</i>                      |                   |       |                   |       |                   |       |                   |       |       |       |       |       |
| <i>2008</i>                                  | 1.082             | 0.268 | 0.917             | 0.220 | 1.068             | 0.820 | 1.759             | 1.133 |       |       |       |       |
| <i>2009</i>                                  | 0.985             | 0.251 | 0.641             | +     | 0.171             | 1.795 | *                 | 0.525 | 2.229 | **    | 0.552 |       |
| <i>2010</i>                                  | 0.623             | +     | 0.175             | 1.015 | 0.255             | 1.137 | 0.189             | 1.106 | 0.167 |       |       |       |
| Detailed Employment Status                   |                   |       |                   |       |                   |       |                   |       |       |       |       |       |
| <i>Employed (ref.)</i>                       |                   |       |                   |       |                   |       |                   |       |       |       |       |       |
| <i>Unemployed - 2 to 5 Months</i>            | 0.691             | 0.384 | 2.044             | 0.933 | 1.226             | 0.328 | 0.959             | 0.261 |       |       |       |       |
| <i>Unemployed - at ATUS &amp; CPS</i>        | 0.932             | 0.384 | 1.270             | 0.459 | 1.078             | 0.294 | 0.636             | 0.193 |       |       |       |       |
| <i>Out of Labor Force</i>                    | 1.223             | 0.264 | 2.035             | ***   | 0.354             | 0.728 | 0.222             | 1.139 | 0.326 |       |       |       |
| <b>Social Context</b>                        |                   |       |                   |       |                   |       |                   |       |       |       |       |       |
| Female                                       | 0.839             | ***   | 0.029             | 1.129 | ***               | 0.039 | 0.838             | ***   | 0.029 | 1.129 | ***   | 0.039 |
| Life Stage                                   |                   |       |                   |       |                   |       |                   |       |       |       |       |       |
| <i>45 or Younger without Children (ref.)</i> |                   |       |                   |       |                   |       |                   |       |       |       |       |       |
| <i>Parent of Child under 18</i>              | 1.077             | +     | 0.048             | 0.735 | ***               | 0.033 | 1.077             | +     | 0.048 | 0.735 | ***   | 0.033 |
| <i>Older than 45 without Children</i>        | 1.166             | **    | 0.060             | 0.659 | ***               | 0.034 | 1.167             | **    | 0.060 | 0.659 | ***   | 0.034 |
| Marital or Partner Status/Spouse's           |                   |       |                   |       |                   |       |                   |       |       |       |       |       |
| Employment Status                            |                   |       |                   |       |                   |       |                   |       |       |       |       |       |
| <i>No Spouse or Partner</i>                  | 1.113             | 0.077 | 0.890             | 0.069 | 1.115             | 0.078 | 0.889             | 0.069 |       |       |       |       |
| <i>Spouse/Partner Employed Full-Time</i>     | 1.022             | 0.052 | 0.808             | ***   | 0.040             | 1.023 | 0.052             | 0.808 | ***   | 0.040 |       |       |
| <i>Spouse/Partner Employed Part-Time</i>     | 1.139             | *     | 0.064             | 1.061 | 0.058             | 1.140 | *                 | 0.064 | 1.061 | 0.058 |       |       |
| <i>Spouse/Partner is Not Employed (ref.)</i> |                   |       |                   |       |                   |       |                   |       |       |       |       |       |
| Education                                    |                   |       |                   |       |                   |       |                   |       |       |       |       |       |
| <i>High School Diploma or Less</i>           | 1.156             | ***   | 0.046             | 1.481 | ***               | 0.063 | 1.156             | ***   | 0.046 | 1.481 | ***   | 0.063 |
| <i>Some College or Associates</i>            | 1.123             | **    | 0.045             | 1.722 | ***               | 0.070 | 1.123             | **    | 0.045 | 1.722 | ***   | 0.070 |
| <i>College Degree or More (ref.)</i>         |                   |       |                   |       |                   |       |                   |       |       |       |       |       |
| <b>Interactions</b>                          |                   |       |                   |       |                   |       |                   |       |       |       |       |       |

|   |       |     |       |  |       |     |       |  |       |     |       |       |           |
|---|-------|-----|-------|--|-------|-----|-------|--|-------|-----|-------|-------|-----------|
| <i>Unemployed - 2 to 5</i>                  |       |     |       |  |       |     |       |  |       |     |       |       |           |
| <i>Months*Unemployment Rate</i>             | 1.063 |     | 0.101 |  | 0.994 |     | 0.080 |  | 0.860 |     | 0.140 | 0.888 | 0.130     |
| <i>Unemployed - at ATUS &amp;</i>           |       |     |       |  |       |     |       |  |       |     |       |       |           |
| <i>CPS*Unemployment Rate</i>                | 0.895 |     | 0.180 |  | 1.117 |     | 0.189 |  | 1.332 |     | 0.470 | 1.319 | 0.412     |
| <i>Out of Labor Force*Unemployment Rate</i> | 0.792 |     | 0.226 |  | 1.032 |     | 0.247 |  | 1.388 |     | 0.680 | 1.424 | 0.627     |
| <i>Unemployed - 2 to 5 Months*2008</i>      | 0.693 |     | 0.295 |  | 1.481 |     | 0.551 |  | 0.047 | +   | 0.077 | 0.869 | 1.400     |
| <i>Unemployed - at ATUS &amp; CPS*2008</i>  | 0.669 |     | 0.248 |  | 0.650 |     | 0.197 |  | 0.950 |     | 1.455 | 0.274 | 0.407     |
| <i>Out of Labor Force*2008</i>              | 1.086 |     | 0.175 |  | 1.085 |     | 0.149 |  | 0.449 |     | 0.338 | 0.868 | 0.538     |
| <i>Unemployed - 2 to 5 Months*2009</i>      | 0.472 |     | 0.267 |  | 1.110 |     | 0.531 |  | 0.128 |     | 0.216 | 0.205 | 0.378     |
| <i>Unemployed - at ATUS &amp; CPS*2009</i>  | 0.591 |     | 0.231 |  | 0.545 | +   | 0.182 |  | 0.122 |     | 0.168 | 0.420 | 0.587     |
| <i>Out of Labor Force*2009</i>              | 1.334 |     | 0.286 |  | 1.126 |     | 0.204 |  | 1.069 |     | 0.954 | 1.521 | 1.045     |
| <i>Unemployed - 2 to 5 Months*2010</i>      | 0.442 |     | 0.232 |  | 0.737 |     | 0.349 |  | 0.033 |     | 0.077 | 0.377 | 0.580     |
| <i>Unemployed - at ATUS &amp; CPS*2010</i>  | 0.732 |     | 0.325 |  | 0.637 |     | 0.227 |  | 1.263 |     | 1.874 | 0.352 | 0.401     |
| <i>Out of Labor Force*2010</i>              | 1.022 |     | 0.235 |  | 0.953 |     | 0.186 |  | 0.267 |     | 0.225 | 0.540 | 0.372     |
| <i>2008*Unemployment Rate</i>               | 0.987 |     | 0.042 |  | 1.011 |     | 0.041 |  | 0.964 |     | 0.045 | 1.002 | 0.047     |
| <i>2009*Unemployment Rate</i>               | 1.017 |     | 0.032 |  | 1.077 | *   | 0.035 |  | 1.002 |     | 0.034 | 1.076 | + 0.040   |
| <i>2010*Unemployment Rate</i>               | 1.058 | +   | 0.034 |  | 1.014 |     | 0.030 |  | 1.035 |     | 0.036 | 1.000 | 0.034     |
| <i>Unemployed - 2 to 5</i>                  |       |     |       |  |       |     |       |  |       |     |       |       |           |
| <i>Months*Unemployment Rate*2008</i>        |       |     |       |  |       |     |       |  | 1.591 | +   | 0.441 | 1.107 | 0.290     |
| <i>Unemployed - at ATUS &amp;</i>           |       |     |       |  |       |     |       |  |       |     |       |       |           |
| <i>CPS*Unemployment Rate*2008</i>           |       |     |       |  |       |     |       |  | 0.947 |     | 0.241 | 1.156 | 0.279     |
| <i>Out of Labor Force*Unemployment</i>      |       |     |       |  |       |     |       |  |       |     |       |       |           |
| <i>Rate*2008</i>                            |       |     |       |  |       |     |       |  | 1.174 |     | 0.155 | 1.041 | 0.111     |
| <i>Unemployed - 2 to 5</i>                  |       |     |       |  |       |     |       |  |       |     |       |       |           |
| <i>Months*Unemployment Rate*2009</i>        |       |     |       |  |       |     |       |  | 1.262 |     | 0.283 | 1.257 | 0.281     |
| <i>Unemployed - at ATUS &amp;</i>           |       |     |       |  |       |     |       |  |       |     |       |       |           |
| <i>CPS*Unemployment Rate*2009</i>           |       |     |       |  |       |     |       |  | 1.194 |     | 0.220 | 1.056 | 0.185     |
| <i>Out of Labor Force*Unemployment</i>      |       |     |       |  |       |     |       |  |       |     |       |       |           |
| <i>Rate*2009</i>                            |       |     |       |  |       |     |       |  | 1.058 |     | 0.112 | 0.976 | 0.080     |
| <i>Unemployed - 2 to 5</i>                  |       |     |       |  |       |     |       |  |       |     |       |       |           |
| <i>Months*Unemployment Rate*2010</i>        |       |     |       |  |       |     |       |  | 1.430 |     | 0.384 | 1.128 | 0.223     |
| <i>Unemployed - at ATUS &amp;</i>           |       |     |       |  |       |     |       |  |       |     |       |       |           |
| <i>CPS*Unemployment Rate*2010</i>           |       |     |       |  |       |     |       |  | 0.959 |     | 0.182 | 1.091 | 0.159     |
| <i>Out of Labor Force*Unemployment</i>      |       |     |       |  |       |     |       |  |       |     |       |       |           |
| <i>Rate*2010</i>                            |       |     |       |  |       |     |       |  | 1.190 | +   | 0.115 | 1.069 | 0.084     |
| Constant                                    | 0.635 | *** | 0.080 |  | 0.425 | *** | 0.056 |  | 0.597 | *** | 0.077 | 0.413 | *** 0.057 |

Notes: N=42,978. \* p<.05, \*\* p <.01, \*\*\* p<.001. Controls include race, immigrant status, region, metropolitan area, and season.

**Appendix B. Logistic Regression Models Predicting Experiencing a Sleep Disruption with Moderating Effects of Economic Climate, ATUS 2003-2010.**

|  | Model 4 |           | Model 5 |     |           |
|--|---------|-----------|---------|-----|-----------|
|  | OR      | SE        | OR      | SE  |           |
| <b>Economic Climate</b>                              |         |           |         |     |           |
| State Level Unemployment                             | 1.412   | 0.546     | 4.670   | *   | 3.160     |
| Time Period  |         |           |         |     |           |
| 2003-2007 (ref.)                                     |         |           |         |     |           |
| 2008   | 2.067   | 0.981     | 2.000   |     | 1.044     |
| 2009   | 0.465   | 0.315     | 0.404   |     | 0.312     |
| 2010   | 0.674   | 0.471     | 1.122   |     | 0.861     |
| Detailed Employment Status                           |         |           |         |     |           |
| Employed (ref.)                                      |         |           |         |     |           |
| Unemployed - 2 to 5 months                           | 1.393   | 3.756     | 323.400 | +   | 1,091.688 |
| Unemployed - at ATUS & CPS                           | 0.928   | 0.927     | 1.554   |     | 2.520     |
| Out of Labor Force                                   | 3.365   | ** 1.304  | 3.388   | *   | 1.774     |
| <b>Social Context</b>                                |         |           |         |     |           |
| Female   | 1.756   | *** 0.174 | 1.754   | *** | 0.174     |
| Life Stage   |         |           |         |     |           |
| 45 or Younger without Children (ref.)                |         |           |         |     |           |
| Parent of Child under 18                             | 1.653   | *** 0.226 | 1.655   | *** | 0.226     |
| Older than 45 without Children                       | 1.591   | ** 0.246  | 1.592   | **  | 0.246     |
| Marital or Partner Status/Spouse's Employment Status |         |           |         |     |           |
| No Spouse or Partner                                 | 1.013   | 0.195     | 1.018   |     | 0.196     |
| Spouse/Partner Employed Full-Time                    | 1.038   | 0.149     | 1.037   |     | 0.149     |
| Spouse/Partner Employed Part-Time                    | 0.812   | 0.132     | 0.813   |     | 0.132     |
| Spouse/Partner is Not Employed (ref.)                |         |           |         |     |           |
| Education  |         |           |         |     |           |
| High School Diploma or Less                          | 1.343   | ** 0.136  | 1.345   | **  | 0.137     |
| Some College or Associates                           | 1.179   | 0.122     | 1.182   |     | 0.122     |
| College Degree or More (ref.)                        |         |           |         |     |           |
| <b>Interactions</b>                                  |         |           |         |     |           |
| Unemployed - 2 to 5 months*Unemployment Rate         | 0.809   | 0.310     | 0.247   | *   | 0.165     |
| Unemployed - at ATUS & CPS*Unemployment Rate         | 1.590   | 1.241     | 15.531  | *   | 21.209    |
| Out of Labor Force*Unemployment Rate                 | 1.678   | 1.932     | 58.942  | *   | 118.490   |
| Unemployed - 2 to 5 months*2008                      |         |           |         |     |           |
| Unemployed - at ATUS & CPS*2008                      | 0.807   | 0.667     | 0.098   |     | 0.208     |
| Out of Labor Force*2008                              | 0.689   | 0.220     | 1.429   |     | 1.886     |
| Unemployed - 2 to 5 months*2009                      | 5.977   | + 5.814   | 0.002   |     | 0.009     |
| Unemployed - at ATUS & CPS*2009                      | 0.332   | 0.298     | 0.004   | **  | 0.008     |
| Out of Labor Force*2009                              | 1.258   | 0.572     | 6.346   |     | 10.650    |
| Unemployed - 2 to 5 months*2010                      | 5.056   | + 4.478   | 0.000   | +   | 0.001     |
| Unemployed - at ATUS & CPS*2010                      | 0.605   | 0.585     | 0.645   |     | 1.579     |
| Out of Labor Force*2010                              | 1.103   | 0.499     | 0.123   |     | 0.194     |
| 2008*Unemployment Rate                               | 0.832   | * 0.068   | 0.837   | *   | 0.076     |
| 2009*Unemployment Rate                               | 0.969   | 0.078     | 0.980   |     | 0.089     |
| 2010*Unemployment Rate                               | 0.938   | 0.070     | 0.886   |     | 0.076     |
| Unemployed - 2 to 5 months*Unemployment Rate*2008    |         |           |         |     |           |
| Unemployed - at ATUS & CPS*Unemployment Rate*2008    |         |           | 1.407   |     | 0.498     |

|  |       |     |       |       |     |       |
|--|-------|-----|-------|-------|-----|-------|
| <i>Out of Labor Force*Unemployment Rate*2008</i>             |       |     |       | 0.875 |     | 0.211 |
| <i>Unemployed - 2 to 5 months*Unemployment Rate*2009</i>     |       |     |       | 4.247 | *   | 2.970 |
| <i>Unemployed - at ATUS &amp; CPS*Unemployment Rate*2009</i> |       |     |       | 1.617 |     | 0.500 |
| <i>Out of Labor Force*Unemployment Rate*2009</i>             |       |     |       | 0.835 |     | 0.173 |
| <i>Unemployed - 2 to 5 months*Unemployment Rate*2010</i>     |       |     |       | 5.371 | *   | 4.071 |
| <i>Unemployed - at ATUS &amp; CPS*Unemployment Rate*2010</i> |       |     |       | 1.042 |     | 0.349 |
| <i>Out of Labor Force*Unemployment Rate*2010</i>             |       |     |       | 1.255 |     | 0.214 |
| Constant   | 0.005 | *** | 0.002 | 0.005 | *** | 0.002 |

Notes: N=42,888. + p<.10, \* p<.05, \*\* p <.01, \*\*\* p<.001. Controls include race, immigrant status, region, metropolitan area, and season.

### Appendix C. Logistic Regression Models Predicting Experiencing Sleeplessness with Moderating Effects of Economic Climate, ATUS 2003-2010.

|   | Model 4 |    | Model 5 |        | SE  |        |
|---|---------|----|---------|--------|-----|--------|
|   | OR      |    | OR      |        |     |        |
| <b>Economic Climate</b>                                 |         |    |         |        |     |        |
| State Level Unemployment                                | 0.704   | *  | 0.119   | 0.912  | *** | 0.021  |
| Time Period   |         |    |         |        |     |        |
| <i>2003-2007 (ref.)</i>                                 |         |    |         |        |     |        |
| <i>2008</i>   | 1.228   |    | 0.481   | 1.371  | **  | 0.135  |
| <i>2009</i>   | 1.050   |    | 0.489   | 2.100  | *** | 0.260  |
| <i>2010</i>   | 1.000   |    | 0.459   | 1.664  | *** | 0.220  |
| Detailed Employment Status                              |         |    |         |        |     |        |
| <i>Employed (ref.)</i>                                  |         |    |         |        |     |        |
| <i>Unemployed - 2 to 5 months</i>                       | 0.885   |    | 0.684   | 0.571  |     | 0.851  |
| <i>Unemployed - at ATUS &amp; CPS</i>                   | 6.670   | ** | 4.864   | 43.033 | *   | 66.165 |
| <i>Out of Labor Force</i>                               | 1.204   |    | 0.369   | 1.566  |     | 0.760  |
| <b>Social Context</b>                                   |         |    |         |        |     |        |
| Female  | 1.136   | +  | 0.084   | 1.131  | +   | 0.083  |
| Life Stage  |         |    |         |        |     |        |
| <i>45 or Younger without Children (ref.)</i>            |         |    |         |        |     |        |
| <i>Parent of Child under 18</i>                         | 1.031   |    | 0.102   | 1.036  |     | 0.102  |
| <i>Older than 45 without Children</i>                   | 1.162   |    | 0.127   | 1.167  |     | 0.128  |
| Marital or Partner Status/Spouse's Employment Status    |         |    |         |        |     |        |
| <i>No Spouse or Partner</i>                             | 0.973   |    | 0.144   | 0.975  |     | 0.144  |
| <i>Spouse/Partner Employed Full-Time</i>                | 0.950   |    | 0.110   | 0.950  |     | 0.110  |
| <i>Spouse/Partner Employed Part-Time</i>                | 1.094   |    | 0.140   | 1.093  |     | 0.140  |
| <i>Spouse/Partner is Not Employed (ref.)</i>            |         |    |         |        |     |        |
| Education   |         |    |         |        |     |        |
| <i>High School Diploma or Less</i>                      | 1.163   | +  | 0.099   | 1.165  | +   | 0.099  |
| <i>Some College or Associates</i>                       | 1.254   | ** | 0.104   | 1.254  | **  | 0.104  |
| <i>College Degree or More (ref.)</i>                    |         |    |         |        |     |        |
| <b>Interactions</b>                                     |         |    |         |        |     |        |
| <i>Unemployed - 2 to 5 months*Unemployment Rate</i>     | 1.203   |    | 0.196   | 1.304  |     | 0.394  |
| <i>Unemployed - at ATUS &amp; CPS*Unemployment Rate</i> | 0.548   | +  | 0.188   | 0.318  | +   | 0.215  |
| <i>Out of Labor Force*Unemployment Rate</i>             | 0.620   |    | 0.302   | 0.462  |     | 0.418  |

|  |       |     |       |       |     |       |
|--|-------|-----|-------|-------|-----|-------|
| <i>Unemployed - 2 to 5 months*2008</i>                       | 0.149 | *   | 0.126 | 0.011 |     | 0.031 |
| <i>Unemployed - at ATUS &amp; CPS*2008</i>                   | 0.374 |     | 0.268 | 0.007 | **  | 0.013 |
| <i>Out of Labor Force*2008</i>                               | 0.540 | *   | 0.135 | 0.392 |     | 0.377 |
| <i>Unemployed - 2 to 5 months*2009</i>                       | 0.081 | *   | 0.098 | 2.250 |     | 5.312 |
| <i>Unemployed - at ATUS &amp; CPS*2009</i>                   | 2.087 |     | 1.398 | 0.236 |     | 0.561 |
| <i>Out of Labor Force*2009</i>                               | 0.579 | +   | 0.168 | 0.218 |     | 0.247 |
| <i>Unemployed - 2 to 5 months*2010</i>                       | 0.419 |     | 0.438 | 1.251 |     | 3.090 |
| <i>Unemployed - at ATUS &amp; CPS*2010</i>                   | 1.648 |     | 0.978 | 0.030 |     | 0.066 |
| <i>Out of Labor Force*2010</i>                               | 0.555 | +   | 0.187 | 0.500 |     | 0.485 |
| <i>2008*Unemployment Rate</i>                                | 1.058 |     | 0.074 | 1.023 |     | 0.081 |
| <i>2009*Unemployment Rate</i>                                | 1.127 | *   | 0.066 | 1.089 |     | 0.074 |
| <i>2010*Unemployment Rate</i>                                | 1.102 | +   | 0.063 | 1.071 |     | 0.071 |
| <i>Unemployed - 2 to 5 months*Unemployment Rate*2008</i>     |       |     |       | 1.473 |     | 0.705 |
| <i>Unemployed - at ATUS &amp; CPS*Unemployment Rate*2008</i> |       |     |       | 2.110 | *   | 0.726 |
| <i>Out of Labor Force*Unemployment Rate*2008</i>             |       |     |       | 1.064 |     | 0.173 |
| <i>Unemployed - 2 to 5 months*Unemployment Rate*2009</i>     |       |     |       | 0.677 |     | 0.234 |
| <i>Unemployed - at ATUS &amp; CPS*Unemployment Rate*2009</i> |       |     |       | 1.520 |     | 0.564 |
| <i>Out of Labor Force*Unemployment Rate*2009</i>             |       |     |       | 1.137 |     | 0.159 |
| <i>Unemployed - 2 to 5 months*Unemployment Rate*2010</i>     |       |     |       | 0.864 |     | 0.314 |
| <i>Unemployed - at ATUS &amp; CPS*Unemployment Rate*2010</i> |       |     |       | 1.838 | +   | 0.657 |
| <i>Out of Labor Force*Unemployment Rate*2010</i>             |       |     |       | 1.036 |     | 0.126 |
| Constant   | 0.074 | *** | 0.021 | 0.066 | *** | 0.020 |

Notes: N=42,978. + p<.10, \* p<.05, \*\* p <.01, \*\*\* p<.001. Controls include race, immigrant status, region, metropolitan area, and season.

#### **Appendix D. OLS Regression Models Predicting the Logged Time in Sleeplessness, ATUS 2003-2010.**

|  | Model 1 |       | Model 2 |    |       |
|--|---------|-------|---------|----|-------|
|  | Coef.   | SE    | Coef.   | SE |       |
| <b>Economic Climate</b>                      |         |       |         |    |       |
| State Level Unemployment                     | 0.043   | 0.127 | -0.091  | ** | 0.032 |
| Recessionary Time Period                     |         |       |         |    |       |
| <i>2003-2007 (ref.)</i>                      |         |       |         |    |       |
| <i>2008</i>                                  | 0.069   | 0.317 | 0.278   | *  | 0.113 |
| <i>2009</i>                                  | -0.224  | 0.319 | 0.703   | ** | 0.242 |
| <i>2010</i>                                  | 0.232   | 0.314 | 0.402   | *  | 0.182 |
| Detailed Employment Status                   |         |       |         |    |       |
| <i>Employed (ref.)</i>                       |         |       |         |    |       |
| <i>Unemployed - 2 to 5 Months</i>            | 0.636   | 0.407 | 0.741   |    | 0.796 |
| <i>Unemployed - at ATUS &amp; CPS</i>        | -0.064  | 0.719 | 0.203   |    | 1.689 |
| <i>Out of Labor Force</i>                    | 0.165   | 0.247 | 0.019   |    | 0.443 |
| Employment Status                            |         |       |         |    |       |
| <i>Employed (ref.)</i>                       |         |       |         |    |       |
| <i>Unemployed</i>                            |         |       |         |    |       |
| <i>Out of Labor Force</i>                    |         |       |         |    |       |
| <b>Social Context</b>                        |         |       |         |    |       |
| Female                                       | 0.090   | 0.060 | 0.136   | *  | 0.062 |
| Life Stage                                   |         |       |         |    |       |
| <i>45 or Younger without Children (ref.)</i> |         |       |         |    |       |
| <i>Parent of Child under 18</i>              | 0.046   | 0.066 | 0.048   |    | 0.066 |

|  |        |     |       |         |     |       |
|--|--------|-----|-------|---------|-----|-------|
| <i>Older than 45 without Children</i>                        | 0.218  | **  | 0.082 | 0.258   | **  | 0.088 |
| <b>Marital or Partner Status/Spouse's Employment Status</b>  |        |     |       |         |     |       |
| <i>No Spouse or Partner</i>                                  | 0.008  |     | 0.111 | 0.002   |     | 0.111 |
| <i>Spouse/Partner Employed Full-Time</i>                     | 0.016  |     | 0.073 | -0.013  |     | 0.073 |
| <i>Spouse/Partner Employed Part-Time</i>                     | 0.079  |     | 0.079 | 0.104   |     | 0.080 |
| <i>Spouse/Partner is Not Employed (ref.)</i>                 |        |     |       |         |     |       |
| <b>Education</b>   |        |     |       |         |     |       |
| <i>High School Diploma or Less</i>                           | 0.060  |     | 0.065 | 0.105   |     | 0.069 |
| <i>Some College or Associates</i>                            | 0.096  |     | 0.084 | 0.175   | +   | 0.092 |
| <i>College Degree or More (ref.)</i>                         |        |     |       |         |     |       |
| <b>Interactions</b>  |        |     |       |         |     |       |
| <i>Unemployed - 2 to 5 Months*Unemployment Rate</i>          | -0.136 |     | 0.091 | -0.158  |     | 0.157 |
| <i>Unemployed - at ATUS &amp; CPS*Unemployment Rate</i>      | 0.282  |     | 0.248 | 0.269   |     | 0.485 |
| <i>Out of Labor Force*Unemployment Rate</i>                  | 0.439  | +   | 0.265 | 0.533   |     | 0.472 |
| <i>Unemployed - 2 to 5 Months*2008</i>                       | 0.556  |     | 0.454 | 0.723   |     | 0.996 |
| <i>Unemployed - at ATUS &amp; CPS*2008</i>                   | -0.615 | +   | 0.360 | -12.931 | **  | 4.581 |
| <i>Out of Labor Force*2008</i>                               | -0.500 | *   | 0.201 | -0.048  |     | 0.714 |
| <i>Unemployed - 2 to 5 Months*2009</i>                       | 0.664  |     | 0.701 | -0.180  |     | 1.822 |
| <i>Unemployed - at ATUS &amp; CPS*2009</i>                   | -0.221 |     | 0.433 | -0.743  |     | 1.272 |
| <i>Out of Labor Force*2009</i>                               | -0.298 |     | 0.237 | -0.599  |     | 0.927 |
| <i>Unemployed - 2 to 5 Months*2010</i>                       | 0.852  | +   | 0.438 | 0.706   |     | 0.997 |
| <i>Unemployed - at ATUS &amp; CPS*2010</i>                   | 0.144  |     | 0.391 | -0.491  |     | 1.764 |
| <i>Out of Labor Force*2010</i>                               | 0.019  |     | 0.263 | 1.429   | +   | 0.832 |
| <i>2008*Unemployment Rate</i>                                | 0.034  |     | 0.055 | 0.043   |     | 0.064 |
| <i>2009*Unemployment Rate</i>                                | 0.092  | +   | 0.050 | 0.084   |     | 0.054 |
| <i>2010*Unemployment Rate</i>                                | 0.009  |     | 0.050 | 0.023   |     | 0.053 |
| <i>Unemployed - 2 to 5 Months*Unemployment Rate*2008</i>     |        |     |       | -0.016  |     | 0.167 |
| <i>Unemployed - at ATUS &amp; CPS*Unemployment Rate*2008</i> |        |     |       | 2.004   | **  | 0.736 |
| <i>Out of Labor Force*Unemployment Rate*2008</i>             |        |     |       | -0.081  |     | 0.118 |
| <i>Unemployed - 2 to 5 Months*Unemployment Rate*2009</i>     |        |     |       | 0.108   |     | 0.234 |
| <i>Unemployed - at ATUS &amp; CPS*Unemployment Rate*2009</i> |        |     |       | 0.085   |     | 0.238 |
| <i>Out of Labor Force*Unemployment Rate*2009</i>             |        |     |       | 0.020   |     | 0.116 |
| <i>Unemployed - 2 to 5 Months*Unemployment Rate*2010</i>     |        |     |       | 0.023   |     | 0.159 |
| <i>Unemployed - at ATUS &amp; CPS*Unemployment Rate*2010</i> |        |     |       | 0.094   |     | 0.286 |
| <i>Out of Labor Force*Unemployment Rate*2010</i>             |        |     |       | -0.161  |     | 0.105 |
| <b>Constant</b>  | 4.054  | *** | 0.404 | 4.049   | *** | 0.350 |

Notes: Model 1 N=1,816, Model 2 N=1,816, Model 3 N=1,754, Model 4 N=1,754, Model 5 N=1,754. + p<.10, \* p<.05, \*\* p <.01, \*\*\* p<.001. Controls include race, immigrant status, region, metropolitan area, season, and predicted probability of Sleeplessness calculated from the models shown in Appendix C.

*Additional Analyses – Number of Sleep Disruptions*

**Appendix E. OLS Regression Models Predicting the Number of Sleep Disruptions, ATUS 2003-2010.**

|  | Model 1 |       | Model 2 |       | Model 3 |       | Model 4 |     | Model 5 |        |     |       |
|--|---------|-------|---------|-------|---------|-------|---------|-----|---------|--------|-----|-------|
|  | Coef.   | SE    | Coef.   | SE    | Coef.   | SE    | Coef.   | SE  | Coef.   | SE     |     |       |
| <b>Economic Climate</b>                              |         |       |         |       |         |       |         |     |         |        |     |       |
| State Level  |         |       |         |       |         |       |         |     |         |        |     |       |
| Unemployment Rate                                    | -0.015  | 0.013 | -0.013  | 0.013 | -0.007  | 0.011 | 0.114   | +   | 0.067   | 0.323  | *** | 0.058 |
| Recessionary Time Period                             |         |       |         |       |         |       |         |     |         |        |     |       |
| <i>2003-2007 (ref.)</i>                              |         |       |         |       |         |       |         |     |         |        |     |       |
| <i>2008</i>  | 0.058   | 0.096 | 0.046   | 0.096 | 0.008   | 0.066 | 0.236   |     | 0.153   | 0.321  | +   | 0.173 |
| <i>2009</i>  | 0.042   | 0.126 | 0.015   | 0.128 | -0.041  | 0.080 | -0.041  |     | 0.185   | 0.099  |     | 0.169 |
| <i>2010</i>  | 0.079   | 0.149 | 0.055   | 0.150 | 0.003   | 0.087 | 0.338   |     | 0.263   | 0.585  | +   | 0.307 |
| Detailed Employment Status                           |         |       |         |       |         |       |         |     |         |        |     |       |
| <i>Employed (ref.)</i>                               |         |       |         |       |         |       |         |     |         |        |     |       |
| <i>Unemployed - 2 to 5 Months</i>                    |         |       | 0.229   | 0.178 | 0.207   | 0.178 | 0.927   | *** | 0.253   | 1.765  | *** | 0.219 |
| <i>Unemployed - at ATUS &amp; CPS</i>                |         |       | -0.008  | 0.047 | 0.018   | 0.047 | -0.054  |     | 0.355   | -0.024 |     | 0.446 |
| <i>Out of Labor Force</i>                            |         |       | 0.043   | 0.140 | 0.094   | 0.059 | 0.127   |     | 0.159   | 0.301  | +   | 0.180 |
| Employment Status                                    |         |       |         |       |         |       |         |     |         |        |     |       |
| <i>Employed (ref.)</i>                               |         |       |         |       |         |       |         |     |         |        |     |       |
| <i>Unemployed</i>                                    | 0.059   | 0.075 |         |       |         |       |         |     |         |        |     |       |
| <i>Out of Labor Force</i>                            | 0.020   | 0.139 |         |       |         |       |         |     |         |        |     |       |
| <b>Social Context</b>                                |         |       |         |       |         |       |         |     |         |        |     |       |
| Female   |         |       |         |       | -0.023  | 0.045 | -0.020  |     | 0.042   | -0.020 |     | 0.041 |
| Life Stage   |         |       |         |       |         |       |         |     |         |        |     |       |
| <i>45 or Younger without Children (ref.)</i>         |         |       |         |       |         |       |         |     |         |        |     |       |
| <i>Parent of Child under 18</i>                      |         |       |         |       | 0.036   | 0.049 | 0.047   |     | 0.045   | 0.048  |     | 0.044 |
| <i>Older than 45 without Children</i>                |         |       |         |       | 0.025   | 0.051 | 0.030   |     | 0.048   | 0.032  |     | 0.047 |
| Marital or Partner Status/Spouse's Employment Status |         |       |         |       |         |       |         |     |         |        |     |       |
| <i>No Spouse or Partner</i>                          |         |       |         |       |         |       |         |     |         |        |     |       |
| <i>Spouse/Partner Employed Full-Time</i>             |         |       |         |       | 0.047   | 0.051 | 0.052   |     | 0.052   | 0.050  |     | 0.052 |
| <i>Spouse/Partner Employed Part-Time</i>             |         |       |         |       | 0.037   | 0.032 | 0.027   |     | 0.032   | 0.029  |     | 0.031 |
| <i>Spouse/Partner is Not Employed (ref.)</i>         |         |       |         |       | 0.029   | 0.042 | 0.019   |     | 0.041   | 0.024  |     | 0.041 |
| Education  |         |       |         |       |         |       |         |     |         |        |     |       |
| <i>High School Diploma or Less</i>                   |         |       |         |       |         |       |         |     |         |        |     |       |
| <i>Some College or Associates</i>                    |         |       |         |       | -0.002  | 0.036 | -0.003  |     | 0.033   | -0.003 |     | 0.033 |
|  |         |       |         |       | 0.014   | 0.027 | 0.015   |     | 0.026   | 0.012  |     | 0.025 |

College Degree or More (ref.)

**Interactions**

|  |        |   |       |        |       |        |
|--|--------|---|-------|--------|-------|--------|
| <i>Unemployed - 2 to 5 Months*Unemployment Rate</i>          | -0.107 | + | 0.064 | -0.306 | ***   | 0.048  |
| <i>Unemployed - at ATUS &amp; CPS*Unemployment Rate</i>      | 0.230  |   | 0.142 | 0.622  | ***   | 0.124  |
| <i>Out of Labor Force*Unemployment Rate</i>                  | 0.318  | + | 0.190 | 0.883  | ***   | 0.135  |
| <i>Unemployed - 2 to 5 Months*2008</i>                       | 0.000  |   | 0.000 | 0.000  |       | 0.000  |
| <i>Unemployed - at ATUS &amp; CPS*2008</i>                   | -0.102 |   | 0.135 | -0.430 |       | 0.583  |
| <i>Out of Labor Force*2008</i>                               | -0.147 | + | 0.084 | -0.427 |       | 0.300  |
| <i>Unemployed - 2 to 5 Months*2009</i>                       | 0.107  |   | 0.403 | -1.518 | ***   | 0.413  |
| <i>Unemployed - at ATUS &amp; CPS*2009</i>                   | -0.141 |   | 0.430 | 1.123  |       | 2.527  |
| <i>Out of Labor Force*2009</i>                               | 0.071  |   | 0.118 | -0.443 |       | 0.527  |
| <i>Unemployed - 2 to 5 Months*2010</i>                       | 0.077  |   | 0.479 | -2.235 | ***   | 0.486  |
| <i>Unemployed - at ATUS &amp; CPS*2010</i>                   | -0.051 |   | 0.397 | 0.054  |       | 0.980  |
| <i>Out of Labor Force*2010</i>                               | -0.103 |   | 0.123 | -1.262 | **    | 0.445  |
| <i>2008*Unemployment Rate</i>                                | -0.036 |   | 0.026 | -0.051 | +     | 0.028  |
| <i>2009*Unemployment Rate</i>                                | -0.006 |   | 0.022 | -0.026 |       | 0.020  |
| <i>2010*Unemployment Rate</i>                                | -0.038 |   | 0.027 | -0.068 | *     | 0.032  |
| <i>Unemployed - 2 to 5 Months*Unemployment Rate*2008</i>     |        |   |       | 0.000  |       | 0.000  |
| <i>Unemployed - at ATUS &amp; CPS*Unemployment Rate*2008</i> |        |   |       | 0.052  |       | 0.106  |
| <i>Out of Labor Force*Unemployment Rate*2008</i>             |        |   |       | 0.052  |       | 0.050  |
| <i>Unemployed - 2 to 5 Months*Unemployment Rate*2009</i>     |        |   |       | 0.280  | ***   | 0.062  |
| <i>Unemployed - at ATUS &amp; CPS*Unemployment Rate*2009</i> |        |   |       | -0.111 |       | 0.248  |
| <i>Out of Labor Force*Unemployment Rate*2009</i>             |        |   |       | 0.072  |       | 0.069  |
| <i>Unemployed - 2 to 5 Months*Unemployment Rate*2010</i>     |        |   |       | 0.342  | ***   | 0.066  |
| <i>Unemployed - at ATUS &amp; CPS*Unemployment Rate*2010</i> |        |   |       | -0.006 |       | 0.117  |
| <i>Out of Labor Force*Unemployment Rate*2010</i>             |        |   |       | 0.133  | **    | 0.051  |
| Constant   | 0.109  |   | 0.128 | 0.127  | 0.129 | 0.129  |
|  |        |   |       |        | +     | 0.077  |
|  |        |   |       |        |       | 0.043  |
|  |        |   |       |        |       | 0.098  |
|  |        |   |       |        |       | -0.009 |
|  |        |   |       |        |       | 0.096  |

Notes: Model 1 N=1,066, Model 2 N= 1,066, Model 3 N=1,066, Model 4 N=1,026, Model 5=1,026. + p<.10, \* p<.05, \*\* p <.01, \*\*\* p<.001. Controls include race, immigrant status, region, metropolitan area, season, and predicted probability of a Sleep Disruption calculated from the models shown in Table 7 and Appendix B.



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