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Does a Strengthened Economy Weaken Your Health? Evidence from Australian Microdata

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Abstract. A number of recent studies using aggregate data have found a counter-cyclical relationship between business cycles and health; using mortality rates as health measure and where the unemployment rate typically is chosen as the business cycle proxy. This thesis adds to this literature in several respects. Firstly, by conducting the analysis on Australian microdata over the 2001-2011 period I test whether the counter-cyclical variation in health is visible using a more fined-tuned health measure; the SF-6D health state classification system. Secondly, several regional level business cycle proxies are applied in addition to the use of unemployment rates. Thirdly, I test whether the business cycle effects differ across different population subgroups, principally based on socioeconomic affiliation. Lastly, I investigate whether the effect of the business cycle on health goes through the channel of changes in lifestyle decisions affected by the business cycle. The main result of this study suggests indeed that health declines as the economy strengthens. Notably, the analysis on population subgroups suggests that it is only the health of low-income and low-educated groups that is affected by the business cycle. No evidence is found suggesting that the counter-cyclical variation in health is driven by cyclically varying lifestyle decisions.

Keywords: health, business cycle, socioeconomic factors, lifestyle decisions.

Supervisor: Ulf Gerdtham

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I. Introduction

The relationship between health and the business cycle surged as a researched topic with the widely cited publications of Harvey Brenner (1973, 1975, 1979), revealing that health varies pro-cyclically. However, the results of Brenner were brought into question due to serious technical flaws (Gravelle et al., 1981; Stern, 1983; Wagstaff, 1985; Cook and Zarkin, 1986), and studies correcting the problems failed to uncover a consistent relationship between the macroeconomic conditions and health (Forbes and McGregor, 1984; McAvinchey, 1988; Joyce and Mocan, 1993). It was not until the seminal publication of Ruhm (2000) that the topic rebounded in the literature, suggesting that the studies correcting for the problems in Brenner's analysis themselves suffered from omitted variables bias. Ruhm (2000) addressed the omitted variables bias issue by estimating fixed-effect (FE) models for a panel of the 50 states and District of Columbia over a 20-year period (1972–1991) arriving at the opposite conclusion to that of Brenner, namely that health varies counter-cyclically.

Since Ruhm's (2000) publication a number of studies have reproduced the same results. The pro-cyclical effect on mortality has been found in 23 OECD countries between 1960 and 1997 (Gerdtham & Ruhm, 2006), on US data by Ruhm (2000, 2003, 2005, 2006), on German regional data by Neumayer (2004), on Spanish regional data by Tapia Granados (2005), to mention a few. In contrast, Economou et al (2008) find a counter-cyclical relationship studying 13 countries within the European Union and Svensson (2007) using Swedish data finds a counter-cyclical effect for those in prime working age.

The standard methodological procedure in these studies is the use of aggregate data with mortality rates as health measure and where the unemployment rate typically is chosen as the business cycle proxy. On this practice at least a few notes can be made. Firstly, one drawback of using aggregate data is that individual-level relationships can not be ascertained. Thus, the effects could vary by income or education. Secondly, mortality rates capture only the extreme fatal consequence of the complete absence of health. The merits of using morbidity rather than mortality data has therefore naturally been brought forwards in the literature (Wagstaff, 1985; McAvinchey, 1988), since such a health measure allows for capturing more nuanced changes in health status.

Thirdly, it is not obvious that using the level of the unemployment rate as the business cycle proxy is the best way to account for the business cycle. Lastly, although these studies find a relationship between economic conditions and health, the channels through which the business cycle affects health remain obscure in most studies.

With respect to these four notes this study is to make its contribution: Firstly, by conducting the analysis on microdata. Thus, the effect of regional business cycles on individual-level health will be investigated which allows for testing whether the effects differ across different population subgroups. Secondly, by using morbidity data which captures more fine-tuned health changes compared to mortality data. Thirdly, by applying several business cycle proxies in addition to the use of unemployment rates. Lastly, by investigating whether the effect of the business cycle on health goes through the channel of changes in lifestyle decisions affected by the business cycle.

Of the few studies that do use microdata, Ruhm (2003) finds that health typically deteriorate as the state unemployment rate decreases, with the effect being particularly strong for persons of prime working age, employed individuals under the age of 65, and men. Gerdtham and Johannesson (2005) stand out in the literature both by using individual-level Swedish data and by using several different business cycle proxies; including the notification rate, the deviation from the GDP trend, the industry capacity utilization, and the industry confidence indicator. They find a significant counter-cyclical relationship for three out of six business cycle indicators for men. However, they measure the business cycle at the national level and hence fail to control for fixed effects.

Concerning channels though which the business cycle may affect health Ruhm (2000, 2005) has explicitly examined whether lifestyle factors are affected by the business cycle. The results indicate that the state unemployment rate has statistically significant negative effects on smoking, body mass index (BMI), specifically the likelihoods of being overweight or obese, while a positive effect on physical activity and fruit and vegetable consumption is found.

Specifically, this study is conducted on an individual-level data set comprising 6 263 individuals between the ages of 20-64 year collected from the Household, Income and

Labour Dynamics in Australia (HILDA) survey, covering the years of 2001-2011. Health is measured by the SF-6D health state classification system, which is a cardinal health measure bounded between 0 and 1 on which 18.000 unique health states can be defined. Macroeconomic conditions are accounted for in the six states of Australia. Four different measures of economic activity collected from the Australian Bureau of Statistics (ABS), from which the regional business cycles can be derived, are used: the unemployment rate, Gross State Product (GSP), Real Gross State Income (RGSI), and State Final Demand (SFD). In addition to using the unemployment rate, GSP growth and RGSI growth as measures of macroeconomic fluctuations, the business cycle is accounted for by extracting the cyclical components from these times series which are then normalized with the associated trend components yielding the series gap. In order to investigate the channel through which the business cycle may affect health, cyclical variation in lifestyle factors in terms of smoking, drinking, physical exercise and BMI are accounted for from 2002-2011 and from 2006-2011 respectively.

Unlike most prior studies no effect of the unemployment rate on health is found, nor of the unemployment-gap. However, the preferred measures for accounting for the business cycle in this study, the GSP-gap and RGSI-gap, suggest that health varies counter-cyclically. Evidence of omitted variable bias is found when fixed-effects are excluded from the models. Stratifying the sample by population subgroups reveals that the health of low-income and low-educated people declines as the economy strengthens whereas no significant effect is found for high-income and high-educated people. Significant effects are also found for both male and females as well as for people of 20-44 years of age and 45-64 years of age. No evidence is found suggesting that the counter-cyclical variation in health is driven by cyclically varying lifestyle decisions.

This thesis is organized as follows. In the next section reasons for why health may vary with the business cycle are presented. Methods used are found in section III. Section IV empirically investigates if health varies with the business cycle. Whether the business cycle affects health though changes in lifestyle decisions will be examined in section V. Discussion and conclusion is given in section VI.

II. Why would health vary with the business cycle?

Health conditions haven been theorized to vary with the business cycle for a number of reasons, out of which two main perspectives can been distinguished (Brenner and Mooney, 1983; Watkins, 1985; Ruhm, 2000; Neumayer, 2004)

One perspective, taking a mainly social and psychological viewpoint, focuses on psychological hardship caused by economic downturns. During recessions the risk for employed people of losing their job increases while the chance of finding jobs for unemployed people decreases. The fear of job loss or not finding a job can lead to increased stress, anxiety and psychological hardship that affect health negatively. Novo et al. (2001) found that young employed persons report higher level of somatic and psychological symptoms during economic downturn than during economic upturn. Increased psychological pressure is in turn particularly detrimental to health if individuals resort to alcohol and other drugs to alleviate their stress and hardship. Recessions would in these ways deteriorate health while economic expansion would benefit health by reducing stress and psychological hardship (Brenner and Mooney, 1983; Ferrie et al., 1995; Catalano & Dooley, 1983; Fenwick & Tausig, 1994).

The other perspective is derived explicitly from economic theory. Health is in this theoretical context produced by utility maximizing individuals choosing to allocate production inputs, such as nonmarket leisure time, and other consumption as arguments subject to budget and time constraints in such way as to equalize the marginal utility of the last dollar‘s worth across consumption and leisure (see Grossman (1972)). In such as model economic downturns can have positive effects on health for at least 3 major reasons (Ruhm, 2000).

Firstly, the opportunity cost of leisure time increases in economic upturns as individuals work and gain more. As a consequence, it becomes more costly for individuals to undertake time-intensive health-producing activities such as exercise. Similarly, as less time is available individuals may substitute calorie-rich prepared food for home cooked lower-calorie and quality meals (Chou et al., 2002). Consistent with this, data from the Behavioral Risk Factor Surveillance System (BRFSS) suggests that physical activity is reduced in times of economic expansion while worse diet and obesity increase (Ruhm, 2005). Likewise, as individuals work more the time

price of medical care increases making it more costly to schedule medical appointments. Mwabu (1988) and Vistnes & Hamilton (1995) find in line with this a negative relationship between employment and the utilization of medical care.

Secondly, health may be an input into the production of goods and services. For example, job hours may extend during short-lasting economic expansions that in tandem with physical exertion of employment and job-related stress have negative health effects (Baker, 1985; Karasek & Theorell, 1990; Sokejima & Kagamimori, 1998). Also, hazardous working conditions and work-related accidents may increase during economic booms (Tapia Granados, 2002), especially in cyclically sensitive sectors such as construction that have pro-cyclical accident rates (Ruhm, 2002).

Lastly, health-damaging consumption of normal goods might increase with income during economic expansion, such as alcohol and tobacco (Freeman, 1999; Ruhm, 2002; Ruhm & Black, 2002).

The net effect of these two perspectives and their associated theories is ultimately an empirical question. Rather than being inconstant with each other the two perspectives may captures different aspects of the presumed relationship between the business cycle and health. A net effect that goes in one direction needs therefore not suggest that the links between health and economic conditions of the other perspective are absent. Rather, such a result would suggest that the effect of one perspective dominates the other. If the two effects would be equally strong, no relationship would be found.

III. Methods

In this section, the methods used to the investigate whether the business cycle impacts on health and whether the effect on health goes through the channel of changes in lifestyle decisions affected by the business cycle are presented.

A. Data

The analysis is based on data from two sources. The population of interest is collected from the Household, Income and Labour Dynamics in Australia (HILDA) survey,

which began in 2001 covering a broad range of social and economic question. The initial yearly wave comprise a sample of 7,682 households and 19,914 individuals selected for participation based various data sampling methods to achieve representativeness of all Australian household (Summerfield et al, 2012). Waves 1-11 under General Release 11 are available for this study meaning that individual in the final data set will be followed from year 2001 until 2011. In addition to the individual level data, state and country level macroeconomic data is collected from the Australian Bureau of Statistics (ABS).

A1. Measuring health

Prior studies have almost exclusively used total mortality as a proportion of the population as a proxy for health, as restricted to the use of aggregate data. Of course, mortality rates capture only the extreme fatal consequence of the complete absence of health. The merits of using morbidity rather than mortality data has therefore naturally been brought forwards in the literature (Wagstaff, 1985; McAvinchey, 1988), since such a health measure allows for capturing more nuanced changes in health status.

This thesis will derive its health measure from the SF-36 Health Survey which is included within the Self-Completion Questionnaire in the HILDA survey in each wave. The SF-36 Health Survey is a well-recognized diagnostic tool for assessing functional health status and well-being. Comprising 36 different questions presenting respondents with choices about their perception of their health, it allows for measuring health across eight distinct dimensions: physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional and mental health (Summerfield et al., 2012). These eight health dimensions are then transformed into a 0-100 index, using the scoring rules described in Ware et al. (2000).

The scoring method is however not preference based. The scoring algorithm assumes instead both equal intervals between the response choices and equal importance of the items. To account for the interval issue and allow for trade-offs between health dimensions, a preference-based measure of health is derived using utility weights developed by the work of Brazier et al. (2002). Within this framework preferences are used to determine how much utility is associated with a particular health state.

The resultant health measure is cardinal and bounded between 0 (a health state comparable to death) and 1 (a health state comparable to full health). This new health measure is referred to as the SF-6D health state classification system. The eight health dimensions of the SF-36 Health Survey is now reduced to six dimensions where a total of 18.000 unique health states can be defined (Brazier et al., 2002).

A2. Lifestyle factors

The lifestyle indicators height-adjusted weight, tobacco use, drinking and physical activity are all collected from the self-completion questionnaire in the (HILDA) survey. Height-adjusted weight is measured by the body mass index (BMI), defined as weight in kilograms divided by height in meters squared. The variable BMI is available from wave 6 to wave 11.

Data on tobacco use, drinking and physical activity is available from wave 2 and to wave 11. Tobacco use is analyzed using a dummy variable indicating whether the respondent smoke daily, weakly, or less than weakly compared to respondents that no longer smoke or have never smoked. For those that do smoke, the number of cigarettes usually smoked each week will in addition be analyzed. Alcohol consumption is analyzed using a dummy variable indicating whether respondents drink as compared to respondents that do not drinking any more and have never drunk. The last variable, physical activity is a dummy variable that indicates whether or not the respondent participate in physical activity or not.

A3. Measuring the business cycle

Most previous studies on the relationship between the business cycle and health have used the unemployment rate as the business cycle indicator; the unemployment rate has been used as a proxy for recessions and expansions respectively and also as a general proxy for "macroeconomic" effects, "cyclical" variations, (e.g. see Ruhm (2000) & Ruhm (2005)). A few studies have in addition used level of GDP per capita and real GDP growth the business cycle indicator (Gonzalez & Quas, 2010; Neumayer, 2004). Gerdtham & Johannesson (2005) stand out in the literature by in

addition utilizing the following indicators: the notification rate, the deviation from the GDP trend (deterministic), the industry capacity utilization, and the industry confidence indicator.

This study uses four different measures of economic activity from which the business cycle can be derived: the unemployment rate, Gross State Product (GSP), Real Gross State Income (RGSI), and State Final Demand (SFD). GSP is the most comprehensive measure of state economic activity along with RGSI that adjusts GSP to account for changes the terms of trade (i.e. to adjust the purchasing power of the income generated within a state to changes in different rates in the prices of international exports and imports (ABS, 2012)). These two measures are the preferred ones for measuring state level economic activity in this study. These are available on an annual basis. The unemployment rate and SFD is available on monthly and quarterly basis, respectively. The unemployment rate is an imperfect measure of aggregate economic activity but provides an indication of labor market conditions. The measure therefore captures one interesting aspect of the business cycle; the dynamics of the labor market. A drawback is that the unemployment rate does not take into account changes in the labor force and government sponsored labor market policy programs (Gerdtham & Johannesson, 2005). SFD measures total domestic spending in each state but excludes important components of economic activity, particularly international and intrastate trade. SFD has priory been used as a proxy of state economic activity to estimate regional business cycles in Australia when restricted to quarterly data (see Norman & Walker, 2004).

Given the measures of state level economic activity available the question of how to best use them to capture the business cycle arises. One helpful way to proceed is by first defining the business cycle and on basis of the definition go on to how to best account for the business cycle in empirical work.

In the macroeconomic literature the business cycle is commonly defined as short-run fluctuations in economic activity around a long-term economic growth trend (see e.g. Sorensen & Whitta-Jacobsen, ch.13., 2010 and Fregert & Jonung, ch.13., 2005). This, although rather loose, definition of a business cycle reveals that there are two forces at play in most macro economic time series.

To clarify, let Y_t be say, real GDP in period t. Then it is helpful to think of Y_t as the product of a growth component Y_t^g indicating long-term economic growth trend and a cyclical component Y_t^c:

$$Y_t = Y_t^g \cdot Y_t^c \quad (1)$$

Taking the natural logarithm of equation (1) and defining $y_t = lnY_t$, $g_t = lnY_t^g$ and $c_t = lnY_t^c$, we get:

$$y_t = g_t + c_t \quad (2)$$

the observed macro economic times series y_t can for clarifying reasons thus be decomposed as the sum of two components:

the long term trend component g_t, corresponding to the series growth trend and,

the cyclical component c_t, corresponding the business cycle fluctuations

In the macroeconomic literature in general when studying the business cycle the interest lies in how large the cyclical component is in relation to the trend, as opposed to using the absolute value of the cyclical component (Fregert & Jonung, 2005). For this reason, the series deviation from trend as a proportion to the trend value, the (GDP-) gap, is used as a main business cycle indicator, defined as follows:

$$(GDP-)gap = \frac{c_t}{g_t} \quad (3)$$

Assuming that c_t fluctuates around a long run mean value of 0 implies that if the amplitude of the cyclical component Y_t^c remains constant, the absolute amplitude of the business cycle fluctuations will rise over time. For this reason dividing the cyclical component with the trend component, as done in the output-gap, allows for meaningful comparisons to be make over time, as the percentage deviation in this case will be constant over time. Moreover, given that the interest lies in comparing the macro economy across different regions, as is the interest in this study, normalizing the cyclical component with the trend component is necessary for meaningful comparisons to be made; since regional macroeconomic trends may differ

across states (Fregert & Jonung 2005; Sorensen & Whitta-Jacobsen, 2010).

The suggested way of accounting for the business cycle by decomposing the time series into a short-run cyclical component representing the business cycle and a long-run trend component is informative also as it indicates whether the economic is above or below the general economic trend and because it offers a measure of the intensity to which the economy deviates from its trend. Hence, and suggestively, given that the idea is to account for the influence of *the business cycle* on health and not, e.g. the unemployment rate *per se*, is not obvious that merely using the level of the series without decomposing the it, as typically done in the context of this study, is the most accurate way to proceed. Using the level of a time series would arguably be particularly problematic when the measure is referred to as "cyclical" variations (see Ruhm (2000) & Ruhm (2005)).

Following the suggested path, one may notice that we only observe y_t directly. What subsequently is needed is a way to separately *tease out* the trend component g_t and the cyclical component c_t from the observed series. There are in principle two different approaches for doing this (Fregert & Jonung, 2005), both of which will be applied.

The first approach (the traditional approach) assumes that the trend component g_t follows a deterministic trend. This kind of trend will be estimated using the following a linear regression model:

$$y_t = u + \gamma t + e_t \tag{4}$$

where the subscript denotes time periods, u is an intercept, t is a linear time trend and e_t is the error term. The trend component g_t is then simply the fitted values from the above regression and the cyclical component c_t is given by the residuals. This model is run on each region on the measures available on an annual basis from a time period of 1992 until 2013; that is on the unemployment rate, GSP and RGSI.

The benefit of using this model is that the preferred measures GSP and RGSI easily can be decomposed using annual data. As the model represents the trend value along the regression line this model implies the economy would always be in steady state

equilibrium with a constant growth rate, given that the cyclical component c_t is equal to zero (Sorensen & Whitta-Jacobsen, 2010). Yet, the theory of economic growth gives us no reason to believe that this necessarily needs to be the case[1]. Furthermore, some yearly changes, e.g. technical innovations, may give rise to permanent changes that affects and alters the trend successively. Responding to these concerns lead us to the second approach for estimating the trend.

What distinguishes the second approach, commonly referred to as the modern approach, is that the methods used here allow for the trend to be smooth so that the slope of the trend may change gradually over time, hence relaxing the assumption of that the economy always being in steady state equilibrium. One of the most popular methods used is the Hodrick-Prescott filter, which finds the trend component g_t by minimizing the following magnitude:

$$HP = \sum_{t=1}^{T}(y_t - g_t)^2 + \lambda \sum_{t=1}^{T-1}[(y_{t+1} - g_t) - (g_t - g_{t-1})]^2 \quad (5)$$

with respect to all g_t. The expression consists of two sums. The first sum corresponds squared cyclical fluctuations and the second sum corresponds to squared changes in the growth rate of the trend. These two sums thus correspond to two different objectives; minimizing cyclical fluctuations and minimizing changes in the estimated trend growth, respectively. The choice of the value placed on λ determines the relative weight placed on these two conflicting objectives. Among business cycle researchers using quarterly data, the customary value of λ equals 1600.

The HP-filter tends however to give imprecise estimates at the end-points of a time series. For this reason it is not recommended to apply the filter to the measures available only on annual basis in this study; as the last HILDA wave is of year 2011 and data naturally only extends to year 2013, yearly data cannot be estimated as only two end-points can be dropped. The HP-filter will nonetheless be used to estimate the trend unemployment. Having two methods of estimating trend unemployment, i.e. smooth and deterministic trend, trend unemployment estimated using the HP-filter is the preferred way of accounting for dynamics in the labor market in this study. The

[1] For example, according to conventional growth theory the economy's steady state will respond to changes in the capital-labor ratio as well as changes in technology. In the adjustment process to the new steady state growth rates will differ whereas steady state growth itself is characterized by a constant growth rate.

estimation will be done using monthly data from January 1991 to July 2014[2], adjusting λ to 129600 following the recommendation of Raven and Uhlig (2001). Also, the trend in SFD used a proxy for overall economic activity, will be extracted using the HP-filter. From these estimations the unemployment-gap and the SFD-gap is calculated and subsequently transformed into annual observation by simply taking the annual averages of these gaps.

In sum, to replicate prior studies the unemployment rate and GSP growth along with RGSI growth will be used in the analysis that will follow. These measures are used as proxies for macroeconomic fluctuations on a more general level. Thereafter, the business cycle component of the unemployment rate, GSP, RGSI and SFD normalized with the associated deterministic trend and smooth trend will be utilized. These measures are used as proxies for the business cycle.

A4. Control variables

There is a large body of literature reporting a direct relationship between unemployment and individual income on health (see Suhrcke & Stuckler, (2012) for an overview). As the interest of this study lies in the impact of the business cycle on health independent of factors that may covary with the business cycle such as the labor force status of the respondents and individual income, these factors need to be controlled for.

Dummy variables indicating whether the respondent is employment or unemployed are therefore introduced as control variables. In order to control for income, which more generally may be through of as a proxy for socioeconomic status, household financial year disposable regular income is used. This income variable should be interpreted in terms of available economic resources rather than as income exchange for labor, as income is defined at the household level instead of individual-level. Since disposable income is calculated as total household income after receipt of

[2] Estimating trend unemployment relying solely on statistical techniques is somewhat problematic as all information other than unemployment is ignored; particularly the link between the unemployment gap and inflation. Most popular approaches to estimate trend unemployment or the non-accelerating inflation rate of unemployment (NAIRU) are based on expectation-augmented Phillips curve (Turner et al., 2001). This approach is out of scope for this study. Resigning to statistical techniques, the HP-filter is nonetheless commonly used to estimate trend unemployment.

government benefits and deduction of income tax (Summerfield et al., 2012), the variable is transformed into household equivalised disposable income to allow for comparability between households of different compositions and over time, following Haagenars et al., (1994). The transformation is calculated as follows:

$$\text{household equivalised disposable income} = \frac{\text{financial year disposable income}}{0{,}5\times(number\ of\ adults-1)+0{,}3\times number\ of\ children} \quad (6)$$

where "number of adults" is calculated as the number persons in a household minus the "number of children" where "number of children" corresponds to the count of resident and non-resident persons belonging to a household that are aged less than 15 years old. The variables is thereafter expressed in real terms by deflation using state level consumer price index (CPI) data from ABS, choosing base year 2011.

The analysis also controls for several demographic factors. Martial status is controlled for using a dummy variable indicating if the respondent is married or in a de facto relationship as opposed to being divorced, separated, widowed or never married and not de facto. Education is controlled for using a dummy variable indicating whether or not the individual has completed higher education, defined as bachelor, diploma, honours or doctorate degree. In addition, another dummy variable controls for whether the respondent is currently a full time student or not. The sex and age (and age squared) of the respondent is included. Lastly, a dummy variable indication whether nor not the respondent is indigenous or not is included.

B. Estimation Strategy

Rather than taking a national perspective, this study has the advantage of studying the impact of the business cycle on health at the state level in Australia with the additional benefit of using of individual-level micro data. Using the subscripts i, j and t to index individual, state and year, the basic regression specification is:

$$h_{ijt} = a_t + C_j + X_{ijt}\beta + E_{jt}\gamma + \varepsilon_{ijt} \quad (7)$$

where h is the SF-6D health state classification system measure or lifestyle factors,

X is a vector of personal characteristics, E is the variable accounting for the regional level macro economy, a_t is a year-specific intercept, C_j are state fixed-effects, and ε

is a disturbance term.

The year effect holds constant universal determinants of health occurring yearly across states. The fixed-effects controls for time-invariant unobserved heterogeneity that differs across state. The impact of the business cycle is therefore identified by within-state variations in the regional economies, relative to the changes occurring in other states.

The principle advantage of this fixed effects model is that a variety of difficult-to-observe factors that might affect health automatically are controlled for; for example, differences in lifestyles between residents of Tasmania and Western Australia or varying state-specific institutions. There may however be factors affecting health that vary over time within states. To control for factors of this kind the preferred model also include a vector of state-specific linear time trends ($C_j xT$), implying the following regression equation:

$$h_{ijt} = a_t + C_j + C_j xT + X_{ijt}\beta + E_{jt}\gamma + \varepsilon_{ijt} \quad (8)$$

In addition, the models will include a control for national macroeconomic fluctuations, to investigate whether regional business cycles influence on health independently of broader Australian macroeconomic conditions.

All regressions are estimated using standard errors that are robust towards arbitrary heteroscedasticity and autocorrelation such that observations are assumed to be independent across individuals, but not necessarily within individuals.

C. Descriptive Statistics

Summary statistics on main variables used in the analysis on the relationship between health and the business cycle are displayed in Table I. below and are in large self-explanatory. The sample consists of the working population between 20 and 64 years of age. Concerning the labor force distribution within the sample one may note that 76 % of the individuals in the sample are employed, 3.5 % unemployed whereas 21% of the respondents do not participate on the labor market. About 1% of the sample are Aboriginal or of Torres Strait Islander origin; belonging to the Australian indigenous minorities.

One may note that the two methods for estimating trend unemployment rate gave somewhat different outcomes in terms of unemployment-gaps; unemployment on average is below deterministic trend while above smooth trend.

Table I. Descriptive information of main variables used in analysis

Variable	Mean	Standard Deviation
Dependent Variable:		
Health	0.767	0.118
Regional Macroeconomic Measures:		
Macroeconomic Fluctuations:		
Unemployment rate	5.401	0.962
GSP growth	2.977	1.590
RGSI growth	4.088	1.414
Dev. from Deterministic Trend:		
Unemployment rate	-0.067	0.141
GSP	0.00058	0.00087
RGSI	0.00012	0.00102
Dev. from Smooth Trend:		
Unemployment rate	0.00534	0.07507
SFD	-.000172	0.00145
Individual Characteristics		
Personal income	10.480	1.474
Employed	0.763	0.424
Unemployed	0.024	0.153
Not in labor force	0.212	0.409
Marital status	0.730	0.443
Higher education	0.363	0.480
Full-time student	0.021	0.146
Sex	0.545	0.497
Age	44.028	11.472
Indigenous	0.015	0.124

Note: These are the main variables used in the regression analyses that will follow, excluding the national macroeconomic variables, representing a sample of 6 263 individuals with a total of 56 126 observations.

Summary statistics on lifestyle factors are presented in table 2. The number of observations is 28 405 when analyzing BMI and 50 304 for the analyses on tobacco use, drinking and physical activity.

Table 2. Descriptive information of lifestyle factors

Variable	Mean	Standard Deviation
Lifestyle factors		
Current smoker	.217	.413
Number of cigarettes usually smoked each week (smoker only)	85.721	70.25
Current drinker	.863	.343
Participators in physical exercise	.735	.441
Body mass index	27.204	5.645

Note: The sample of smoker, drinker and physical exercise covers refers to year 2002-2012 and contains 6 171 individuals and 50 304 observations. The sample of cigarettes per day (smokers only) contain 1 881 individuals and 10 944 observations. The sample of BMI refers to year 2005-2012 and comprises 5 720 individuals and 28 405 observations.

As seen, about 21 % of the respondents smoke whereas about 86 % drink and 73% of the respondents participate in physical activity. The average person is overweight with a BMI of about 27.

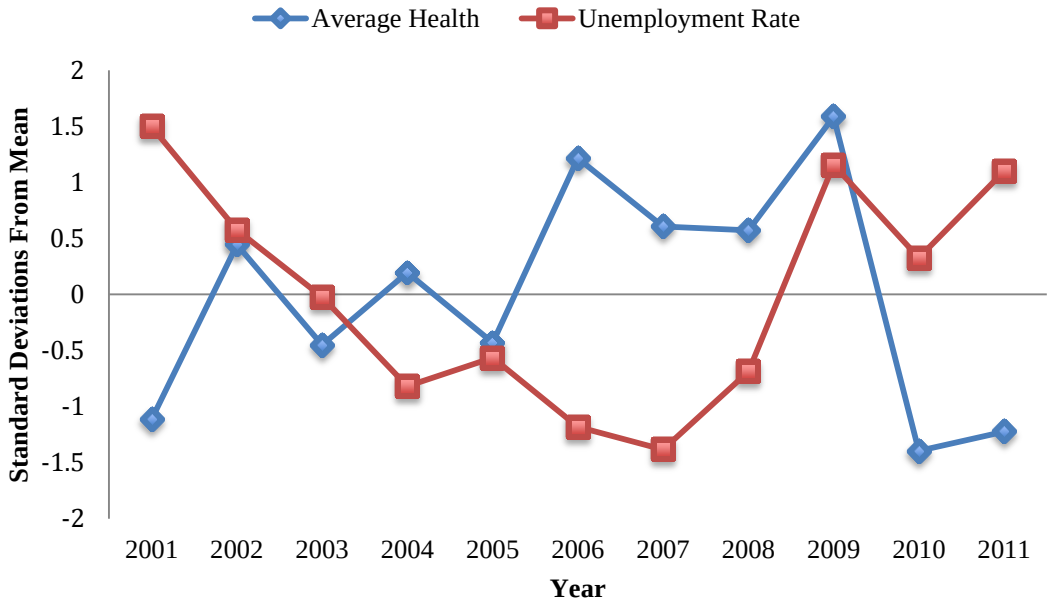

Figure 1. Average Health and Unemployment Rates in Australia (detrended and normalized).

Replicating the relationship between health and the business cycle of many prior studies at a national level, a first indication is provided in Fig. 1, which displays average health on a national aggregate level and Australian unemployment rates from 2001 to 2011. The variables are detrended, using a deterministic trend, and normalized to have a mean of zero and a standard deviation of one, for ease of interpretation. Previewing the econometric results that will follow in the next section,

the figure illustrates an inverse relationship between the unemployment rate and health. This would in contrast to most prior findings suggest that health improves when labor markets strengthen.

This finding is based on national level Australian unemployment rates. Note however that it is not possible to control for unobserved heterogeneity at the national level, which is, given the results' aforementioned sensitivity to the inclusion of fixed effects, a big concern. The fixed-effects estimates, reducing the variation in the data as exploiting within-state variations in economic conditions, have the potential to improve on this aggregate time series, provided that there are substantial independent macroeconomic fluctuations in states over time. This condition appears to be met. Figures 2 displays the Australian and the regional business cycles measured as GSP-gaps and GDP-gap; the preferred measure of the business cycle of this study.

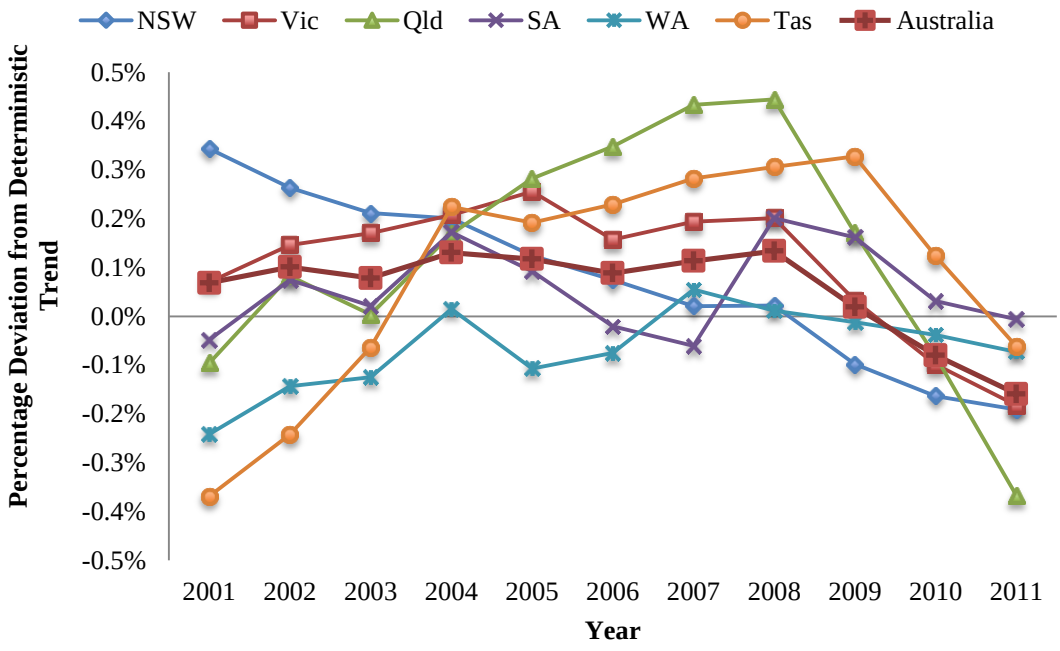

Figure 2. Australian Business Cycles: GSP-gap and GDP-gap

The fluctuations in regional economic activity in these times series are on average about twice as large as the variation in Australia at large (the average of the regional standard deviations of the series are 0.16% whereas the standard deviation of the GDP-gap is 0.09%). Moreover, all states except Victoria (Vic) exhibit a correlation coefficient below 0.8 with the national GDP-gap; three of the states: South Australia (SA), Western Australia (WA) and Tasmania (Tas.) display a correlation coefficient

lower than 0.3. The intra-state variation is large. Of the 21 intra-state correlation coefficients (that is, each state correlated with all others), only two demonstrates a correlation marginally above 0.8. These indications suggest a large independent variation in the data which supports the motivation for using the fixed effects estimator.

IV. Does health vary with the business cycle?

The empirical results of the impact of the business cycle on health are presented in this section. The results are first displayed for the full sample. Thereafter, the results re-estimated on population subgroups are displayed.

A. Full Sample Estimates

The econometric estimates of the impact of macroeconomic fluctuations and the business cycle on health are presented below. To replicate prior studies the results are first presented on indicators of macroeconomics fluctuations. Thereafter, the results using the business cycle measures are presented.

A1. The effects of macroeconomic fluctuations

Table 3 summarizes the results of the influence of macroeconomic fluctuations on health for a variety of econometric models, all of which control for the aforementioned personal characteristics. Specification (a) shows the results of regressing health on three macroeconomic proxies, controlling for fixed-effects, year effects, and state-specific linear time trends while excluding income. GSP growth and RGSI growth are statistically significant and indicate that health deteriorate when the economy strengthens. The to get an appreciation of the effects, a standard deviation increase of GSP growth and RGSI growth implies a decline in average health with 0.22 and 0.18 percentage points respectively[3].

Does health decline because incomes increase when the economy strengthens? Column (b) adds control for income. The effects of GSP growth and RGSI growth on health increase somewhat in absolute magnitude, with 5% compared to column (a).

[3] Since health averages at 0,767 a standard deviation increase in GSP growth of 1.59 times the coefficient estimate of -.00108 yields an effect of -0,00172 on health, implying that health declines with 0.22 percentage points.

There is hence no indication that health deteriorates because incomes increase.[4] Instead, the slightly larger effect on health in column (b) suggests a protective effect of higher incomes.

The next three columns investigate the sensitivity of the results to various alternative specifications. State-fixed effects and state-specific time trends are excluded in specification (c). Column (d) excludes state-specific time trends. Column (e) omits year effects. All specifications except specification (a) include income as a control.[5]

What stands out in the regression specifications (c)-(e) is that the unemployment variable now is significant indicating that health improves when labor market strengthens when fixed-effects and state specific time trends are excluded. Moreover, GSP growth and RGSI growth cease to be significant in all these three specifications. The most interesting result is the change in sign in GSP growth and RGSI growth when fixed-effects are excluded. Although not significant, the change in sign is problematic and corroborates with Ruhm (2000)'s argument that not controlling for fixed effects leads to an omitted variable. [6] The change in sign suggests that studies measuring the business cycle at the national level where fixed effects can not be controlled for may suffer from an omitted variable bias (e.g. Gerdtham & Johannesson (2005) and Svensson & Krüger (2012)).

Specification (f) substitutes the state-level macroeconomic conditions for the national macroeconomic effects. Specification (g) is the preferred specification because it includes in addition to the control for state and year fixed-effects, state-specific time trend and income also national macroeconomic conditions along with regional ones to examine whether local conditions exert an independent influence on health.

[4] Instead, the effect of income on health is significant and positive in all specifications in this thesis.
[5] Many studies, including Gerdtham & Ruhm, (2006) in their preferred specification, choose not to control for income. However, this study seeks to study the influence of the business cycle independently on changes in labor force status and income, putting the regressions to somewhat stricter test compared to earlier research. Moreover, excluding these control variables may lead to an omitted variable bias given the strong independent influence of these variables on health.
[6] Ruhm (2000) presented however only the estimated results from the fixed effects models and did not show the sensitivity of his results to the exclusion of fixed effects.

Table 3. Econometric estimates of the impact of macroeconomic fluctuations on health

Regressor	Specification						
	(a)	(b)	(c)	(d)	(e)	(f)	(g)
State unemployment rate	.000026	-.000021	-.003109**	-.000167	-.000789		-.000029
	(.000993)	(.000991)	(.001227)	(.000892)	(.000567)		(.000997)
Australian unemployment rate						-.002363**	-.002341*
						(.000949)	(.001384)
State GSP growth	-.00108**	-.0011338**	.0004378	-.0006732	-.0000238		-.0011097**
	(.000457)	(.0004573)	(.0006479)	(.0004413)	(.0003116)		(.0004573)
Australian GDP growth						.001418**	.002693***
						(.000706)	(.000877)
State RGSI growth	-.000469**	-.000495***	.000354	-.000273	-.000064		-.000494***
	(.000183)	(.000183)	(.000294)	(.000182)	(.000148)		(.000183)
Australian RGDI growth						.000459	.000891***
						(.000308)	(.000345)
Year effects	Yes	Yes	Yes	Yes	No	Yes	Yes
State-specific trends	Yes	Yes	No	No	Yes	Yes	Yes
State fixed effects	Yes	Yes	No	Yes	Yes	Yes	Yes

Note: *, **, and *** indicate significance at the 10, 5, and 1% level respectively. The regressions are run of a sample consisting of 6 263 individuals between the ages of 20-64 years with a total of 56 126 observations. Specification (a) excludes personal income. With this as the exception, all models control for the following personal characteristics: personal income, employment status, marital status, level of education, whether full-time student, sex, age, and indigenous origin. State and year fixed-effects and state-specific time trends are altered as indicated.

As seen, country level conditions significantly influence health. The inverse relationship between conditions on the Australian labor market at large and health illustrated in figure 1 is here confirmed. However, this result should be interpreted with great caution as country level unobserved heterogeneity can not be controlled for. For this reason, national wide macroeconomic conditions should be viewed more as a control for whether there is an independent influence of regional level macroeconomic conditions on health. The regression results shown in specification (g) indicate that this is the case. The statistically significant effects of GSP growth and RGSI growth on health suggest indeed that regional level economic conditions affect individual health independently of the macroeconomic conditions at the national level. Unlike many prior studies using mortality as a proxy for health status, no effect on health of the unemployment rate at the regional level is found.

A2. The effect of the business cycle

The results just presented report the findings of macroeconomic fluctuations on health. We now turn to the results of the preferred macroeconomic measures that as argued more accurately ought to account for the business cycle. Table 4 displays the estimated results of the cyclical components expressed in terms of the suggested (respective) gaps, extracted from series under a deterministic trend. Again, the measures of GSP and RGSI are significant in specification (a) and (b) while the unemployment-gap is not. What stands out in the specification (c)-(e) is that the sign of the GSP-gap and RGSI-gap now no longer is sensitive to state-fixed effects, while the unemployment-gap is. Compared to the results presented in table 2, the GSP-gap and RGSI-gap are significant in specification (c) with a somewhat smaller effect on health compared to prior specification (a) and (b).

Most importantly, regional business cycles are indicated to impact on health, and as shown in specification (g) the impact is independent from the national business cycle. The effects of a standard deviation increase in GSP-gap and RGSI-gap on the average individual's health are rather similar as those of the GSP growth and RGSI growth priory presented, 0.22 percentage points for both gaps.

Although not of primary interest, the national business cycle is suggested to affect the health of individuals across the country, in a pro-cyclical fashion. However, again, fixed effects can not be controlled for at the country aggregate level. No valid conclusions of interest can therefore be drawn concerning country-level influence on health if we are to generalize the results outside of the Australian context.

The results presented in table 5 show the estimated effects of the unemployment-gap and the SFD-gap, respectively, estimated using the HP-filter. In no specification is cyclical deviation in from trend unemployment significant, nor is the cyclical deviation in SFD[7].

The econometric estimates of the impact of macroeconomic fluctuations and the business cycle on health have now been presented, to sum up: Significant impact of economic conditions on health are found suggesting that both macroeconomic fluctuations and the business cycle affect health in the way that a strengthened economic is associated with weaker health. What characterizes the significant business cycle estimates is that they represented broader measures of economic activity in terms of GSP and RGSI compared to the unemployment rate focusing on labor market dynamics or SFD excluding important economic activities such as international trade. One may also note the significant business cycle measures are those defining the cyclical component in relation to a deterministic long run trend.

[7] Due to data limitations, domestic final demand was not included in the analysis.

Table 4. Econometric estimates of the impact of cyclical fluctuations (deterministic trend) on health

Repressor	Specification						
	(a)	(b)	(c)	(d)	(e)	(f)	(g)
State unemployment rate	-.000901	-.001227	.004966	-.000741	-.004632		-.001628
	(.005529)	(.005536)	(.005921)	(.005287)	(.003051)		(.00541)
Australian unemployment rate						-.005984	-.004353
						(.003640)	(.006454)
State GSP	-.948892**	-1.00399**	-.944764**	-.423927	.118757		-.979608**
	(.425739)	(.425617)	(.455989)	(.364514)	(.295935)		(.424414)
Australian GDP						1.64265***	3.02413***
						(.562934)	(.80736)
State RGSI	-.602339**	-.635481***	-.598894**	-.170730	-.008308		-.591286**
	(.239663)	(.239662)	(.254136)	(.200372)	(.192963)		(.236373)
Australian RGDI						1.54507***	2.33853***
						(.4255173)	(.521077)
Year effects	Yes	Yes	Yes	Yes	No	No	No
State-specific trends	Yes	Yes	No	No	Yes	Yes	Yes
State fixed effects	Yes	Yes	No	Yes	Yes	Yes	Yes

Note: *, **, and *** indicate significance at the 10, 5, and 1% level respectively. The regressions are run of a sample consisting of 6 263 individuals between the ages of 20-64 years with a total of 56 126 observations. Specification (a) excludes personal income. With this as the exception, all models control for the following personal characteristics: personal income, employment status, marital status, level of education, whether full-time student, sex, age, and indigenous origin. State and year fixed-effects and state-specific time trends are altered as indicated.

Table 5. Econometric estimates of the impact of cyclical fluctuations (smooth trend) on health

Repressor	Specification						
	(a)	(b)	(c)	(d)	(e)	(f)	(g)
State							
Unemployment rate	-.009741	-.010492	-.004045	-.011765	-.001522		-.003962
	(.009616)	(.009630)	(.010106)	(.009619)	(.004702)		(.006677)
Australian							
Unemployment rate						.001026	-.003962
State							
SFD	.189118	.189118	-.259448	.20298	.338675		
	(.3613937)	(.3613937)	(.4053226)	(.3631943)	(.2595274)		
Year effects	Yes	Yes	Yes	Yes	No	No	No
State-specific trends	Yes	Yes	No	No	Yes	Yes	Yes
State fixed effects	Yes	Yes	No	Yes	Yes	Yes	Yes

Note: *, **, and *** indicate significance at the 10, 5, and 1% level respectively. The regressions are run of a sample consisting of 6 263 individuals between the ages of 20-64 years with a total of 56 126 observations. Specification (a) excludes personal income. With this as the exception, all models control for the following personal characteristics: personal income, employment status, marital status, level of education, whether full-time student, sex, age, and indigenous origin. State and year fixed-effects and state-specific time trends are altered as indicated.

B. Population Subsamples

This section investigates whether the effect of the macroeconomic conditions differ between different groups in the Australian society. In the analyses that will follow the estimated effect of both economic fluctuations and of a subgroup of preferred business cycle proxies are presented.

B1. Income groups

It is interesting to investigate if the effect of the business cycle differs between income groups, which on a more general level may be though of as testing whether the effect of the business cycle differs across socioeconomic groups. To this end, the regressions are re-estimated for two income groups separately: one low-income group and one high-income group. These groups are simply defined by dividing the income distribution within the sample into two subsamples by using the median (the natural logarithm 10.61213) as cutoff point[8].

Table 6 presented the results. Only the preferred specifications (a), (b) and (g) are displayed. As shown there is a striking difference between the two groups. For the low-income group, the GSP and RGSI measures are statistically significant both in terms of more general macroeconomic fluctuations and in terms of business cycle fluctuations. The counter-cyclical variation in health in the low-income group is about twice as large compared to the estimated effect in the main sample. A standard deviation increase in GSP-growth and GSP-gap lower the health for the average individual in this group with 0.46 and 0.48 percentage points respectively. The variations in the effects are larger measured in terms of RGSI, 0.48 and 0.13 percentage points for RGSI-growth and RGSI-gap respectively.

Contrasting these results, no macroeconomic proxy is significant for the high-income group in the preferred specification (g), testing whether regional macroeconomic conditions impact on health independently from national macroeconomic conditions.

[8] Individuals belonging to the low income group thus have incomes equal to or lower than ln 10.612 and individuals belonging to the high income group have incomes higher than ln 10.612.

Table 6. Econometric estimates of the impact of macroeconomic and cyclical fluctuations on health on sample stratified by income

Regressor	Low income			High Income		
	(a)	(b)	(g)	(a)	(b)	(g)
State unemployment rate	.000691 (.001596)	.00072 (.001596)	.00072 (.001596)	-.001009 (.001399)	-.001206 (.001403)	-.001206 (.001403)
Australian unemployment rate			-.003419 (.002296)			-.001818 (.00196)
State GSP growth	-.002106*** (.000691)	-.002144*** .000691	-.002144*** (.000691)	-.000110 (.000698)	-.000048 (.000700)	-.000048 (.000700)
Australian GDP growth			.004624*** (.001416)			.003595*** (.0013790)
State RGSI growth	-.000683** (.000302)	-.00070** (.000301)	-.00070** (.000302)	-.000286 (.000254)	-.000273 (.000254)	-.000273 (.000254)
Australian RGDI growth			.000507 (.000613)			.000913* (.000477)
State unemployment-gap	-.013454 (.015539)	.004587 (.008311)	.00042 (.011055)	-.006782 (.01390)	-.010745* (.006483)	-.006310 (.00937)
Australian unemployment-gap			.008476 (.01455)			-.008514 (.012481)
State GSP-gap	-2.0518*** (.681124)	-.561582 (.481180)	-2.08606*** (.678774)	.005813 (.605216)	1.03757*** (.420237)	.115944 (.603467)
Australian GDP-gap			4.30559*** (1.36644)			2.48023** (1.14502)
State						
State RGSI-gap	-1.04317*** (.39335)	-.359779 (.312693)	-.995076*** (.385294)	-.227978 (.340731)	.380397 (.273154)	-.155499 (.336951)
Australian RGDI-gap			2.61901*** (.900753)			2.08375*** (.733162)

Note: *, **, and *** indicate significance at the 10, 5, and 1% level respectively. The low-income sample contains 5 178 individuals and the high-income sample contains 4 843 individuals. Both samples contains 28 063 observations. The unemployment-gap is estimated using the HP-filter. The GSP-gap and RGSI-gap are estimated using deterministic trend. Specification (a) excludes personal income. With this as the exception, all aforementioned personal characteristics are controlled for. All specification control for year and state fixed-effects and state-specific time trends.

Relaxing this restriction, specification (b) even indicates that the effect of regional business cycles on health, measured in terms of GSP-gap, is pro-cyclical for the high-income group.

B2. Educational groups

Does the business cycle affect the health of low-educated people and high-educated people differently? Table 7 displays the results of a sample stratified by the level of education. As indicated by the results, the answer to the question is suggested to be yes. Interestingly, the health high-educated people are in none of the specifications indicated to be affected by the business cycle. Dissimilarly, the health of low-educated people is suggested to vary counter-cyclically. Statistically significant results are found in all specifications for the GSP-growth and RGSI-growth. For the business-cycle measures GSP-gap and RGSI-gap the effects are significant in specification (a) while not in specification (b) that adds control for income. When refining the regional business cycle effects by further adding national cyclical fluctuation, the results again indicate that health of low-educated people decline as the economy strengthens.

In terms of the magnitude of the effects, a standard deviation increase in GSP-growth and RGSI-growth is associated with a decrease in average health in the group of low-educated people by 0.28 and 0.25 percentage points respectively. A standard deviation increase in the GSP-gap and RGSI-gap yield a decline of 0.28 and 0.11 in average health respectively.

B3. Age and sex

To see whether the effects of the business cycle differ in groups stratified by core demographic characteristics, results of subsamples divided by age and sex are shown in appendix. Table 9 displays the results from the regressions re-estimated separately for individuals of age 20-44 and 45-64 respectively. For persons of age 20-44 the results indicate that economic fluctuations in terms of GSP-growth and RGSI-growth affect health whereas for individuals between 45-64 years of age the effect derives from the business cycle measures. A standard deviation increase in GSP and RGSI growth is associated with a reduction in health for 20-44 year old persons with 0.29

and 0.24 percentage points respectively. For people of 45-64 years of age a standard deviation increase the GSP-gap and RGSI-gap is associated with a decline in health with 0.25 percentage points.

Concerning subsamples based on sex, shown in table 10, the results indicate significant effects for both the male and female population, although the results stem from different measures. For males, a standard deviation increase in RGSI growth and RGSI-gap is associated with a reduction in health with 0.33 and 0.27 percentage points respectively. For females, a standard deviation increase in GSP growth and GSP-gap is associated with a reduction in health with 0.26 and 0.28 percentage points respectively. Prior findings that health weakens as the economy strengthens are hence indicated to hold for both age groups and both populations divided by sex.

Table 7. Econometric estimates of the impact economic and cyclical fluctuations on health on sample stratified by education

Regressor	Low-educated			High-educated		
	(a)	(b)	(g)	(a)	(b)	(g)
State unemployment rate	-.0008738 (.0012596)	-.0008612 (.001259)	-.0008612 (.001259)	.0015287 (.0016483)	.0014525 (.0016525)	.0014525 (.0016525)
Australian unemployment rate			-.0028732 (.0017972)			-.0015818 (.0021789)
State GSP growth	-.0012476** (.0005695)	-.0012942** (.0005695)	-.0012942** (.0005695)	-.0008864 (.0007715)	-.0009468 (.000773)	-.0009468 (.000773)
Australian GDP growth			.0030639*** (.0011189)			0022971 (.0014109)
State RGSI growth	-.0006261*** (.0002289)	-.0006441*** (.0002289)	-.0006441*** (.0002289)	-.0001961 (.0003083)	-.0002303 (.0003091)	-.0002303 (.0003091)
Australian RGDI growth			.0007891* (.0004512)			.0010681 (.0005318)
State unemployment-gap	-.0181311 (.0119542)	-.0035449 (.0059795)	-.0061014 (.0083907)	.0057614 (.0164363)	.0006446 (.0077026)	-.0003632 (.0111106)
Australian unemployment-gap			.0051014 (.0110896)			.0019327 (.0142668)
State GSP-gap	-1.151796* (.5322181)	.113267 (.3703464)	-1.192224** (.5308749)	-.7246084 (.7107718)	.1319635 (.49153859)	-.6839781 (.7078947)
Australian GDP-gap			3.691121*** (1.043585)			2.135174* (1.278949)
State RGSI-gap	-.8680855*** (.2986755)	-.1102349 (.2403274)	-.8076229*** (.2949142)	-.1931059 (.4041698)	.1841651 (.32381)	-.2095725 (.397374)
Australian RGDI-gap			2.866712*** (.6821751)			1.505791* (.8095845)

Note: *, **, and *** indicate significance at the 10, 5, and 1% level respectively. The low-educated sample contains 4 288 individuals and 35 749 observations. The high-educated sample contains 2 296 individuals 20 377 observations. The unemployment-gap is estimated using the HP-filter. The GSP-gap and RGSI-gap are estimated using deterministic trend. Specification (a) excludes personal income. With this as the exception, all aforementioned personal characteristics are controlled for. All specification control for year and state fixed-effects and state-specific time trends.

V. An analysis of health-related lifestyle decisions

The preceding analysis documents that health varies counter-cyclically. In order to narrow down on the possible reasons for why health declines when the economy strengthens and increase when the economy weakens, a second analysis will be conducted to investigate whether this cyclical variation in health can be explained by changes in lifestyle. This analysis will be conducted on the GSP-growth and GSP-gap.

Lifestyle decisions, such as what we decided to eat, whether we choose to smoke and consume alcohol and how often we exercise all have a huge impact on our health. In Australia lifestyle related diseases are the leading cause of death. In fact, out of the top 10 causes of death in Australia in 2009, 8 are lifestyle related (Allianz Life Insurance, (2014) referring to ABS, (2011))

As suggested in the theory section, one possible reason for why health might decrease when the economy strengthens is that the opportunity cost of leisure time increases in economic upturns. Time-intensive health-producing activities such as exercise and quality home cooking may therefore decrease as they become more costly. Also consumption of health-damaging normal goods such as alcohol and tobacco was brought forward as a possible reason for why health might decline when the economy strengthens.

Suggestively, the outcomes that will be examined in the forthcoming analysis include the following: height-adjusted weight, physical activity, tobacco use and drinking.
Changes in height-adjusted weight and physical activity ought to captures general health risk, along with tobacco use and drinking. At the extreme one may note that about 3 in 5 Australians are overweight or obese which has strong links to e.g. heart disease, which is the primary lifestyle related cause of death in (Australia Australian Institute of Health and Welfare, 2012). Lung cancer is the second leading cause of death among males and the fourth leading cause of death for females in Australia where cigarette smoke being the common cause of lung cancer. Over 5.000 people per year die of excessive alcohol consumption in Australia.

A. Does lifestyle factors vary with the business cycle?

As indicated in table 8, economic conditions do not seem to influence the lifestyle factors put to investigation. [9] In none of the specification for none of the outcomes are the regional economic conditions suggested to influence the probability of smoking, drinking, participating in physical activity, nor on the intensity of smoking or weight-adjusted height.

As a robustness check to examine whether economic condition might affect different weight group differently, the regressions are reestimated on underweight, overweight and obese individuals separately.[10] Again, no influence of economic conditions was found. The robustness of the results were further examined by re-estimating the regressions by dividing the sample into the same income, education, age and sex groups as in section IV. These results did not differ to any significant extent for the results shown in table 8. [11]

[9] The linear probability model gives virtually identical results as to the ones given by the probit model. For this reasons, only the result of the linear probability models will be displayed.
[10] Following the standard classification of BMI for adults recommended by the WHO that is based on the association between BMI and illness and death (WHO 2000) where: underweight is BMI < 18.5, healthy weight is BMI ≥ 18.5 and BMI < 25, overweight but not obese is BMI ≥ 25 and BMI < 30, obese is BMI ≥ 30.
[11] Table of these results are not displayed but are available upon request.

Table 8. Econometric estimates of the impact of macroeconomic and cyclical fluctuations on lifestyle decisions

Regressor	(a)	(g)	(a)	(g)	(a)	(g)	(a)	(g)
	Smoker		Cigarettes per day (smokers only)		Drinker		Physical exercise	
State GSP-growth	.00063 (.00150)	.00071 (.00151)	.22587 (.72641)	.22409 (.72655)	-.00035 (.00134)	-.00049 (.00134)	-.00053 (.00237)	-.00065 (.00237)
Australian GDP-growth		-.00098 (.00281)		-5.2352 (1.5000)		-.00268 (.00267)		-.00737 (.00483)
State GSP-gap	.7253 (1.3719)	.67195 (1.3696)	379.20 (610.37)	329.77 (610.26)	.1107 (1.271)	-.07581 (1.2679)	-2.4818 (1.9313)	-2.5407 (1.9275)
Australian GDP-gap		-.36863 (2.5514)		-3890.0*** (1220.5)		.70037 (2.3966)		11.247 (3.8605)
	Body mass index		Underweight		Overweight		Obese	
State GSP-growth	.03237 (.03563)	.03536 (.03574)	-.07851 (.05268)	-.03263 (.08861)	-.00525 (.01283)	.00260 (.01982)	.03950 (.05255)	.10562 (.08316)
Australian GDP-growth		-.09380** (.04780)		-.08757 (.12381)		-.01468 (.02887)		-.12579 (.11243)
State GSP-gap	-34.292 (34.875)	-29.141 (34.871)	-75.362* (44.774)	78.351 (86.035)	-5.9251 (13.677)	-10.569 (21.790)	59.120 (52.965)	4.2636 (82.114)
Australian GDP-gap		49.899 (56.329)		-350.12** (175.97)		9.775 (35.973)		-32.822 (136.77)

Note: *, **, and *** indicate significance at the 10, 5, and 1% level respectively. The regressions for the determinants of smoker, drinker and physical exercise contains 6 171 individuals and 50 304 observations. The regressions on cigarettes per day (smokers only) contain 1 881 individuals and 10 944 observations. The determinants of BMI is estimated for 5 720 individuals and 28 405 observations. Subsamples on weight groups comprise 235 individuals and 398 observations for underweight, 3 213 individuals and 10 312 observations for overweight, and 2 025 individuals and 7 268 observations for obese. Specification (a) excludes personal income. With this as the exception, all aforementioned personal characteristics are controlled for. All specification control for year and state fixed-effects and state-specific time trends.

VI. Discussion and conclusion

This thesis can be viewed as a test of whether the previous findings on mortality rates suggesting that health weakens as the economy strengthens are visible using a more find-tuned health measure. Indeed, the principle finding of this study suggests that health declines as the economy strengthens. Both indicators of macro economic fluctuation measured in terms of growth rates and refined business cycle indicators measured in terms of deviations from the long run trend significantly affect health, as indicated by the Gross State Product (GSP) and Real Gross State Income (RGSI) measures. The counter-cyclical variation in health found is consistent with the pro-cyclical variation in mortality in Ruhm's (2000) seminal paper.

Earlier studies have typically interpreted their findings of a significant relationship between changes in the level of the unemployment rate and morality as evidence for that health varies cyclically. This study sought to clarify on the use of terminology in this respect. Interpreting a change in level of a time series, typically the unemployment rate, as a cyclical variation may not necessarily be the most accurate way of describing the fluctuation; as a decomposition of the time series, comprising both a trend component and a cyclical component, is suggested for such an interpretation to be valid.

Only a few studies have used decomposed time series. What characterize the significant indicators in the study by Gerdtham and Johannesson (2005) using Swedish microdata is however that they mainly focus on changes from the current level, rather than cyclical deviations from the long run trend. Svensson and Krüger (2012) perform a wavelet decomposition of GDP growth rates in Sweden for a period of 200 years (1800–2000). The findings of both these studies deviate with most of the previous literature in suggesting that mortality varies counter-cyclically. Although standing out in the literature by their measurements of the business cycle, the studies by Gerdtham and Johannesson (2005) and Svensson and Krüger (2012) are conducted on a country-level and hence fail to follow Ruhm's (2000) recommendation to control for fixed effects. The findings of this study support Rhum (2000)'s argument that not controlling for fixed-effects leads to an omitted variable bias, as if state-specific

effects are not controlled for then often I arrive at the opposite sign of the business cycle effect suggesting that a strengthened economy is associated with better health. The opposite results in the studies by Gerdtham and Johannesson (2005) and Svensson and Krüger (2012) may therefore follow from the fact that these studies are not able to control for unobserved heterogeneity.

Previous studies have found a rather robust effect of the unemployment rate on health. In this study the unemployment rate did not significantly influence health, nor the unemployment-gap. A possible reason could be that labor market dynamics simply do not affect health in the context of this study. Another reason could be that the effects of dynamics at the labor market are captured directly when individual-level labor force status is controlled for in this study, in contrast to prior studies using aggregate data where it is not possible to control for individual level characteristics. The finding that mortality rates are affected by changes in the unemployment rate on a sample consisting of elderly suggests nonetheless that the variable accounts for broader dynamics and may affect health independent of changes in labor force status (Ruhm, 2000).

A natural question that arises given the principle result in this study is whether the counter-cyclical variation in health is generalizable across different population subgroups. As an attempt to close in on this question, the main sample was stratified into subsamples based on the income and educational status of the respondents. The results indicate that the health of the low-income and low-educated subpopulations is affected counter-cyclically by the business cycle whereas no effect was found for the high-income and high-education population subgroups. Whether or not a business cycle effect is present is hence suggested to depend on socio-economic affiliation. Although there is a wealth of epidemiological evidence at the level of the individual suggesting a strong and positive association between lower income and poor health (see Suhrcke & Stuckler, (2012) for an overview), there are to my knowledge no empirical studies within the health and business cycle literature examining whether socio-economic groups are differently affected by the business cycle. For comparability of these results further studies are therefore needed.

Unlike Gerdtham and Johannesson (2005) and Ruhm (2003) who found stronger effect of the business cycle among men, the results of this study goes more in line with those of Neumayer (2004) in finding that the health of both men and women is affected by economic conditions. The magnitudes of the effects are also rather equal across sexes. Re-estimating the general results for 20-44 year old respondents and respondents of 45-64 years of age separately further indicate that both the age clusters are affected by economic conditions, again with rather equal sizes in effects. These results are consistent with Ruhm (2003) and Neumayer (2004) whereas Ruhm (2000) found the largest effect among young adults.

Why does health weaken as the economy strengthens? In order to narrow down on the possible reasons for why health declines when the economy strengthens, a second analysis was conducted to investigate whether the cyclical variation in health could be explained by changes in lifestyle decisions affected by the business cycle. Contrary to the findings of Ruhm (2000, 2005), no significant effects of business cycle on the lifestyle factors of smoking, drinking physical exercise and height-adjusted weight were found. Thus, no evidence is found in line with explanations for counter-cyclical variation in health as caused by cyclical variations in health-damaging consumption of normal goods or by variations in health-producing time-intensive activities influenced by the cyclical sensitive opportunity cost of leisure.

What then may drive the counter-cyclical variation in health? Speculating, perhaps the results point more towards the explanation of health as an input into the production of goods and services. During short-lasting economic expansions job hours may extend that in tandem with physical exertion of employment and job-related stress have negative health effects. These work-related negative health effects may be the most pronounced among worker of the low-income group that also may not have the highest education. Incentive to work more intense and harder during short-lasting economic expansions in order to save money for tougher times as insurance may explain the cyclical variation in health in this group.

The finding that low-income and low-educated groups are suggested to be counter-cyclically affected by the business cycle whereas no effect was found for high-income and high-educated groups needs to be examined in further studies before any firm

conclusions to be drawn. Further studies would also benefit from employing a greater variety of measures to account for macroeconomic fluctuations. Notably, measures accounting for the business cycle deriving from decomposed time series could be used to a greater extent.

In conclusion, does a strengthened economy weaken your health? It depends

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Appendix

Table 9. Econometric estimates of the impact of macroeconomic and cyclical fluctuations on health on sample stratified by age

Regressor	Individuals of age 20-44			Individuals of age 44-64		
	(a)	(b)	(g)	(a)	(b)	(g)
State unemployment rate	-.000739 (.001475)	-.000742 (.001476)	-.000742 (.001476)	.000167 (.001471)	.000139 (.001471)	.000139 (.001471)
Australian unemployment rate			.001290 (.00208)			-.004134** (002011)
State GSP growth	-.001354** (.000649)	-.001387** (.000650)	-.001387** (.000649)	-.000559 (.000682)	-.000642 (.000683)	-.000642 (.000683)
Australian GDP growth			.001364 (.001253)			.003188** (.001320)
State RGSI growth	-.000615** (.000275)	-.000646*** (.000275)	-.000646** (.000275)	-.000324 (.000255)	-.000339 (.000256)	-.000339 (.000256)
Australian RGDI growth			.001632 (.000543)			.000462 (.000469)
State unemployment-gap	-.015360 (.014317)	.000796 (.007139)	-.004017 (.009951)	-.008554 (.014003)	-.001923 (.006596)	-.005125 (.009461)
Australian unemployment-gap			.009633 (.012998)			.006198 (.012428)
State GSP-gap	-.684185 (.637163)	-.334588 (.438775)	-.668115 (.633590)	-.973515 (.631512)	.391161 (.441710)	-1.06596* (.629904)
Australian GDP-gap			.939228 (1.24862)			3.92671*** (1.17062)
State RGSI-gap	-.494817 (.370453)	-.174451 (.291916)	-.5476333 (.3623836)	-.678287** (.337322)	.063256 (.281146)	-.659224** (.334941)
Australian RGDI-gap			1.542011* (.8001516)			2.81133*** (.727686)

Note: *, **, and *** indicate significance at the 10, 5, and 1% level respectively. The sample of individuals of 20-44 years of age contains 3 848 individuals and 28 206 observations. The sample of individuals of 20-44 years of age contains 4 064 individuals and 27 920 observations. Specification (a) excludes personal income. With this as the exception, all aforementioned personal characteristics are controlled for. All specification control for year and state fixed-effects and state-specific time trends.

Table 10. Econometric estimates of the impact of macroeconomic and cyclical fluctuations on health on sample stratified by sex

Regressor	Males			Females		
	(a)	(b)	(g)	(a)	(b)	(g)
State unemployment rate	.000919 (.0014243)	.0009382 (.001424)	.0009382 (.001424)	-.0007652 (.0013933)	-.0008037 (.0013943)	-.0008037 (.0013943)
Australian unemployment rate			-.003505* (.001979)			-.001648 (.0019388)
State GSP growth	-.0008302 (.0006536)	-.0009305 (.000654)	-.0009299 (.0006542)	-.0012352* (.0006388)	-.0012634** (.000639)	-.0012634** (.000639)
Australian GDP growth			.0030985** (.0012775)			.002354* (.0012083)
State RGSI growth	-.0008226*** (.0002643)	-.00085*** (.0002639)	-.00085*** (.0002639)	-.0001847 (.0002541)	-.0002072 (.0002544)	-.0002072 (.0002544)
Australian RGDI growth			.0008147 (.0004995)			.0009268* (.0004757)
State unemployment-gap	-.0042942 (.0135394)	.0021954 (.0067516)	.0016568 (.0094615)	-.0142764 (.0135937)	-.00515 (.0065567)	-.009129 (.0093969)
Australian unemployment-gap			.0010628 (.0125063)			.0078008 (.0121823)
State GSP-gap	-.5775629 (.6070019)	.3192473 (.4189048)	-.6796358 (.6038713)	-1.25273** (.5950259)	.017384 (.416298)	-1.22423** (.5939422)
Australian GDP-gap			2.735964** (1.170045)			3.433783*** (1.115422)
State GSP-gap	-.7285519* (.3399182)	-.0927931 (.2731153)	-.7270632** (.3345685)	-.5548498* (.3360595)	.0617885 (.2715139)	-.5184105 (.3321778)
Australian GDP-gap			2.573842*** (.7463525)			2.305363*** (.7266412)

Note: *, **, and *** indicate significance at the 10, 5, and 1% level respectively. The male sample contains 2 268 individuals and 25 530 observations. The female sample contains 3 396 individuals 30 596 observations. Specification (a) excludes personal income. With this as the exception, all models control for the following personal characteristics: personal income, employment status, marital status, level of education, whether full-time student, sex, age, and indigenous origin. All specification control for year and state fixed-effects and state-specific time trends.