PEOPLE'S WELL-BEING AND ECONOMIC SECTOR PERFORMANCE

A Thesis

Presented to the Faculty of the Graduate School

of Cornell University

in Partial Fulfillment of the Requirements for the Degree of

Master of Science

by

Jingru Jia

August 2021

© 2021 Jingru Jia

ALL RIGHTS RESERVED

ABSTRACT

This thesis shows that movements in different industry sectors have significant and different effects on the individual's subjective well-being. Using subjective well-being data of Europe and disaggregated macroeconomic data from five industry sectors (agriculture, construction, manufacturing, finance, and wholesale & retail), we demonstrate that subjective well-being is correlated with the growth of each industry sector, and the impact of different industry sectors differ in size, duration, and influence mechanism. In addition, we also find an asymmetry in the effects of positive and negative economic growth on subjective well-being. The well-being loss caused by recessions are greater in both magnitude and statistical significance. People's subjective well-being is mainly driven by periods of negative growth. Besides that, we also further studied from supply and demand side, determined the positive correlation between consumer surplus and social well-being, while impact of supply side is negative. This research provides a new perspective on well-being and macroeconomic performance and has implications for growth policy.

Keywords: Well-being, macroeconomics, business cycle

BIOGRAPHICAL SKETCH

Jingru Jia received her Bachelor's degree in Economics from Nankai University in 2019. Due to the interest in development economics and social welfare, she joined Cornell University and pursued a research Master's degree. Her advisors are Professor David Just and Professor Giles Hooker.

This document is dedicated to all Cornell graduate students.

ACKNOWLEDGEMENTS

Throughout the time at Cornell, I have received a great deal of support. I would like to express my deepest gratitude to Professor David R. Just, who leads me to the research world from nearly zero. He generously gave me a lot of advice and encouragement when I applied for Ph.D., helping me through that difficult time. I'm also extremely grateful to Professor Giles Hooker for his invaluable guidance in shaping my research. I have benefited a lot from his suggestions on statistical models and result testing. I would also gratefully acknowledge the assistance of Professor Shanjun Li and Professor Calum Turvey. They provided me with a lot of academic planning advice during my time at Cornell, which convinced me to pursue a Ph.D..

Many thanks to my family members: my mom, dad, grandma and my grandpa in my heart. They are the reason I am who I am today, without their guidance and support, I could not attain the accomplishments I have now. Thanks should also go to Neo, Yellow and Black. Their companionship throughout the quarantine time made me feel less lonely while living outside my homeland.

My life was dramatically changed during my two years at Cornell. Things are much more difficult during the pandemic, which made every decision more tough. In the end, I would like to praise myself for not giving up. Pandemic can't stop me! Then nothing can stop me!

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1.1 Background and motivation

"Are you happy?" What things do you believe are most directly related to your happiness, if you were asked this question? Happiness and economic development, the ultimate goal and the objective performance of human's development, are closely intertwined, and the deeper connections between them is worth examining.

Economic growth and fluctuation are always two of the most discussed topics among economists, as they are intimately linked to societal progress and stability(Kaldor (1954)). Since the time of Keynes(Leijonhufvud (1967)), short-term fluctuations has been a prominent question among economists. This is because of the frequent crisis, as well as the resulting decline in employment, social discontent, and recession. However, in recent years, the operation of the western economies has gradually become more stable. The features of economic fluctuation are vastly different from those observed during the Great Depression and subsequent financial crises in the early twentieth century. In light of this, some economists (see Acemoglu (2012)'s review) think that we should focus more on long-term growth rather than short-term fluctuations. In this case, determining the value of these two types of studies became the primary concern.

Most economists calculated the cost of economic fluctuation by computing the drop in GDP or other macroeconomic indicators(Baxter and Kouparitsas (2005),Arby (2001)). It is evident that economic performance can be used to as-

sess a country's development. Economic development, on the other hand, has as its primary purpose the improvement of people's living standards and overall happiness. Rather than using numerous measures to determine the level of economic progress, it is preferable to investigate whether people's happiness has actually improved. Therefore, the most effective method is to question individuals directly about their well-being.

The objective of this thesis is to investigate the relationships between people's welfare and the macro factors. This research, on the other hand, takes a different method to addressing this issue.

Firstly, the growth of macro-economy is treated in a disaggregated way. There are already many existed studies focusing on the influence of business cycle but most of them discussed it from an aggregated aspect(Easterlin (1974),Layard (2011),Graham (2012),Tella et al. (2003),De Neve et al. (2018)). The most prevalent factor used to depict macroeconomics in these studies is GDP. Zellner and Israilevich (2005) demonstrated that, in the prediction question, it is more precise to use disaggregated data. Note that different industry sectors, like agriculture, services, construction, have extremely varied growth patterns. Each of them has its own cycling regularities and influential factors. Using aggregate data for evaluation would lose a lot of information due to the diverse patterns of different industries. Furthermore, when analyzed in a disaggregated manner, it is better targeted for policy research.

Second, in this thesis, subjective well-being data is employed to assess social welfare. Welfare is a topic which people started to think about since ancient times. Happiness, in his perspective, stems from people's spiritual fulfillment. Zhuangzi, an ancient Chinese philosopher, also stated that "happi-

ness is a state of unlimited spiritual freedom." Since Pigou and Bentham coined the term "welfare cost," studies have focused on economic welfare. The consumer utility function is used to compute economic well-being, and overall social welfare is computed by adding the individual utilities together. Later, Paul Samuelson constructed a multiple function with labor, capital, and consumption to assess social well-being in his social welfare function theory. These economic theories are growing more sophisticated in terms of mathematics and economics, but they disregard psychological and emotional components. According to these welfare theories, with consistent economic expansion in recent years, social welfare is predicted to rise in lockstep with economic prosperity. This is obviously untenable. This is the welfare-development paradox raised by Easterlin (1974). As economists and sociologists tend to focus more on people-oriented problems such as inequality and pollution, social welfare should be measured by people's true feelings of happiness rather than economic data.

The total welfare in a market is defined as the sum of consumer surplus and producer surplus. When deciding what form of policy will best enhance people's happiness, we must examine the effects of both the demand and supply sides. Antitrust laws have been implemented in a number of countries in order to foster market competition. According to the report of the Unilateral Conduct Working Group, one of the antitrust purposes was to protect an effective market Group et al. (2007). Surely, supporting competitive markets is not solely for this reason. The market efficiency is worthwhile to keep only if it has other roles and can produce other outcomes. Does the competition policies' ultimate objective ends at promoting people's well-being? If it does, then boosting consumer surplus while simultaneously constraining producer surplus will be an effective approach to improve people's well-being. In other words, policymakers assume

that consumer surplus has a greater effect on people's happiness. To see if this claim is true, we'll calculate the impact of producer and consumer surpluses in the agriculture industry and compare them.

1.2 Literature Review

Welfare economics studies how to figure out the ways to create better resource allocation decisions to maximize societal welfare (Just et al. (2008)). The most distinguishing feature of welfare economics is that "welfare" is in fact unobservable. Unlike income, population, prices or costs, the utility of individuals, which symbolizes welfare, is unobservable. This brings difficulties as well as a lot of controversies in studying this topic. Pigou's *the Economics of Welfare* (Pigou (2013)) marked the establishment of a complete theoretical system of welfare economics. This also laid the foundation for the birth of the Cambridge School. Marshall proposed an analytical tool for social welfare, such as the concept of social welfare, economics rent, consumer and producer surplus in *the principal of economics* (Marshall (2009)). Their viewpoints form the old welfare economics. There are two major theories in the old welfare economics: (1) Jeremy Bentham's utilitarianism theory. Under this theory,Every individual would optimize his or her personal well-being , and the social welfare is the sum of every individual's well-being. (2) cardinal utility theory, which assumed that the utility of commodities can be measured and compared among individuals.

On the foundation of old welfare economics, new welfare economics was established, which was better suited to the new social development of the twentieth century.There are several main distinctions between them. Firstly, in

new welfare economics, ordinal utility displaces cardinal utility. In Koopmans (1960)'s view, utility cannot be measured by specific values. It's impossible to compare one's welfare with the other's since the criteria for each varies. Pareto (1896) argues that the society is better off only when somebody is better off while no one is worse off. This argument was also reinforced by HicksHicks (1939) by claiming that social welfare cannot be obtained simply by summing up every individual's utility since people are expected to have different welfare weights. Kaldor Efficiency (Kaldor (1939)), developed by Kaldor and Hicks, was used to compare the effects of various government programs. This is also known as compensation principal: if a policy improves an individual's situation, and this improvement may compensate for the loss of other people with surpluses, the general benefit of society is improved. Later, De Scitovszky (1941) pointed out the shortcoming and inconsistency of Kaldor Efficiency by introducing the state changes: suppose policy X is better than policy Y in the origin state, and the gainers can compensate the loser by adopting policy X; however, after policy X is implemented, we may conclude that policy Y is better than p based on the new condition. Therefore, Scitovsky introduced double criteria and set the pre-requisite that the losers won't try to avoid making the change or moving back.

The discussion of modern social welfare function was first introduced by Burk (1938) and was fully interpreted by (Samuelson (1948)). Under their view, social welfare, denoted by w, is dependent on a wide range of real-value factors, that $w = w(z_1, z_2, ...)$, where z_i are the households numbers.This means that the social welfare is wholly reliant on the utility of households. It doesn't have any specific settings, or say, it's only a concept, and thus it's not systemized or meaningful enough. To address this issue, Arrow and Debreu (1954) introduced the Arrow social welfare function, which is a novel type of welfare function. Unlike

Samuelson's welfare function, it take various sets of personal preferences or welfare ordinaries into consideration that could constrain the function. However, in the following years, he independently developed Arrow's impossibility theorem, demonstrating that the Arrow social welfare function cannot exist since the reasonable requirement for the function cannot be fulfilled. The studies on welfare economics were then temporarily suspended for a long time. From 1970s, economists started to notice that using conventional utility functions to calculate social welfare rankings was illogical. In 1975, Ng (1975) once showed that the individual cardinal utilities is worthwhile to be reconsidered. Although by itself is insufficient, by using an alternative method, he proved that the social welfare function can be a sum of individual utilities. Since then, several types of social welfare functions based on cardinal effect theory have emerged, including the Nash social welfare function, which was developed using game theory and public choice theory, and Atkinson's social welfare function, which captures society's inequality aversion by assigning different parameters to the rich and poor. There are several axioms that cardinal welfare function is supposed to satisfy. (1) Related to Pareto optimality, if an individual's utility increases with all other people's utility unchanged, the latter utility profile would strictly dominate the first one. (2) Permutation of the profile cannot change the total social welfare. (3) The utility profiles are continuous. (4) Individuals' preferences are separable. The four axioms allows the welfare function $w = w(z_1, z_2...)$ a continuous increasing function.

From 20th century, the studies focusing on people's happiness started being largely conducted. Typically, the surveys on people's feelings emerged. Large scale happiness survey came into world after 1960s(Cantril et al. (1965);Gallup (1976)). Gallup, for example, conducted a study to find out what individuals are

concerned about. Their choices include their personal health, living standard, children, housing, working conditions and several other choices. Participants were asked to rank the importance of each option. With the technological advancement, sampling methodologies and techniques have progressed, allowing for the collection of happiness data from entire countries. At that time, most surveys are quite brief and shallow, only described people's feeling in a broadly way. (Diener and Larsen (2009);Diener et al. (1985);Diener and Fujita (1995);Diener and Fujita (1997)) contributes a lot on constructing the scale of subjective well-being. Diener built up the development and validation of a scale to measure global life satisfaction, the Satisfaction With Life Scale (SWLS). SWLS covers most factors and characteristic of life, is internal consistent and performs well in different time period. From then on, well-being surveys gradually became mature and complicated, which contains enough features of both micro and macro level. Since the self-report approaches that SWLS relied have danger of bias, it was been called in question for a long time. Some researchers also developed other methods to measure people's well-being such as with facial expressions analysis, emotion tests. However, in 1993, Sandvik et al. (2009) showed the validity of self-report approaches and its long-term stability relative to other methods.

Over the years, psychologists have launched several studies in order to hypothesize the reasons of happiness. A large number of demographic characteristics have been found to be significant. Early studies, for example, discovered that age is a crucial variable. In Bradburn and Caplovitz (1965)'s study, the impact of income was given considerable attention. They revealed that because younger people have not yet reached their full earning potential, they have a higher expectation of future earnings, which leads to greater life pleasure. They

eventually came to the conclusion that younger people are more likely than older people to be happy. However, a later investigation showed that this trend is primarily due to health concerns. Older people reported higher level satisfaction in every domain but health(Campbell (1981)). More recent studies turned to use life cycles rather than age(Medley (1980)). Additional, the influence of age on subjective well-being is more through life goals(Cheng (2004)). Gender has an impact that is compounded by age. Based on the data collected from adult population in the United States, Spreitzer and Snyder (1974) found out that young females experience happier life than young male, but this difference fades as they get older. However, when focused solely on gender variable, little influence is found(Olsen (1979); Sauer (1977)). In Batz and Tay (2018)'s literature review, they concluded that the small gap of subjective well-being between different genders is attributable to null values in surveys. Another aspect that is strongly correlated to life satisfaction is job satisfaction.Cohn (1979)employed a nationwide cross-sectional survey that is tied to the stage of people's labor force participation: satisfaction would be driven by the outcome of employment rather than the experience itself at a later level. Even when income differences are controlled, the unemployed group appears to be the less happy group(Campbell (1981)).It was discovered that a stronger social norm would amplify the negative effects of unemployment (Stam et al. (2016)). Campbell (1981)'s dataset reveals that education degree is essential in determining subjective well-being. Higher education is associated with a better quality of life, but he also raised the question of the collinearity between education and income. Freedman (1978) further discussed that on the one hand, higher education level can provide higher living property, on the other hand, it can also add pressure to some extent. This argument is further proven based on broader data and

better approaches that educated people set higher expectations, which might create anxiety. Once the expectations are met, this effect of education could be negligible(Kristoffersen (2018)).

Easterlin (1974) first began researching macroeconomic issues with subjective well-being surveys. Later, Easterlin(Easterlin (1995), Easterlin (2009)) further proved that, rising the average income of the entire country does not lead to the rising of people's average happiness level. In other word, life satisfaction is an untrend variable. Freedman (1978) also also conducted study on happiness and national income, finding that the effect of income is only restricted to a certain extent by the level of poverty, but that once the baseline is reached, its influence is no longer substantial.

Kahneman and Deaton (2010), Clark et al. (2008) further explored the income study based on the subjective well-being data. The evidence of its relationship with both absolute and relative income had been found. Wolfers (2003) later discovered evidence that increased inflation and unemployment were associated with poorer subjective well-being. Using a world-wide data, Layard (2011) and Graham (2012) failed to determine significant relationship between self-reported happiness and GDP per capita. On the contrary, Tella et al. (2003) found robust evidence of the movements in reported well-being are correlated with changes in macroeconomic variables, using data from United States and Europe.Utilizing smokers as a sample, citeGruber investigated the impact of taxation on people's happiness. Rubio et al. (2020) did a cross-sectional study to look at the relationship between the quality of a health system's service and the pleasure of its users. The researchers have been doing further in-depth explorations on this topic in recent works. Iyer and Muncy (2016) assessed the ef-

fects of consumption attitudes and found that, on the personal level, consumption attitudes are positively associated to an individual's subjective well-being, whereas macro attitudes are more likely to cause people concern. Based on the decrease of average subjective well-being in Europe during the economic recessions, Morgan and O'Connor (2019) presents empirical evidence that labor market policies which provide protection for employee can eliminate the negative effect of crisis. Conigliaro (2018) studies the relationship between employment and social averaged subjective well-being from the labour status, discovering that labour status could have impact by influencing living conditions and income. In De Neve et al. (2018)'s study, the differences between positive and negative economic growth is taken into consideration. They came to the conclusion that economic growth has significant influence on people's subjective well-being, but the gradient is twice as steep at the negative growth rate compared to the one at the positive growth rate.

Production is a crucial component of economic activities. A large number of studies have been conducted on related research topics involving production performance and its relationship to the market in various industry sectors. For example, how does price affect the market competitiveness? How much does public policy affect the costs and profits of producers, as well as their well-being? There are several approaches to measure producer's welfare: (1) *Profit.* Profit maximization is regarded to be the purpose of every business. Profit is given by subtracting total costs from total income, that is, $\pi = TR - TC$, where π is the profit, TR and TC are total revenue and total cost. When a new policy is implemented, the change in profits can measure the increase or decrease of producer's welfare (Just et al. (2008)). (2) *Producer surplus.* Producer surplus is defined as the area between the price line and the supply curve (Stigler (1949)).

In fact, these two measurements are based on the same criteria since producer surplus would be the exact amount of the sum of profit and fixed cost. In addition, if the data of output market is unavailable, it's also reasonable to obtain producer welfare by estimating demand curves of intermediate products.

Similarly, consumer welfare gain can be calculated by determining how much a consumer would be willing to pay for a better circumstance, as proposed by Dupuit (1844) in 1844. Based on this view, Hicks et al. (1986) further established the approach of measuring utility change of consumers. According to his argument, consumer surplus, which is defined as the area below the demand curve and above the price line, can approximately capture the change of consumer's willingness-to-pay, or put another way, consumer's welfare change as long as the impact of income effect is modest enough to be ignored. Later, Willig (1976) provided a more accurate quantitative derivation, indicating that even a tiny income effect should be taken into account in order to achieve a satisfactory fit of consumer's welfare.

Sufficient evidence support that the welfare effects of supply and demand side are disparate. Based on the US beef market data, Mullen et al. (1988) found out that the distribution of surplus gains are impacted by the substitution of inputs. Chung and Kaiser (1999) argued that policy changes would affect consumers and producers in very different ways. Therefore, we'll investigate how the differences between the supply and demand sides affect people's subjective well-being. Different industry sectors have various properties and influences, thus using aggregated data may lead to the loss of much information. No one has looked into well-being indicators based on disaggregated data. We will conduct our research based on sector-level data to bridge that gap.

1.3 Structure of the thesis

This paper structures as follows. Chapter two describes data and analyzes the micro pattern of the subjective well-being data. The main data source of this paper is from the Euro-Barometer GESIS survey series. This data series record people's self-reported life satisfaction level and their essential personal characteristics. From 1976 to 2015, the surveys included roughly 420,000 people from European countries. Micro patterns of data are also recognized in order to assess the data's reliability and gain an initial understanding of it.

The empirical study was carried out in Chapter 3. We analyzed the macro data in a disaggregated way since sectors react differently throughout evolution. We selected main sectors includes agriculture, construction, finance, manufacturing and wholesale and retail. According to the results of probit regression, the survey results reflect how individuals feel about their life, which moves consistently with the performance of industry sectors. Aside from that, we identified the distinct effects of industry sector growth in positive and negative growth years.

In chapter 4, we explored from supply and demand side. We looked at the effects of producer and consumer surplus on people's subjective well-being in the agriculture sector as an example. The outcomes suggest that increasing consumer surplus has a beneficial impact on people's happiness, whereas increasing producer surplus has the reverse effect.

Chapter 5 summarizes.

CHAPTER 2

SUBJECTIVE WELL-BEING DATA PATTERN

2.1 Descriptive statistics

The Eurobarometer Survey Series and the United States General Social Survey provide the subjective well-being data used in this thesis. Every year, a random sample of Europeans are selected by Eurobarometer researchers. The chosen individuals respond to a series of questions pertaining to many disciplines, one of which we focus on: Overall, are you very satisfied, somewhat content, not very satisfied, or not at all content with your life? Over the course of 26 years, 287,960 people from 12 countries took part in the study and answered the ”life satisfaction” question.

Table 5.1 - Table 5.3 present summary statistics regarding the distribution of life satisfaction. According to their self-reported data, over 82.05% are more than fairly satisfied of the 287,960 participants. That is, people are more inclined to express optimism about their lives. The difference between unemployed and employed people seems significant. Only 14.32% of unemployed persons say they are very satisfied compared to 27.69% of employed persons ($Z = -106.15$, $p = 0.00$). The situation is identical for the distribution of fairly satisfied people. 55.79% of employed people are fairly satisfied about their life, while only 48.02% of unemployed people share the same sentiment, which is 7.77% less than the former one ($Z = 48.5212$, $p = 0.00$). This distribution is accord with our intuition and can also point us in the right path for future research, since unemployment rate is highly related to the macro economy. Many policies are also aimed at addressing the issue of unemployment. A similar pattern can be seen in the

income quartile distribution: it's apparent that people's levels of life satisfaction rise as their income rises. For people with income in top 25%, 29.4% of them are very satisfied with their life, while the number for people in bottom 25% is only 21.98%.

2.2 Missing value analysis and Data imputation

As our data is collected from survey series, there exists the problem of missing values in each feature over time. The proportion of missing values for each variable is presented in table 5.4. To assure the study's completeness, we do data imputation after assessing the missing values and conduct subsequent investigations using the complete data set.

In general, the mechanism of missing value can fall into three categories(Rubin (1976)):

(1) Missing completely at random (MCAR)

In this situation, the missing data is completely random, and the probability of the missing occurrence has nothing to do with the observed or the unobserved data. This is an ideal situation, especially when the number of missing value is small.

(2) Missing at random(MAR)

The missing data is not completely random. The probability of the occurrence of missing data is related to the observed variables, but has nothing to do with the characteristics of the unobserved data. In this case, we need to further

check the data collection process and figure out why the data is missing.

(3)Missing not at random(MNAR)

Missing data not only depends on other variables, but also on the variables themselves, this kind of missing is called missing not at random, it is also named not negligible missing.

There are primarily two reasons for the missing value in our study. The first is that some of the participants refused to respond to certain questions. This could be due to selection bias. The other reason is due to the questionnaire. Some questions were not covered or were evaluated in different ways in some specific years so we cannot get the values. This type of missing value falls to the last category, MNAR, because the missing data is related to the years as well as their own attributes. However, based on the fact that we are using historical survey data and nothing can be changed at this point, we are unable to correct the data in any other way than by imputing with data analysis and prediction tools, despite the fact that this may result in some error in the final result.

See figure 5.1. Each row represents a missing pattern, with red indicating that it is missing and blue indicating that it is not missing. The legend on the right displays the number of this pattern, which can be seen in the table. Figure 5.2 depicts the distribution of each row. The transition colors from black to gray to white signify different values, and red represents missing values. A greater number of transition colors indicates more scattered data values, while a smaller number of transition colors indicates more concentrated data values. Thus, all of the variables have even data distribution.

Since there are multiple missing variables in our dataset, we use Multiple

Imputation method(Carpenter and Kenward (2012)) to complete the dataset. MI method uses Monte Carlo simulation to build a set of possible filling values from a sample with missing values, resulting in a set of numerous complete data. The new dataset will then be statistically examined, and the results of each filled data will be combined. The final statistical inference is then obtained, as well as the confidence range for the missing value. We do the following analysis with this completed dataset.

2.3 Data pattern

Studying social welfare with subjective well-being data is a new perspective that emerged recent years. Although many breakthroughs have been made in a short period of time, some people continue to dispute the data's reliability. There are no uniform standards for evaluating life satisfaction because subjective well-being data is obtained from each individual. Each person has their own definition of happiness, which is so variable that the weather on the day of the interview could play a massive effect. How can we verify that the subjective well-being data we're using is adequate for a formal study in this case?

First, in Tella et al. (2003)'s paper, a regression on suicide rates and country averaged life satisfaction level was conducted. Higher national suicide rates are connected with poorer national averaged life satisfaction levels, according to the regression result, which is statistically significant. This supports the hypothesis that the data on subjective well-being in this group of countries is related to people's mental health and provides useful information. Another regression is used to assess the data's dependability. The protester claims that self-reported

happiness data is unreliable due to the lack of natural scaling. While the survey data of every individual could be volatile, it is less of a problem if we can find some common reasonable patterns based on large samples.

Table 5.5 and table 5.6 provides the result of the well-being regression equation of different countries with various personal characteristics and dummy variables of years. We may deduce from the tables that the subjective well-being data for different countries appear to follow a similar trend. Life satisfaction, for example, has a U-shape pattern in age, indicating that there is a life cycle pattern. Unemployment is the factor always has the greatest effect: its negative effect cannot be offset even if the individual possesses all of other properties with positive effect. The unemployment status has a significant negative effect on income and it has the greatest effect among all personal characteristics(Bloom and Michalopoulos (2001)). In other word, the result is accord with the principal of utility function in welfare economics.

CHAPTER 3

EMPIRICAL STUDY

3.1 Disaggregated Model

It has been proven that changes in GDP have a substantial impact on people's subjective well-being(Tella et al. (2003);De Neve et al. (2018)). However, the aggregate data as GDP could lose a lot of information, since different economic sectors have different development and fluctuation behavior. Figure 5.3 plots the annual growth rate of different economic sectors as well as GDP for European countries. The economic sectors taken into consideration are: (1) agriculture; (2) construction; (3) manufacturing; (4) finance; (5) wholesale & Retail. Obviously, different sectors have quite varied behaviors, therefore adopting aggregate models could result in the loss of a lot of relevant information. Additionally, policy analysis based on aggregated data appears improbable, as the effect on specific sectors is impossible to determine. We use a model with data disaggregated by economic sectors in this paper.

Emerging improvements in the growth forecasting literature highlight the importance of using disaggregated market data. The Marshallian Macroeconomics Model(MMM) is first derived by Zellner(Zellner and Tobias (1998); Veloce and Zellner (1985)). It is derived from three basic equations: (1) the industry output demand equation, (2) the industry output supply equation and (3) the firm entry condition equation, which capture the behaviors of each industries. In this thesis, we use a simplified MMM. According to prior work by Zellner, based on Cobb-Douglas production function with two inputs: Labor, L and Capital, K, and the derived firm profits:

$$q = AL^{\alpha}K^{\beta}, A > 0, 0 < \alpha < 1, 0 < \beta < 1, 0 < \alpha + \beta < 1 \tag{3.1}$$

$$\pi = pq - wL - rK \tag{3.2}$$

where q is each representative firm's total production, A is the technological parameter, and p, w, r denote the output, labor, and capital prices per unit. By the maximization condition of each firm and the entry condition of the industry, three-equation DSE(Demand, Supply and Entry) can be derived as following:

Demand

$$\dot{S}/S = (1-\eta)\dot{p}/p + \sum_{n=1}^{k} \eta_i \dot{x_i}/x_i, \tag{3.3}$$

Supply

$$\dot{S}/S = \dot{N}/N + (1/\theta)\dot{p}/p - (\alpha/\theta)\dot{w}/w - (\beta/\theta)\dot{r}/r, 0 < \theta < 1, \tag{3.4}$$

Entry

$$\dot{N}/N = \gamma(F_e - \theta S), 0 < \theta < 1, \tag{3.5}$$

where p is the product price and changes by time, N is the number of companies enters into this industry, $S = pQ = Bp^{1-\eta}Y^{\eta_s}x_1^{\eta_1}x_2^{\eta_2}...x_d^{\eta_d}$, represents the industry nominal sale, Y is nominal income, and x variables are demand shift variables, $F_e(t)$ is profits level.

From the above three equations, we can derive the following non-linear differential equation for the total sales of each industry, which is denoted by S:

$$(1/S)dS/dt = a(1 - S/F) + g \tag{3.6}$$

in which a and F are reorganized parameters, g is a linear combination of wage rate, capital price and demand shifters(GDP, real money, etc.). When g is a constant value greater or equal to zero, the differential equation (3.6) would present a logistic curve solution.

The model was used to predict a sector growth rate by employing a sector relationship. Each sector's prediction result can be added together to get a total growth forecast, which can then be used to calculate total production. The accuracy of the forecasts from the model with disaggregated data was greatly improved when compared to the forecasts from the model with aggregated data. In the following part, agriculture, construction, manufacturing, finance, wholesale & retail will be taken into consideration as part of total outputs.

We will use a simplified static version of the MMM model to tie people's subjective well-being measures to economic growth by sector in the following sections. We hypothesized that different industries had varying effects on people's well-being, with some industries being more significant than others. Positive growth and negative growth may also have opposite influence. Finally, we will identify which side of the supply or demand side is more worthy of attention in terms of social well-being.

3.2 Regression analysis

3.2.1 Baseline regression

We begin by estimating the impact of each economic sector on an individual's life satisfaction in order to evaluate the effect of economic fluctuation on welfare. According to Easterlin (1974), there is no discernible trend in people's happiness levels. In other words, people's feeling of happiness is a stationary variable. The economy, on the other hand, evolves with time. In this case, focusing on the growth rate of industries' value adding as well as GDP is a wiser choice. We disaggregate the economy and estimate the regression of the following form:

$$LIFESATISFACTION_{jit} = \beta_1 Agri_{it} + \beta_2 Const_{it} + \beta_3 Manu_{it} + \beta_4 Fin_{it} + \beta_5 Whsale_{it} + \sum Personal_{jit} + \xi_t + \lambda_t + \mu_{jit} \tag{3.7}$$

where the $LIFESATISFACTION_{jit}$ is the self-reported subjective well-being by individual j from country i at time t. $Sector_{it}$ are the value added growth rate of each sector of country i at time t. The vector $\sum Personal_{jit}$ represents an individual's personal characteristics, including gender, age, education years, marital status and employment status. Country fixed effect ξ_t and year fixed effect λ_t is also included to eliminate the difference culture and institutional difference, and the global economic shocks that would influence all the countries.

Easterlin (1974) has concluded that there is no repetitive rising tendency in people's happiness. On the other hand, the output of the national industrial sector, as well as GDP, has been steadily expanding over time. As a result, the

βs would approximately equal to 0 due to the standard reasons. Therefore, we focus on the growth rate of value added data. The employment status is included in the personal variable. This variable enables us to evaluate a type of loss caused by economic downturns. The unemployment rate is a key indicator of recessions, and it can have two effects on people's well-being: (1) Those who lose their work will suffer the consequences of job loss and wage reductions. (2) Those who are employed may experience a drop in well-being as a result of the anxiety brought on by rising unemployment. When people see their friends and coworkers lose their jobs, it's difficult not to wonder if it will be their turn someday. Their well-being bears the cost of this anxiety.

See table 5.7. In the ordered probit regression, the dependent variable is self-reported subjective well-being, while the independent variables are the value added growth rate of five industry sectors, as well as personal controllers. We have two objectives here. The first one is to test which sectors have significant impact on people's well-being. The second is to figure out how big the effects are. According to the result, all five sectors have statistically significant impact on people's well-being. The agriculture sector variable is with a coefficient of 0.06 and a standard error of 0.02, while the construction sector has a coefficient of 0.12 and a standard error of 0.03, the manufacturing sector has a coefficient of 0.23 and a standard error of 0.06, and the finance sector is with a coefficient of 0.22 and a standard error of 0.04. The wholesale and retail sector is the only one with a negative coefficient: the coefficient is -0.33 and the standard error is 0.10. The data we used is from 12 European countries and spans the years 1995 to 2019.

Table 5.8 shows the marginal effect of each industry sector to every life sat-

isfaction category. The proportion of people in very satisfied category(the top happiness category) is raised by 1.99%, 3.84%, 7.04% and 6.73% accordingly with one unit increase in the growth rate of value added of agriculture, construction, manufacturing and finance sector. Meanwhile, the proportion of people in not at all satisfied category(the bottom happiness category) is lowered by 0.33%, 0.63%, 1.16% and 1.11% accordingly with one unit increase in the growth rate of value added of agriculture, construction, manufacturing and finance sector. According to this dataset, the growth of the four industries listed above has an inevitable positive influence on people's well-being. The wholesale and retail sector, on the other hand, is in an entirely different circumstance. A one-unit rise in the wholesale and retail sector's growth rate of value added has a significant impact. It raised the proportion of people in not at all satisfied category by 1.66% percent, and lowered the proportion of people in very satisfied category by -1.01% percent. It implies that individuals are displeased with the rise of the wholesale and retail sectors.

3.2.2 Potential reasons for wholesale and retail sector's negative impact

Differences in the influence mechanism of different industry sectors. The wholesale and retail sector's effect on well-being is delayed, whereas other sectors have instant consequences. When the wholesale and retail sector expands rapidly, companies mostly provide low-skill positions and reduce prices to attract consumers by compressing labor costs(Corbeet (2018)). This type of job cannot boost workers' well-being in the short term, but it can do so in the long

run(Autor et al. (2020)). The industry requires additional technological innovation and product upgrades after the early stage of development. In the later stages, the demand for skilled workers has increased. Firms began to offer high-paying positions, resulting in a gradual increase in the positive impact on workers' well-being. In this case, adding lagged terms to the regression equation may be helpful.

Differences in the development pattern of different industry sectors. As seen in Figure 5.3, different industry sectors have different patterns throughout time. If the wholesale retail sector is the first to grow after a recession, its negative coefficient makes sense: people haven't recovered from the sadness of recession-induced unemployment, whereas the wholesale & retail industry has already started to rise. The growth rate is high since it is at the beginning stage of the business cycle. People's life satisfaction declines when the value added growth rate of the wholesale and retail sector grows, which is consistent with the regression results.

Prices are rising on the consumer side. We notice that from 2000 to 2020, the increasing rate of consumer price are higher than the increasing rate of producer price. Figure 5.4 presents the trend of consumer price index and producer price index of retail goods. CPI grows faster than PPI in the past 20 years. Based on the facts we summarized in the literature review, that the supply and demand sides' influence may be opposing, which may result in a detrimental impact on the retail and wholesale sectors. Further examination on this hypothesis will be conducted in the following sections.

3.2.3 Impact of lagged term

Does the economic development has permanent or temporary effects on people's well-being? According to conventional economic theories, the effect is lasting, but this does not appear to be the case in our experience. There is no evident increasing trend of happiness, according to Easterlin's paradox and some more discussion(Lucas et al. (2004)), and this could be explained by relative income. Another possibility is that while national economic development has a positive effect on people's well-being, other issues associated with it, such as pollution and inequality, may counteract this progress. We're exploring this by incorporating the macro elements' lagged levels into our model.

Table 5.9 shows that the construction and manufacturing sectors are moving in the same direction with subjective well-being. The impact of the construction sector becomes larger, while the impact of the manufacturing sector is smaller. This indicates that these two departments have a long-term impact on people's subjective well-being. The distinction is that the construction sector's influence is progressively growing, whereas the manufacturing sector's influence is shrinking throughout the lag period. The growth of the agricultural sector will have a detrimental impact on people's subjective well-being during the lag period, which may be related to the nature of the annual harvest of agricultural products: People overestimate the agricultural market in the following year because of the previous year's growth, but agricultural product growth is highly dependent on external factors such as climate and environment, and is untrended through time. Wholesale &retail sector has a lagging effect on people's subjective well-being. It has a negative impact in the current period, but a very substantial favorable influence in the lag period. In the lag phase, the

financial sector is no longer significant, indicating that its impact is temporary and unsustainable.

3.2.4 Piecewise regression model

By behavioral economic theories, people are more sensitive to loss than to gains(Kahneman and Tversky (2013);Tversky and Kahneman (1991)). We'd like to see if the loss aversion phenomenon still exists in terms of macroeconomic growth. In this section, we divide the sample into two groups based on whether each industry sector's growth rate is negative or positive, then fit a piecewise regression to see if there are any asymmetry effects of growth. The following is the regression equation:

$$\begin{aligned} LS_{jit} = {} & \beta_1 Agri_{it}^{+} + \beta_2 \left|Agri_{it}^{-}\right| + \beta_3 Const_{it}^{+} + \beta_4 \left|Const_{it}^{-}\right| + \beta_5 Manu_{it}^{+} + \beta_6 \left|Manu_{it}^{-}\right| \\ & + \beta_7 Fin_{it}^{+} + \beta_8 \left|Fin_{it}^{-}\right| + \beta_9 WhR_{it}^{+} + \beta_1 0 \left|WhR_{it}^{-}\right| + \sum Personal_{jit} + \xi_t + \lambda_t + \mu_{jit} \end{aligned} \tag{3.8}$$

where X^{+} represents the corresponding industry sector growth rate in the years that the growth is positive, equals to 0 otherwise, while X^{-} represents the corresponding industry sector growth rate in the years that the growth is negative, equals to 0 otherwise.

Table 5.10 shows the regression results, while table 5.11 shows the marginal effect.When we regress with the separate terms for positive and negative growth, we observe that the coefficients of negative growth terms are greater in both significance and magnitude in the agriculture, construction, finance, and wholesale and retail sectors. Periods of negative growth are the key drivers of people's subjective well-being. There are several conjectures for the mecha-

nisms.

One potential explanation of the ”loss aversion” effect is the non-pecuniary effect of unemployment(Kassenboehmer and Haisken-DeNew (2009)). De Neve et al. (2018) introduced employment rate into the analysis of subjective well-being and GDP, concluding that the unemployment rate is a driving factor in the relationship between the two. This isn't the sole mechanism, though. In addition to the reduction in income, uncertainty is another important symptom of the recession. It is distracting and challenging for people to adapt to a new business cycle. Government employees, a group with relatively steady jobs, experience the least influence on their subjective well-being in an economic shock(Luechinger et al. (2010)).This provide the evidence that economic uncertainty has direct negative effect upon individual's subjective well-being.

As previously noted, in the long run, there is a paradox between economic development and people's subjective well-being: national income continues to grow, but people's subjective well-being is untrended, contradicting traditional welfare theories. The asymmetry effect of positive growth and negative growth can provide an alternative explanation for the paradox. People are more sensitive to recession than to equal growth. Although, in an economic cycle, economic loss during a recession does not reverse wealth accumulation during a growth period, the loss of people's subjective welfare completely offsets the welfare gain brought on by economic expansion. As a result, while economic growth occurs throughout time, subjective well-being remains essentially unchanged.

To illustrate more vividly, see Figure 5.4. We assume that economic development adopts a ten-year cycle: growth in the first eight years, and recession

in the following two years. Assuming that the rates of growth and recession are roughly the same, the economy will display a growth trend in the long run. According to the regression result, negative growth has a significantly greater impact on people's subjective well-being, so the welfare accumulation in the first eight years will be erased in the next two years. In a business cycle (and the same over multiple cycles), people's subjective well-being level hardly increases. Based on this, the income welfare paradox implies that it is futile to improve social well-being in the long-term with economic development. Maintaining long-term stable economic growth, however, makes the recession's impact insufficient to offset growth's positive well-being effect, which is a strategy to preserve societal well-being.

3.3 Robustness check

To test the results' robustness, we utilize three methods: changing the statistical model, dropping the independent variable, and using different dataset.

3.3.1 Changing statistical model

In previous parts, we conducted several ordered probit models and determined the impacts of different industry sectors. We perform the regression with an ordered logit model in this section to see if a different statistical model leads to different regression results.

Table 5.12 shows the result of ordered logit model. As we can see, the sign and relative size of coefficients, and the degree of significance have not changed.

The growth rate of all of the five industry sectors have significant influence on people's subjective well-being, in which agriculture, construction, manufacturing, and finance sector have positive effect well the impact of wholesale retail sector is negative. The result is consistent with our finding with the probit model.

3.3.2 Dropping independent variables

In the previous regression equation, we have the growth rate of the valued added of five industry sectors as independent variables that represent macroeconomic changes. In the robustness test, we orderly drop one of the five variables each time and see whether the regression result changes significantly. If not, then the regression result in this example can be proven to be robust. As shown in table 5.13, after dropping independent variables in turn, the results are still not significantly affected, indicating that the model is robust.

3.3.3 Changing dataset

Finally, we conduct an out-of-sample test by using the dataset collocted from the United States rather than Europe. We use the same method to look at the sample's summary statistics before running an ordered probit model to see the micro pattern of the data. The results are presented in tables 5.14 and 5.15. The micro pattern and data distribution are quite similar to Europe's dataset. We examine the effects of five industry sectors, as well as their lagged terms, on people's well-being in the United States using the same regression equation without

the country control variable. Table 5.16 summarizes the results. The pattern we discovered in the Europe dataset, however, cannot be fully applied here. Manufacturing and financial sector growth have no significant impact ($p-value > 0.1$) on people's subjective well-being, whereas the impact of wholesale and retail sector growth is positive in the first year but negative in the second. The agriculture industry initially has a positive impact, however this effect only lasts one year before turning negative the following year. In both periods, the construction industry has a positive impact. This means that only agriculture and construction have the same effect on people's well-being as they do in Europe. These discrepancies could be attributed to a lack of data, as the US dataset only covers a 19-year span.Further check would be left to future researchers.

CHAPTER 4

EXPLORATION FROM SUPPLY SIDE AND DEMAND SIDE OF AGRICULTURE SECTOR

4.1 Background and motivation

Countries have long been dedicated to protecting the effectiveness of competitive markets by enacting regulations such as antitrust legislation. The goal of antitrust law, as stated by the US court, is to defend the market's competitive process. This is surely not the primary or ultimate purpose of these policies and actions. In fact, it is only the intermediate objective that helps in the achievement of the ultimate aim of social well-being promotion. Increasing consumer surplus is the largest direct consequence of encouraging competitive markets and enhancing market efficiency. The question we will investigate is whether expanding consumer surplus may truly improve society's overall well-being. To put it another way, does promoting consumer surplus have a higher beneficial influence on social welfare than promoting producer surplus?

Supply and demand welfare measures affect different groups. Producer surplus, the total amount of producer's benefits from producing and selling goods, measures producer's welfare. Consumer surplus, the difference between the price that consumer pays and the price that consumer willing to pay, measures the welfare of consumers. In different industries, these groups may be more or less influential or prevalent. For this reason, we will examine the independent effects of producer and consumer surplus. Due to the availability of the data, we will use agriculture sector as an example to explore this subject.

We utilize the agriculture industry in Europe as an example in this chapter. In section 4.2, we estimate the agriculture sector's supply and demand function in preparation for calculating producer and consumer surplus. We calculate producer and consumer surplus in 4.3, based on the estimated result in section 4.2, by computing the triangle area between price and the supply or demand curves. The results and associated interpretation are presented in section 4.4.

4.2 Estimating the aggregate supply and demand function

4.2.1 Estimating supply function

The agricultural sector's aggregate supply function depicts farmers' reactions to changes in the average price of all agricultural products on the market. Although it may lose some information and have some limitations when compared to the supply functions of specific products, it can show the country's ability to produce food and related products. The aggregate agriculture supply function is the sum of all farm supply functions across the country. To measure this relationship, aggregate indices of price and quantity are necessary. The principle between price and quantity will also hold.

Based on the fact that production responds slowly to price changes, it has been suggested that the relationship between output and price is almost fixed in the short run(Cochrane (1947)). This is owing to the farm's stable landscape, labor resources, large farming equipment, and significant short-term investments. Therefore, the aggregate agriculture supply function is almost, although maybe not perfect, inelastic in the short-run. Agriculture, on the other hand,

has evolved dramatically throughout the decades. Later on, researchers began to dispute on aggregate output and its correlation to shifting average prices. Because of the overstatement of the influence of capital and labor constraints, Heady et al. (1955) came up with the claim that the nearly perfect supply curve is an illusion. In fact, technological advancements and capital distribution flexibility can result in a supply curve with a positive slope.

We use Nerlove (1956)'s partial adjustment model to induce the aggregate agriculture supply function. Based on this, we assume that the independent variable values in the current time determine the expected value of the outcome:

$$Y_t^* = a + bX_{t-1} + u_t \tag{4.1}$$

where Y_t^* is the expected output in year t, X is the potential independent variables that could determine output. a and b are parameters and u_t is error term.

However, the real outcome can only be part of the expected output in every specific time period. This is due to the limitation of short-run conditions: the changes of costs, fixities, and labor. So,

$$Y_t - Y_{t-1} = \gamma(Y_t^* - Y_{t-1}), 0 < \gamma \leq 1 \tag{4.2}$$

where γ represents the ratio real output to expected output.

Insert equation 4.1 into equation 4.2:

$$Y_t = \gamma a + \gamma b X_{t-1} + (1-\gamma) Y_{t-1} + \gamma v_t \tag{4.3}$$

where

$$v_t = \gamma u_t - \gamma(1-\beta) u_{t-1} \tag{4.4}$$

For every representative firm, the desired supply:

$$Y_{it}^* = \alpha + \beta P_t + c T_t + \epsilon_i t \tag{4.5}$$

where Y_{it} is the agriculture output in year t. P_t is the producer price index, whose raw data is collected at the farm gate. T_t is technology index. α, β, γ and ϵ are all constants.

Apply the partial adjustment model to it, we have: $\overline{Y_{it}} - \overline{Y_{it-1}} = \gamma_i(Y_i t^* - \overline{Y_{it1-1}}), 0 < \gamma_i \leq 1$

Inserting into :

$$\overline{Y_{it}} = \gamma_i a + \gamma_i b P_t + \gamma_i c T_t + (1-\gamma_i)\overline{Y_{it-1}} + \gamma_i e_i t \tag{4.6}$$

, in which γ_i means that not all firms can adjust perfectly in this procedure. Then for the agriculture market"

$$\overline{Y_{it}} = \sum \overline{Y_{it}} = \sum [\gamma_i \alpha + \gamma_i \beta c T_t + (1-\gamma_i)\overline{Y_{it-1}} + \gamma_i e_i t] = \alpha + \beta P_t + \sigma T_t + \sum (1-\gamma_i)\overline{Y_{it-1}} + v_t \tag{4.7}$$

The difference between actual output and planned output is determined by weather factor and other factors, so the real output can be given by:

$$Y_i t = \overline{Y_i t} + g_i W_t + u_{it} \tag{4.8}$$

where W_t represents weather index in year t and u_{it} With the assumption $E(W_t) = 0$, we can obtain that $E(Y_{it}) = E(\overline{Y_{it}}) = \gamma_i a + \gamma_i b P_t + \gamma_i c T_t (1-\gamma_i)\overline{Y_{it-1}} + \gamma_i e_i t$

Thus the static regression to estimate the supply function is:

$$E(Y_{it}) = \gamma \alpha + \gamma_i \beta P_t + \gamma_i c T_t + g_i W_t \tag{4.9}$$

We employ the time variable to replace the technology index due to the rising tendency of tech0onological development. The final regression equation to estimate each country's supply function over time is:

$$E(Y_{it}) = \gamma_i \alpha + \gamma_i \beta P_t + \gamma_i c t + g_i W_t \tag{4.10}$$

4.2.2 Estimating demand function

The form of the aggregate demand function is:

$$c_t = k y_t^{a_1} P_t^{\beta} Q_t^{\gamma} n_t^{\epsilon} \tag{4.11}$$

where c_t is the amount of food consumption in year t, y_t is the national income (GDP), P_t is food price index, Q_t is price index for other commodities, and n_t is the population of a country in each year, and k is a constant.

The function can be turned to the following form:

$$lnc_t = lnk + a_1 lny_t + \beta lnP_t + \gamma lnQ_t + \epsilon lnn_t \tag{4.12}$$

The data source of total food consumption is FAO STAT food balanced sheet, GDP and population are world bank dataset, indices of food and other goods prices are FRED (Federal Reserve Bank of St.Louis).

4.2.3 Estimation results the functions

Since the aggregate quantity of supply and demand in a year is large, we take logarithm values of each variable in supply function when doing the regression. The regression equation for the supply function after modifying some of the relevant parameters is:

$$lnY_{it} = \gamma lnproducerprice_{it} + \alpha lnw_{it} + \beta lnt_i + c \tag{4.13}$$

In order to eliminate endogeneity, we use 2sls model to do the regression to estimate the equations jointly. In particular, when estimating aggregate supply function, we use price index of other goods, national income and population as IVs. We employ the weather variable in the supply function as IV for the aggregate demand function. Six of the eight countries for which we have full dataset access have reasonable estimated outcomes (the estimated price parameter in the supply function is positive, while it is negative in the demand function). Given the number of observations in at least two of the countries, this could indicate that the instruments are too weak.

The regression results for each country is shown as table 5.17 and table 5.18.

4.3 Impacts of consumer surplus and producer surplus

4.3.1 Consumer and producer surplus

Consumer surplus is defined as the difference between the price that consumers are willing to pay and the price they actually pay (the market price). It measures the welfare that consumers obtain from their consumption behaviors. Producer surplus is the difference between the price they are willing to sell and the income they actually receive, which is also the market price. It measures the producers welfare on the market. Under this setting, the total social welfare is the sum of producer and consumer surplus. Figure 5.5 depicts this relationship for the

majority of goods and services on the market.

The curve D and S according represents demand and supply curve of the country in a specific year. Suppose we have a perfect competitive market, then the market reaches an equilibrium at the intersection of supply curve and demand curve, with an equilibrium price of P_0 and an equilibrium quantity of Q_0. The tangent of the curves is then calculated. Producer surplus is defined as the triangle area above $P0$ and below the demand curve, whereas consumer surplus is defined as the triangle area below $P0$ and below the supply curve.

Recall the supply function in 4.2:

$$lnY_{it} = \gamma lnproducerprice_{it} + \alpha lnw_{it} + \beta lnt_i + c \tag{4.14}$$

In order to calculate the producer surplus, we need to turn it into the format without any logarithms. Suppose that:

$$Q = S\,P^{\gamma} \tag{4.15}$$

where γ is the supply curve's elasticity and $S = w^{\alpha} t^{\beta} e^{c}$. is the supply curve's elasticity. Calculating the triangular area between P_0 and the supply curve yields the producer surplus. The base and height of this triangle are Q_0 and $(P_0 - P_1)$, respectively, which can be represented by the supply function's variables and parameters, and so the producer surplus is:

$$PS_{it} = \frac{1}{2} \frac{2Q_0}{\gamma S P_0^{\gamma} - 1} Q_0 \tag{4.16}$$

The same logic applies to how we get consumer surplus. Given that the demand function for a country in a specific year is:

$$lnc_t = lnk + a_1 lny_t + \beta lnP_t + \gamma lnQ_t + \epsilon lnn_t \tag{4.17}$$

Suppose that:

$$Q = CP^{\eta} \tag{4.18}$$

where η is the elasticity of the demand curve, and $C = GDP^{\alpha} pop^{\beta} pog^{\gamma} e^{c}$, where population and price of other goods are denoted by pop and pog. The base and height of the consumer surplus triangle can be approximated as Q_0 and $P_2 - P_0$. The consumer surplus is:

$$PS_{it} = \frac{1}{2} \frac{-2Q_0}{\gamma S P_0^{\gamma} - 1} Q_0 \tag{4.19}$$

4.3.2 Regression analysis

In order to detect the impacts of producer and consumer surplus, we conduct a regression analysis by include consumer and producer surplus in the regression equation. Recall that in section 3.2, we used a regression equation to assess the impact of different industry sectors' growth:

$$LIFESATISFACTION_{jit} = \beta_1 Agri_{it} + \beta_2 Const_{it} + \beta_3 Manu_{it} + \beta_4 Fin_{it} + \beta_5 Whsale_{it} + \sum Personal_{jit} + \xi_t + \lambda_t + \mu_{jit} \tag{4.20}$$

After adding the consumer and producer surplus, this equation turns out to be:

$$LIFESATISFACTION_{jit} = \beta_1 Agri_{it} + \beta_2 Const_{it} + \beta_3 Manu_{it} + \beta_4 Fin_{it} + \beta_5 Whsale_{it} + \sum Personal_{jit} + lnCS_{it} + lnPS_{it}\xi_t + \lambda_t + \mu_{jit} \tag{4.21}$$

If it is true that stimulating the growth of consumer well-being rather than producer well-being is more effective in increasing total social welfare, we should expect the regression result to show that the estimated parameter of the lnCS variable is positive and significantly greater than the parameter of the lnPS variable.

Table 5.19 shows the results. Column (1) shows the result of regression with all industry sectors. To avoid the problem of collinearity, we also conduct ordered probit regression without agriculture sector and without all five sectors. The results are shown in column (2) and column (3). As in previous parts, we also generate the marginal effect of lnCS and lnPS to well-being under different settings in table 5.20. The proportion of people in very satisfied category(the top happiness category) is raised by 3.37%, 4.13% and 3.00% accordingly with one unit increase in the logarithm value of consumer surplus. Meanwhile, the

proportion of people in not at all satisfied category (the bottom happiness category) is lowered by 0.54%, 0.67%, 0.49% accordingly with one unit increase in it. On the contrary, for producer surplus, with one unit increase in the logarithm value of producer surplus, the proportion of people in very satisfied category is lowered by 3.36%, 3.72%, 7.61%, and the proportion of people in not at all satisfied category is raised by 0.54%, 0.60%, 1.23%. Clearly, these findings imply that a rise in consumer surplus has a positive influence on people's well-being, whereas an increase in producer surplus has a negative impact due to a crowding effect.

4.3.3 Discussion

From the result we can see, in order to raise the total social welfare, government and policy maker should focus more on the demand side rather than the supply side. We'll go over a few strategies for protecting consumer interests and increasing consumer surplus.

Price stability. Although from people's intuition, price stability is conducive to people's welfare, there have been debates throughout the years over whether price consistency is beneficial to consumers. first proposed in 1944 that consumer surplus is significantly higher when prices are unstable than when prices are stable(Waugh (1944)). Later, Massell (1969) further argued that consumers prefer price instability as long as the instability is driven from supply side. However, Samuelson (1972) refuted these views one by one demonstrating that Waugh's theory is inapplicable. Since then, more researchers also concluded that price instability is harmful and that consumers benefit from price stability

using other methodologies such as partial equilibrium. High price fluctuations, particularly in the agriculture sector, are a key characteristic. Grega (2002) explored the impact of price stability in agricultural market and the result support that consumers gain from stable price.

Technology evaluation. Science and technology have advanced at a rapid pace in recent decades. No matter in the IT field, the medical field, or the agricultural field, there are endless new technologies. In this context, the influence on consumer surplus deserves more attention when deciding how to allocate scarce resources to technologies, which involves evaluating the worth of developing a new technology.Currently, there are primarily two techniques to estimating technology value(Brynjolfsson (1996)): (1) Output and productivity. By analyzing with production function, we can assess the value that input can bring(Loveman (1994)). Typically, researchers use Cobb-Douglas production function and estimate by maximizing profits or minimizing costs. (2) Performance metric. In general, performance metrics include income growth, profit growth, market share growth, and a variety of other industry-related factors and indicators. For example, Weill (1992) estimated the investment in information system in manufacturing sector by isolation the contribution of specific technologies with performance metrics. (3) Consumer surplus. The last method is by estimating the change total consumer benefits. While the first two techniques focus on production profits, or, to put it another way, producer welfare, the third approach is more in accord with our point of view.

Price control. As previously stated, maintaining market effectiveness is a key strategy of increasing consumer surplus. Price regulation can lead to market inefficiency in a competitive market(Bulow and Klemperer (2011)). However,

it can enhance consumer surplus in the short term. In the long run, there are three main reasons for the drop in consumer surplus produced by price controls: first, supply will be lowered in the long run, and as a response, consumer surplus will drop as the supply curve shifts downward. Secondly, Consumers who are ready to pay the highest price do not always have access to the highest supplies(Glaeser and Luttmer (2003);Palda (2000)). Viscusi, Harrington and Vernon called this ”allocation costs”(Waller (2006)). Finally, prospective rent-seeking actions reduce consumer surplus.

CHAPTER 5

CONCLUSION

In conclusion, this thesis further advances the existing research on the relationship between economic performance and subjective well-being. We investigated the diverse effects of the growth of the agricultural, construction, manufacturing, finance, and wholesale & retail sectors on people's subjective well-being using disaggregated macroeconomic data. The size, duration, and influencial mechanism of the five sectors were revealed to be different. Wholesale & retail sector is the most special one, as it has no immediate influence and only begins to have a favorable impact later on. This may be due to differences in influence mechanisms or development patterns between wholesale & retail sector and other industry sectors.

We also concluded that the effects of positive and negative economic growth on subjective well-being are asymmetrical. This applies to four of the five industry sectors. The improvement in subjective well-being brought about by positive economic growth is slight, or even insignificant, while the well-being costs caused by negative economic growth are greater in magnitude and significance. As a result, more attention should be paid to the loss of welfare during the recession, with the goal of decreasing it as much as possible, such as through retaining employment and lowering economic uncertainty. Many academic researchers and policy makers overlook this asymmetry and place far too much emphasis on economic growth's beneficial impacts. Here, we reveal how a recession has a substantial negative impact on one's well-being. Solving the problems that occur during the recession may be more beneficial than ensuring positive growth.

Finally, we further detected from the supply and demand side. By adding the consumer and producer surplus to the regression equation, we determined that consumer surplus has positive influence on people's well-being, while producer surplus has a negative impact. In this way, we found out that demand side deserves far more attention than the supply side. in order to promote overall societal well-being, they should concentrate on the demand side and consumer surplus, and attemp to maintain competitive market effectiveness.

BIBLIOGRAPHY

Acemoglu, D. (2012). Introduction to economic growth. *Journal of economic theory*, 147(2):545–550.

Arby, M. F. (2001). Long-run trend, business cycle & short-run shocks in real gdp.

Arrow, K. J. and Debreu, G. (1954). Existence of an equilibrium for a competitive economy. *Econometrica: Journal of the Econometric Society*, pages 265–290.

Autor, D., Dorn, D., Katz, L. F., Patterson, C., and Van Reenen, J. (2020). The fall of the labor share and the rise of superstar firms. *The Quarterly Journal of Economics*, 135(2):645–709.

Batz, C. and Tay, L. (2018). Gender differences in subjective well-being. *Handbook of well-being. Salt Lake City, UT: DEF Publishers*.

Baxter, M. and Kouparitsas, M. A. (2005). Determinants of business cycle comovement: a robust analysis. *Journal of Monetary Economics*, 52(1):113–157.

Bloom, D. and Michalopoulos, C. (2001). How welfare and work policies affect employment and income: A synthesis of research.

Bradburn, N. M. and Caplovitz, D. (1965). Reports on happiness: A pilot study of behavior related to mental health. (3).

Brynjolfsson, E. (1996). The contribution of information technology to consumer welfare. *Information Systems Research*, 7(3):281–300.

Bulow, J. and Klemperer, P. (2011). Price controls and consumer surplus.

Burk, A. (1938). A reformulation of certain aspects of welfare economics. *The Quarterly Journal of Economics*, 52(2):310–334.

Campbell, A. (1981). The sense of well-being in america: Recent patterns and trends.

Cantril, H. et al. (1965). *Pattern of human concerns*. Rutgers University Press.

Carpenter, J. and Kenward, M. (2012). *Multiple imputation and its application*. John Wiley & Sons.

Cheng, S.-T. (2004). Age and subjective well-being revisited: a discrepancy perspective. *Psychology and Aging*, 19(3):409.

Chung, C. and Kaiser, H. M. (1999). Distribution of gains from research and promotion in multistage production systems: Comment. *American Journal of Agricultural Economics*, 81(3):593–597.

Clark, A. E., Frijters, P., and Shields, M. A. (2008). Relative income, happiness, and utility: An explanation for the easterlin paradox and other puzzles. *Journal of Economic literature*, 46(1):95–144.

Cochrane, W. W. (1947). Farm price gyrations—an aggregative hypothesis. *Journal of Farm Economics*, 29(2):383–408.

Cohn, R. M. (1979). Age and the satisfactions from work. *Journal of Gerontology*, 34(2):264–272.

Conigliaro, P. (2018). Labour status and subjective well-being. a micro-level analysis and a multidimensional approach to well-being.

Corbeet, E. (2018). Amazon sends 'anti-union' training video to whole foods team leaders: report. 26.

De Neve, J.-E., Ward, G., De Keulenaer, F., Van Landeghem, B., Kavetsos, G., and Norton, M. I. (2018). The asymmetric experience of positive and negative

economic growth: Global evidence using subjective well-being data. *Review of Economics and Statistics*, 100(2):362–375.

De Scitovszky, T. (1941). A note on welfare propositions in economics. *The Review of Economic Studies*, 9(1):77–88.

Diener, E. and Fujita, F. (1995). Resources, personal strivings, and subjective well-being: a nomothetic and idiographic approach. *Journal of personality and social psychology*, 68(5):926.

Diener, E. and Fujita, F. (1997). Social comparisons and subjective well-being.

Diener, E., Horwitz, J., and Emmons, R. A. (1985). Happiness of the very wealthy. *Social indicators research*, 16(3):263–274.

Diener, E. and Larsen, R. J. (2009). Temporal stability and cross-situational consistency of affective, behavioral, and cognitive responses. pages 7–24.

Dupuit, J. (1844). On the measurement of the utility of public works. *International Economic Papers*, 2(1952):83–110.

Easterlin, R. A. (1974). *Does economic growth improve the human lot? Some empirical evidence*. Elsevier.

Easterlin, R. A. (1995). Will raising the incomes of all increase the happiness of all? *Journal of Economic Behavior & Organization*, 27(1):35–47.

Easterlin, R. A. (2009). *Growth triumphant: The twenty-first century in historical perspective*. University of Michigan Press.

Freedman, J. L. (1978). Happy people: What happiness is, who has it, and why.

Gallup, G. H. (1976). Human needs and satisfactions: A global survey. *Public opinion quarterly*, 40(4):459–467.

Glaeser, E. L. and Luttmer, E. F. (2003). The misallocation of housing under rent control. *American Economic Review*, 93(4):1027–1046.

Graham, C. (2012). Happiness around the world: The paradox of happy peasants and miserable millionaires.

Grega, L. (2002). Price stabilization as a factor of competitiveness of agriculture. *ZEMEDELSKA EKONOMIKA-PRAHA-*, 48(7):281–284.

Group, U. C. W. et al. (2007). Report on the objectives of unilateral conduct laws. *Assessment of Dominance/Substantial Market Power and State Created Monopolies*.

Heady, E. O., Pesek, J. T., and Brown, W. G. (1955). Crop response surfaces and economic optima in fertilizer use. *Iowa Agriculture and Home Economics Experiment Station Research Bulletin*, 32(424):1.

Hicks, J. R. (1939). The foundations of welfare economics. *The Economic Journal*, 49(196):696–712.

Hicks, J. R. et al. (1986). A revision of demand theory. *OUP Catalogue*.

Iyer, R. and Muncy, J. A. (2016). Attitude toward consumption and subjective well-being. *Journal of Consumer Affairs*, 50(1):48–67.

Just, R., Hueth, D. L., and Schmitz, A. (2008). *Applied welfare economics*. Edward Elgar Publishing.

Kahneman, D. and Deaton, A. (2010). High income improves evaluation of life but not emotional well-being. *Proceedings of the national academy of sciences*, 107(38):16489–16493.

Kahneman, D. and Tversky, A. (2013). Prospect theory: An analysis of decision under risk. pages 99–127.

Kaldor, N. (1939). Welfare propositions of economics and interpersonal comparisons of utility. *The Economic Journal*, pages 549–552.

Kaldor, N. (1954). The relation of economic growth and cyclical fluctuations. *The Economic Journal*, 64(253):53–71.

Kassenboehmer, S. C. and Haisken-DeNew, J. P. (2009). You're fired! the causal negative effect of entry unemployment on life satisfaction. *The Economic Journal*, 119(536):448–462.

Koopmans, T. C. (1960). Stationary ordinal utility and impatience. *Econometrica: Journal of the Econometric Society*, pages 287–309.

Kristoffersen, I. (2018). Great expectations: Education and subjective wellbeing. *Journal of Economic Psychology*, 66:64–78.

Layard, R. (2011). *Happiness: Lessons From a New Science, Rev. Ed*. London: Penguin.

Leijonhufvud, A. (1967). Keynes and the keynesians: A suggested interpretation. *The American Economic Review*, 57(2):401–410.

Loveman, G. W. (1994). An assessment of the productivity impact of information technologies. *Information technology and the corporation of the 1990s: Research studies*, 84:110.

Lucas, R. E., Clark, A. E., Georgellis, Y., and Diener, E. (2004). Unemployment alters the set point for life satisfaction. *Psychological science*, 15(1):8–13.

Luechinger, S., Meier, S., and Stutzer, A. (2010). Why does unemployment hurt the employed? evidence from the life satisfaction gap between the public and the private sector. *Journal of Human Resources*, 45(4):998–1045.

Marshall, A. (2009). *Principles of economics: unabridged eighth edition*. Cosimo, Inc.

Massell, B. F. (1969). Price stabilization and welfare. *The Quarterly Journal of Economics*, 83(2):284–298.

Medley, M. L. (1980). Life satisfaction across four stages of adult life. *The International Journal of Aging and Human Development*, 11(3):193–209.

Morgan, R. and O'Connor, K. J. (2019). Labor market policy and subjective well-being during the great recession.

Mullen, J. D., Wohlgenant, M. K., and Farris, D. E. (1988). Input substitution and the distribution of surplus gains from lower us beef-processing costs. *American Journal of Agricultural Economics*, 70(2):245–254.

Nerlove, M. (1956). Estimates of the elasticities of supply of selected agricultural commodities. *American Journal of Agricultural Economics*, 38(2):496–509.

Ng, Y.-K. (1975). Bentham or bergson? finite sensibility, utility functions and social welfare functions. *The Review of Economic Studies*, 42(4):545–569.

Olsen, J. K. (1979). The effect of change in activity in voluntary associations on life satisfaction among people 60 and over who have been active through time.

Palda, F. (2000). Improper selection of high-cost producers in the rent-seeking contest. *Public Choice*, 105(3):291–301.

Pareto, V. (1896). *Cours d'économie politique: professé à l'Université de Lausanne*, volume 1. F. Rouge.

Pigou, A. C. (2013). *The economics of welfare*. Palgrave Macmillan.

Rubin, D. B. (1976). Inference and missing data. *Biometrika*, 63(3):581–592.

Rubio, A., Mendiburo, A., Oyanedel, J. C., Benavente, L., and Paez, D. (2020). Relationship between the evaluation of the health system personnel by their users and their subjective well-being: A cross-sectional study. *Medwave*, 20(6):e7958–e7958.

Samuelson, P. A. (1948). Foundations of economic analysis.

Samuelson, P. A. (1972). The consumer does benefit from feasible price stability. *The Quarterly Journal of Economics*, 86(3):476–493.

Sandvik, E., Diener, E., and Seidlitz, L. (2009). Subjective well-being: The convergence and stability of self-report and non-self-report measures. In *Assessing well-being*, pages 119–138. Springer.

Sauer, W. (1977). Morale of the urban aged: A regression analysis by race. *Journal of Gerontology*, 32(5):600–608.

Spreitzer, E. and Snyder, E. E. (1974). Correlates of life satisfaction among the aged. *Journal of gerontology*, 29(4):454–458.

Stam, K., Sieben, I., Verbakel, E., and de Graaf, P. M. (2016). Employment status and subjective well-being: the role of the social norm to work. *Work, employment and society*, 30(2):309–333.

Stigler, G. J. (1949). A theory of delivered price systems. *The American Economic Review*, 39(6):1144–1159.

Tella, R. D., MacCulloch, R. J., and Oswald, A. J. (2003). The macroeconomics of happiness. *Review of Economics and Statistics*, 85(4):809–827.

Tversky, A. and Kahneman, D. (1991). Loss aversion in riskless choice: A reference-dependent model. *The quarterly journal of economics*, 106(4):1039–1061.

Veloce, W. and Zellner, A. (1985). Entry and empirical demand and supply analysis for competitive industries. *Journal of Econometrics*, 30(1-2):459–471.

Waller, S. W. (2006). Book review: Economics of regulation and antitrust, w. kip viscusi, joseph e. harrington, jr., and john m. vernon (mit press, cambridge, massachusetts & london, england, 4th edn, 2005). *World Competition*, 29(3).

Waugh, F. V. (1944). Does the consumer benefit from price instability? *The Quarterly Journal of Economics*, 58(4):602–614.

Weill, P. (1992). The relationship between investment in information technology and firm performance: A study of the valve manufacturing sector. *Information systems research*, 3(4):307–333.

Willig, R. D. (1976). Consumer's surplus without apology. *The American Economic Review*, 66(4):589–597.

Wolfers, J. (2003). Is business cycle volatility costly? evidence from surveys of subjective well-being. *International finance*, 6(1):1–26.

Zellner, A. and Israilevich, G. (2005). The marshallian macroeconomic model: A progress report. *International journal of forecasting*, 21(4):627–645.

Zellner, A. and Tobias, J. (1998). A note on aggregation, disaggregation and forecasting performance.

LIST OF TABLES

Table 5.1: Life Satisfaction: 1994-2019 (1)

Life Satisfaction	**All %**	**Employment status**		**gender**	
		Unemployed %	**Employed %**	**Male %**	**Female %**
Very Satisfied	26.71	14.32	27.69	27.13	26.33
Fairly Satisfied	55.37	48.02	55.79	55.73	55.04
Not Very Satisfied	13.90	26.47	13.03	13.30	14.46
Not at all Satisfied	4.01	11.19	3.49	3.84	4.17

Table 5.2: Life Satisfaction: 1994-2019 (2)

Life Satisfaction	**Age**			
	15-29 %	**30-44 %**	**45-64 %**	**65-79 %**
Very Satisfied	27.39	25.99	24.65	26.33
Fairly Satisfied	56.37	55.79	54.47	50.94
Not very satisfied	10.30	13.07	14.54	14.45
Not at all satisfied	2.35	3.38	4.49	4.51

Table 5.3: Life Satisfaction: 1994-2019 (3)

Life Satisfaction	**Income Quartile**			
	Top 25%	**26%-50%**	**51%-75%**	**Bottom 25%**
Very Satisfied	29.40	24.58	23.14	21.98
Fairly Satisfied	50.58	54.57	55.72	51.29
Not very satisfied	14.91	13.32	12.69	12.58
Not at all satisfied	4.48	3.19	3.31	3.77

Table 5.4: Proportion of Missing Values

	Sex	Age	Education years	Marital status	Occupation	Nation
proportion	0	0.01%	1.84%	20.45%	7.78%	0

Table 5.5: Micro Pattern of Subjective Well-being

Dependent Variable: Life Satisfaction	**Coefficient**	**Standard Error**	**p-value**
Male	0.0121	0.0045	0.007
Age:			
15-24 years	0.1450	0.0104	0.000
25-34 years	0.2488	0.0090	0.000
35-44 years	0.2919	0.0087	0.000
45-54 years	0.2919	0.0086	0.000
55-64 years	0.1604	0.0077	0.000
Employment Status:			
Self-employed	0.2521	0.0194	0.000
Retired	0.2228	0.0176	0.000
Unemployed	0.6229	0.0174	0.000
Marital Status:			
Singel	-0.2181	0.0069	0.000
Married	-0.2208	0.0080	0.000
Living as Married	-0.2366	0.0113	0.000
Divorced	0.0672	0.0097	0.000
Separated	0.0630	0.0116	0.000
Widowed	0.0392	0.0110	0.000

Table 5.6: Micro Pattern of Subjective Well-being:
Belgium, Denmark, France and Germany

Dependent Variable: Life Satisfaction	Belgium	Denmark	France	Germany
Male	-0.0243**	-0.1039***	-0.0235**	-0.0040
	(0.0146)	(0.0159)	(0.0138)	(0.0141)
Age:				
15-24 years	0.0003	-0.1578***	0.0902***	-0.0882***
	(0.0382)	(0.0421)	(0.0345)	(0.0342)
25-34 years	-0.1825***	-0.2266***	-0.0966***	-0.1807***
	(-0.0313)	(0.0350)	(0.0301)	(0.0296)
35-44 years	-0.2842***	-0.3357***	-0.2647***	-0.2061***
	(0.3000)	(0.0327)	(0.0295)	(0.0287)
45-54 years	-0.2713***	-0.3732***	-0.3386***	-0.1372***
	(0.0291)	(0.3189)	(0.0291)	(0.0286)
55-64 years	-0.1812***	-0.2127***	-0.1775***	-0.1467***
	(0.0253)	(0.2812)	(0.0247)	(0.0251)
Employment Status:				
Self-employed	-0.1282***	-0.0279	-0.1824***	-0.0187
	(0.0624)	(0.0626)	(0.0621)	(0.0563)
Retired	-0.2482***	-0.0073***	-0.0417***	-0.1855***
	(0.0618)	(0.0814)	(0.0610)	(0.0561)
Unemployed	-0.6068***	-0.4480***	-0.6160***	-0.8799***
	(0.0608)	(0.0611)	(0.0607)	(0.1548)
Marital Status:				
Married	0.3810***	0.3767***	0.3508***	0.2272***
	(0.0289)	(0.0236)	(0.0213)	(0.0312)
Divorced	-0.0689***	-0.0699***	-0.1118***	-0.0067
	(0.0364)	(0.0355)	(0.3192)	(0.0395)
Widowed	-0.0906***	-0.1162***	-0.1520***	-0.0951***
	(0.0328)	(0.0379)	(0.0312)	(0.0337)

Table 5.7: Economic Growth and Well-being

Dependent Variable: Life Satisfaction	Coef.	Std.Err.	P-value
Agriculture	0.0646	0.0228	0.007
Construction	0.1242	0.0283	0.000
Manufacturing	0.2280	0.0577	0.000
Finance	0.2181	0.0392	0.000
Wholesale & Retail	-0.3271	0.0980	0.001
Age:			
15-24 years	0.1512	0.0101	0.000
25-34 years	-0.0126	0.0089	0.154
35-44 years	-0.1220	0.0086	0.000
45-54 years	-0.1899	0.0086	0.000
55-64 years	-0.1117	0.0078	0.000
Employment Status:			
Self-employed	-0.0848	0.0131	0.000
Retired	-0.2317	0.0131	0.000
Unemployed	-0.6245	0.0127	0.000
Marital Status:			
Married	0.2887	0.0070	0.000
Divorced	0.1418	0.0098	0.000
Widowed	0.0385	0.0119	0.000

Table 5.8: Marginal Effect of Economic Growth to Well-being

Dependent Variable: Life Satisfaction	dy/dx LS = 1	dy/dx LS = 2	dy/dx LS = 3	dy/dx LS= 4
Agriculture	-0.0033	-0.0109	-0.0058	0.0199
Construction	-0.0063	-0.0210	-0.0111	0.0384
Manufacturing	-0.0116	-0.0375	-0.0204	0.0704
Finance	-0.0111	-0.0368	-0.0195	0.0673
Wholesale & retail	0.0166	0.0552	0.0292	-0.1010

Table 5.9: Economic Growth and Well-being (with lagged term)

Dependent Variable:Life Satisfaction	Coef.	Std.Err.	P-value
Agriculture	0.0814	0.0252	0.002
Construction	0.0999	0.0295	0.001
Manufacturing	0.3420	0.0619	0.000
Finance	0.2817	0.0415	0.000
Wholesale & retail	-0.3271	0.1197	0.004
Agriculture (-1)	-0.0502	0.0252	0.046
Construction(-1)	0.2871	0.0358	0.000
Manufacturing(-1)	0.1544	0.0486	0.001
Finance(-1)	-0.0164	0.0402	0.683
Wholesale & retail (-1)	1.0933	0.1228	0.000
Age:			
15-24 years	0.1259	0.0133	0.000
25-34 years	-0.0173	0.0110	0.118
35-44 years	-0.1412	0.0106	0.000
45-54 years	-0.2151	0.0104	0.000
55-64 years	-0.1288	0.0091	0.000
Employment Status:			
Self-employed	-0.0712	0.0149	0.000
Retired	-0.2794	0.0148	0.000
Unemployed	-0.6994	0.0144	0.000
Marital Status:			
Married	0.3094	0.0074	0.000
Divorced	0.0240	0.0125	0.000
Widowed	0.0078	0.0123	0.000

Table 5.10: Positive vs Negative Economic Growth and Well-being

Dependent Variable: Life Satisfaction	Agriculture	Construction	Manufacturing	Finance	Wholesale &Retail
Positive Growth	-0.043 (0.041)	-0.065 (0.047)	0.532*** (0.083)	-0.120* (0.086)	-0.949*** (0.180)
Negative Growth	-0.187*** (0.042)	-0.329*** (0.046)	-0.274*** (0.107)	-0.596*** (0.071)	-0.572*** (0.175)
Countries	12				
Micro Observations	274.936				

Table 5.11: Marginal Effect of Positive and Negative Economic Growth

Dependent Variable: Life Satisfaction	Industry Sector	dy/dx LS = 1	dy/dx LS = 2	dy/dx LS = 3	dy/dx LS = 4
Positive Growth	Agriculture	0.002 (0.002)	0.007 (0.007)	0.004 (0.004)	-0.013 (0.013)
	Construction	0.003 (0.002)	0.011 (0.008)	0.006 (0.004)	-0.020 (0.013)
	Manufacturing	-0.027*** (0.004)	-0.89*** (0.014)	-0.048*** (0.008)	0.164*** (0.256)
	Finance	0.006** (0.003)	0.020** (0.012)	0.011** (0.009)	-0.037** (0.022)
	Wholesale & Retail	0.047*** (0.009)	0.160*** (0.030)	0.086*** (0.016)	-0.293*** (0.056)
Negative Growth	Agriculture	0.009*** (0.002)	0.031*** (0.007)	0.017*** (0.004)	-0.058*** (0.013)
	Construction	0.016*** (0.002)	0.055*** (0.008)	0.030*** (0.004)	-0.102*** (0.014)
	Manufacturing	0.014** (0.005)	0.046** (0.018)	0.025** (0.010)	-0.085** (0.033)
	Finance	0.030*** (0.004)	0.100*** (0.012)	0.054*** (0.007)	-0.184*** (0.022)
	Wholesale & Retail	0.029*** (0.009)	0.096*** (0.030)	0.052*** (0.016)	-0.177*** (0.054)

Table 5.12: Test: Ordered Logit Model

Dependent Variable: Life Satisfaction	Coef.	Std.Err.	P-value
Agriculture	0.0982	0.0416	0.018
Construction	0.0243	0.0502	0.000
Manufacturing	0.3796	0.0100	0.000
Finance	0.3783	0.0691	0.000
Wholesale & Retail	-0.6249	0.1705	0.000
Age:			
15-24 years	0.2653	0.0179	0.000
25-34 years	-0.0224	0.0157	0.153
35-44 years	-0.2134	0.0153	0.000
45-54 years	-0.3340	0.0152	0.000
55-64 years	-0.1932	0.0139	0.000
Employment Status:			
Self-employed	-0.1414	0.0229	0.000
Retired	-0.3913	0.0230	0.000
Unemployed	-1.1075	0.0226	0.000
Marital Status:			
Married	0.5069	0.0124	0.000
Divorced	0.0700	0.0209	0.001
Widowed	0.0896	0.0198	0.000

Table 5.13: Robustness check: Dropping independent variables

Dependent Variable: Life Satisfaction	(1	(2)	(3)	(4)	(5)
Agriculture		0.0309	0.0353	0.0481***	0.0815***
		(0.0226)	(0.0226)	(0.0236)	(0.0233)
Construction	0.0996***		0.7988***	0.0947***	0.1485***
	(0.0268)		(0.0259)	(0.0278)	(0.0273)
Manufacturing	0.1793***	0.1272***		0.1009**	0.3361***
	(0.0549)	(0.0530)		(0.0530)	(0.0478)
Finance	0.2048***	0.1856***	0.1565***		0.2597***
	(0.0390)	(0.0386)	(0.0361)		(0.0372)
Wholesale & Retail	-0.3836***	-0.4381***	-0.5443***	-0.5000***	
	(-0.3836)	(0.0947)	(0.0811)	(0.0929)	
Age:					
15-24 years	0.1512***	0.1516***	0.1514***	0.1514***	0.1509***
	(0.0101)	(0.0101)	(0.0101)	(0.0101)	(0.0101)
25-34 years	-0.0126	-0.0126	-0.0126	-0.0126	-0.0128
	(0.0089)	(0.0089)	(0.0089)	(0.0089)	(0.0089)
35-44 years	-0.1219***	-0.1221***	-0.1221***	-0.1219***	-0.1221***
	(0.0086)	(0.0086)	(0.0086)	(0.0086)	(0.0086)
45-54 years	-0.1899***	-0.1899***	-0.1899***	-0.1897***	-0.1901***
	(0.0086)	(0.0086)	(0.0086)	(0.0086)	(0.0086)
55-64 years	-0.1117***	-0.1117***	-0.1117***	-0.1114***	-0.1119***
	(0.0079)	(0.0079)	(0.0079)	(0.0079)	(0.0079)
Employment Status:					
Self-employed	-0.0846***	-0.0844***	-0.0844***	-0.0845***	-0.0850***
	(0.0131)	(0.0131)	(0.0131)	(0.0131)	(0.0131)
Retired	-0.2315***	-0.2314***	-0.2314***	-0.2311***	-0.2322***
	(0.0131)	(0.0131)	(0.0131)	(0.0131)	(0.0131)
Unemployed	-0.6243***	-0.6245***	-0.6244***	-0.6244***	-0.6248***
	(0.0127)	(0.0127)	(0.0127)	(0.0127)	(0.0127)
Marital Status:					
Married	0.2889***	0.2895***	0.2889***	0.2885***	0.2885***
	(0.0070)	(0.0070)	(0.0070)	(0.0070)	(0.0070)
Divorced	0.0385***	0.0391***	0.0389***	0.0387***	0.0383***
	(0.0119)	(0.0119)	(0.0187)	(0.0119)	(0.0119)
Widowed	0.0510***	0.0517***	0.0511***	0.0510***	0.0504***
	(0.0112)	(0.0119)	(0.0118)	(0.0112)	(0.0112)

Table 5.14: Summary statistics of subjective well-being in the US

Happy	All	Sex %		Income %		
	%	Male	Female	Low	Medium	High
happy	30.47	30.31	30.59	23.34	27.67	33.61
fair	56.79	57.28	56.41	61.96	57.02	58.26
not Happy	12.74	12.41	13.00	14.70	15.30	8.12

Table 5.15: Micro Pattern of Subjective well-being: the US

Independent Variable: Happy	Coefficient	Std.	p-value
Male	-0.086	0.015	0.000
Age:			
15-24 years	-0.166	0.047	0.000
25-34 years	-0.288	0.045	0.000
35-44 years	-0.373	0.045	0.000
45-54 years	-0.320	0.045	0.000
55-64 years	-0.236	0.047	0.000
Marital Status:			
Married	0.547	0.020	0.000
Widowed	-0.057	0.045	0.207
Divorced	-0.033	0.025	0.191

Table 5.16: Economic Growth and Well-being: the US

Independent Variable: Happy	Coef.	St.Error	p-value
Agriculture	0.673	0.317	0.034
Construction	0.512	0.290	0.077
Manufacturing	-1.181	1.309	0.367
Finance	-0.054	0.196	0.784
Wholesale & retail	0.324	0.672	0.063
Agriculture(-1)	-0.563	0.167	0.001
Construction(-1)	0.058	0.161	0.720
Manufacturing(-1)	-0.802	1.787	0.654
Finance(-1)	-0.689	0.209	0.001
Wholesale & retail	-2.292	0.529	0.000

Table 5.17: Estimated supply functions

Supply Function	Denmark	France	Germany	Greece	UK	Italy	Portugal	Netherland
producer price	0.2376	0.0914	0.2889	6.1692	0.1021	0.0885	-0.1552	-0.0715
weather	0.1674	0.0426	-0.3115	-1.4744	0.0086	0.0156	-0.0344	0.0969
year	-11.8872	8.9017	15.7059	-730.5	-6.4463	-3.8754	23.4879	19.3323
constant	99.9627	-55.7740	-106.6304	5502.569	59.7272	40.6012	-166.5822	-135.9361

Table 5.18: Estimated demand functions

Demand Function	Denmark	France	Germany	Greece	UK	Italy	Portugal	Netherland
consumer food price	-3.9261	-0.2742	-0.8864	-0.6414	-3.2003	-0.2143	-3.0054	0.2785
consumer other price	3.6334	0.3351	0.6716	0.6275	3.2366	0.3565	3.0328	0.0489
GDP	-0.4657	-0.0310	0.0426	-0.1391	-0.9194	0.2219	-0.9638	0.0481
population	9.5183	0.7022	-5.0966	2.7619	22.6088	-14.3115	11.0486	-2.7551
constant	-57.5118	5.4625	70.0625	-11.1993	-210.3367	162.7908	-66.1728	33.2783

Table 5.19: Impact of consumer and producer surplus on subjective well-being

Life satisfaction	(1)	(2)	(3)
lnCS	0.1076 ***	0.0959 ***	0.1318 ***
	(0.0389)	(0.0382)	(0.0387)
lnPS	-0.1072 ***	-0.2430 ***	-0.1188 ***
	(0.0331)	(0.0297)	(0.0330)
Agriculture	0.4196 ***		
	(0.4196)		
Construction	0.7549 ***		0.6243 ***
	(0.0759)		(0.0735)
Manufacturing	0.5566 ***		0.2764 ***
	(0.1766)		(0.6243)
Finance	0.3455 ***		0.2207 ***
	(0.0756)		(0.0734)
Wholesale & retail	0.2897		-0.0935
	(0.1982)		(0.1904)

Table 5.20: marginal effects of consumer and producer surplus

Dependent Variable: Life Satisfaction	Consumer Surplus& Producer Surplus	dy/dx LS = 1	dy/dx LS = 2	dy/dx LS = 3	dy/dx LS = 4
With all five industry sectors	lnCS	-0.0054***	-0.0178***	-0.0101***	0.0337***
	lnPS	0.0054***	0.0178***	0.0104***	-0.0339***
Without agriculture sector	lnCS	-0.0067***	-0.0218***	-0.0128***	0.0413***
	lnPS	0.0060***	0.0197***	0.0115***	-0.0372***
Without all five industry sectors	lnCS	-0.0049**	-0.0159**	-0.0092**	0.0300**
	lnPS	0.0123***	0.0402***	0.0236***	-0.0761***

LIST OF FIGURES

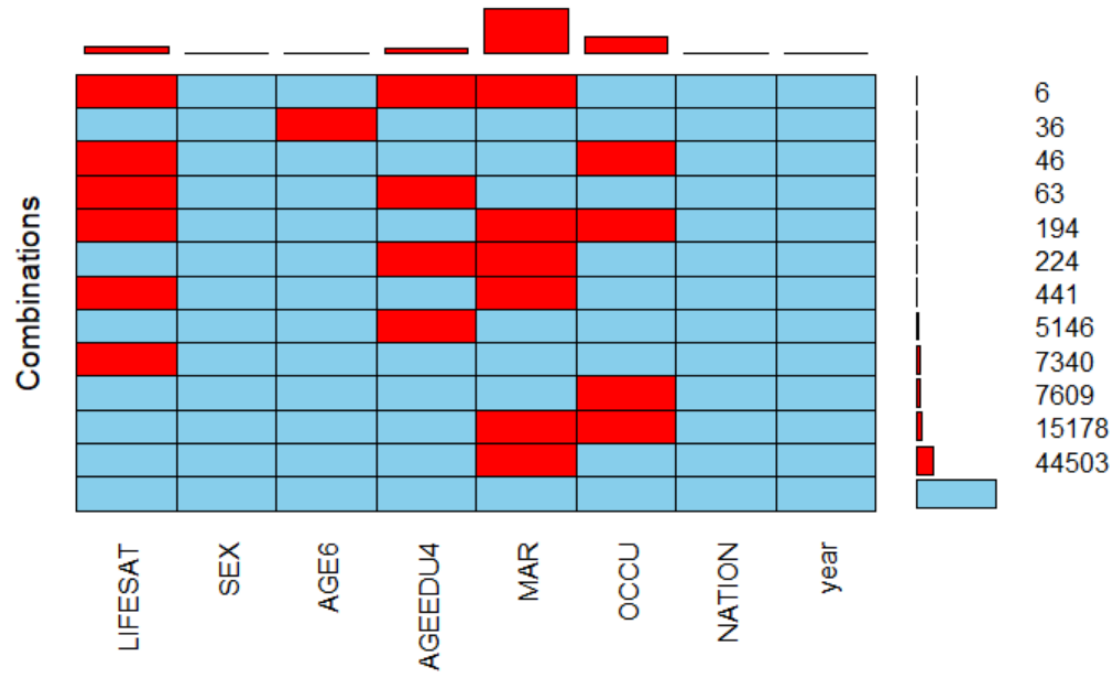


Figure 5.1: Missing Value

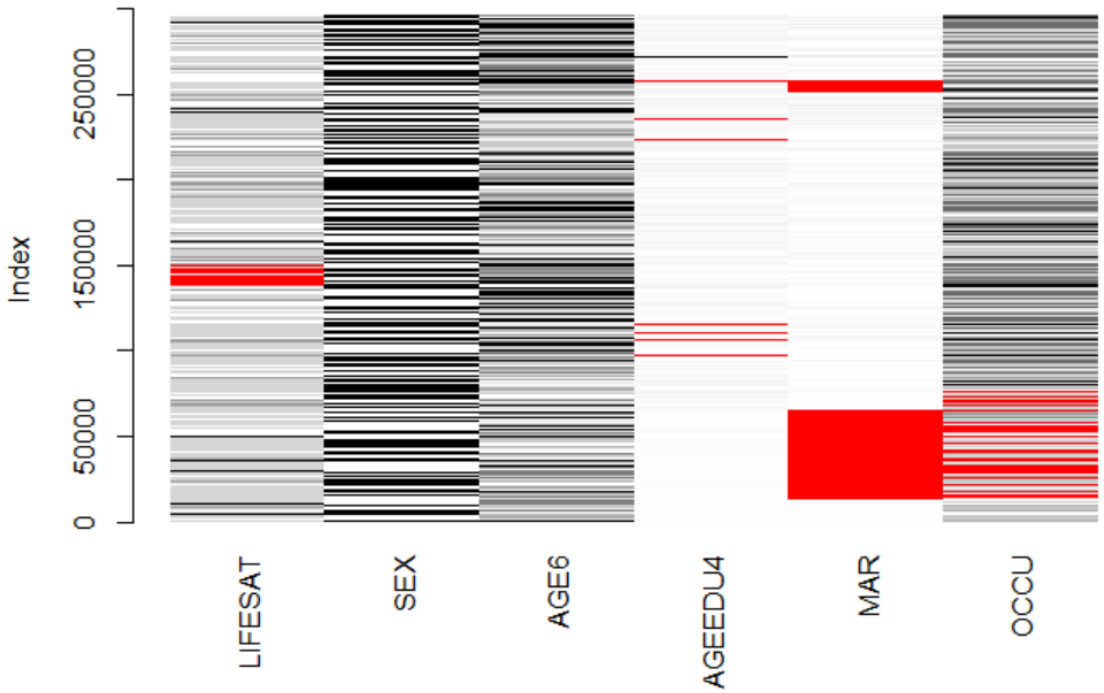


Figure 5.2: Data Distribution

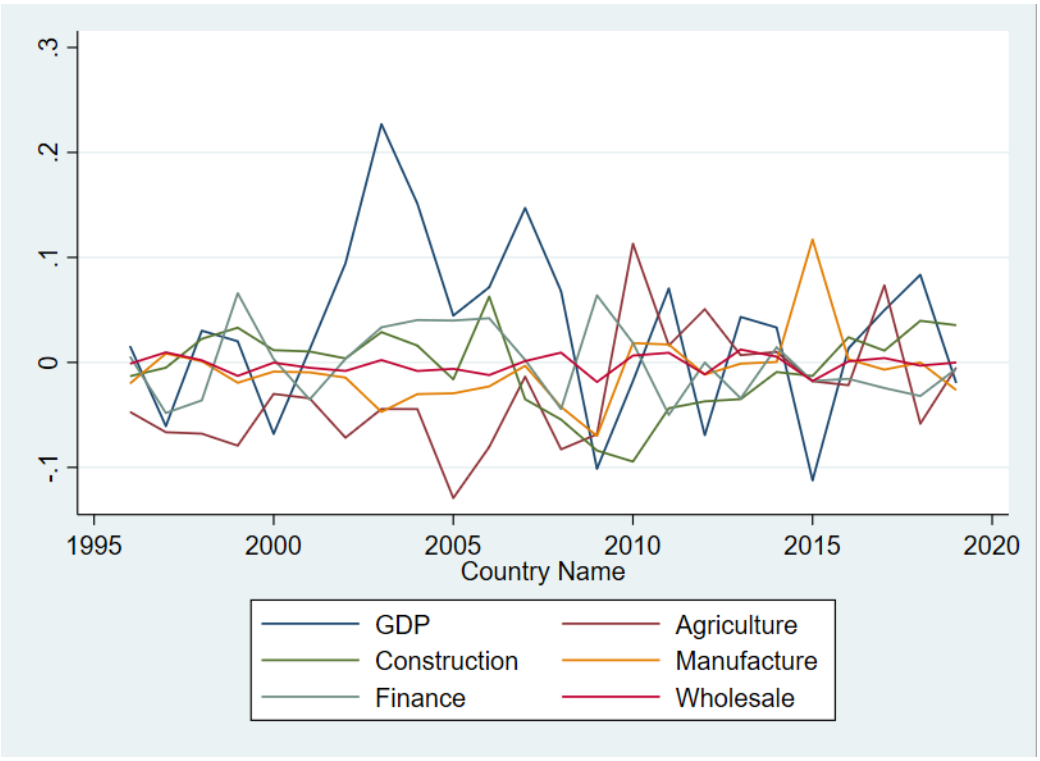
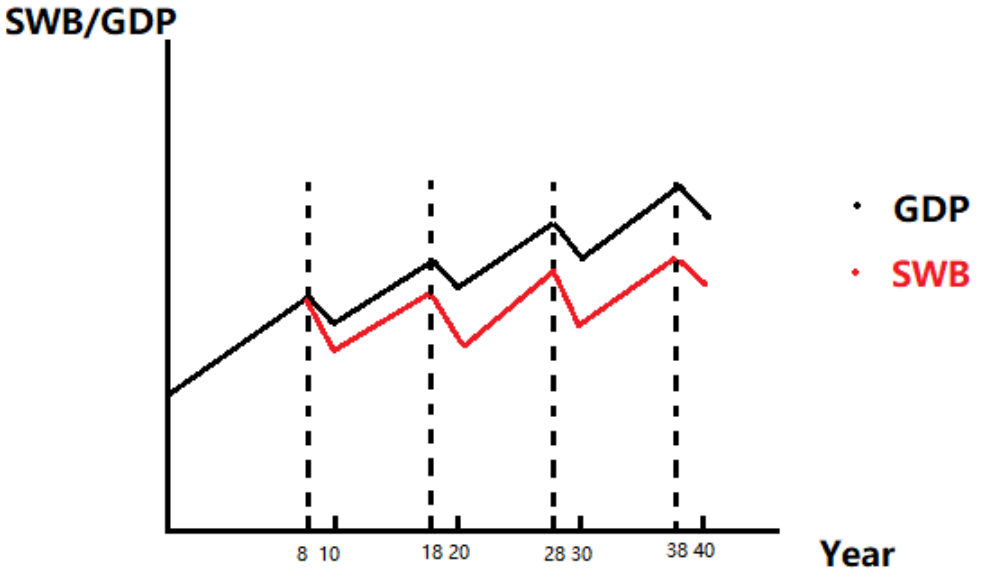


Figure 5.3: Industry sectors growth rate and GDP

Figure 5.4: GDP and subjective well-being growth over business cycles



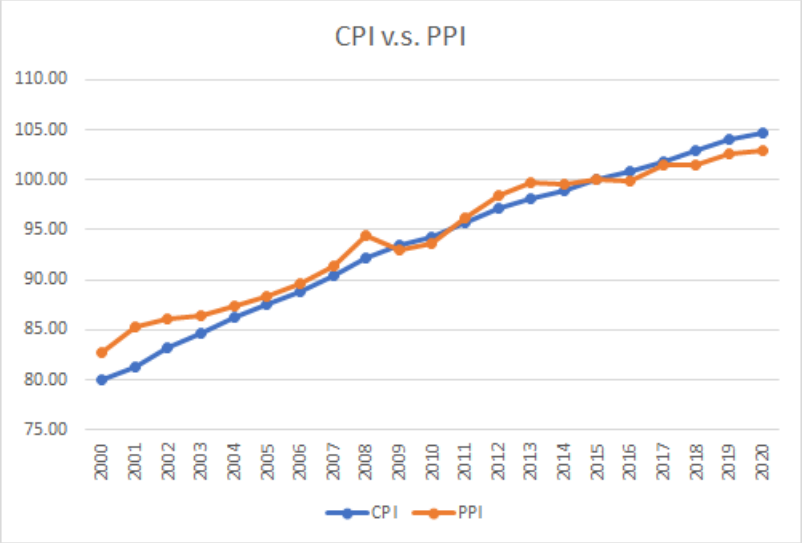


Figure 5.5: PPI v.s. CPI

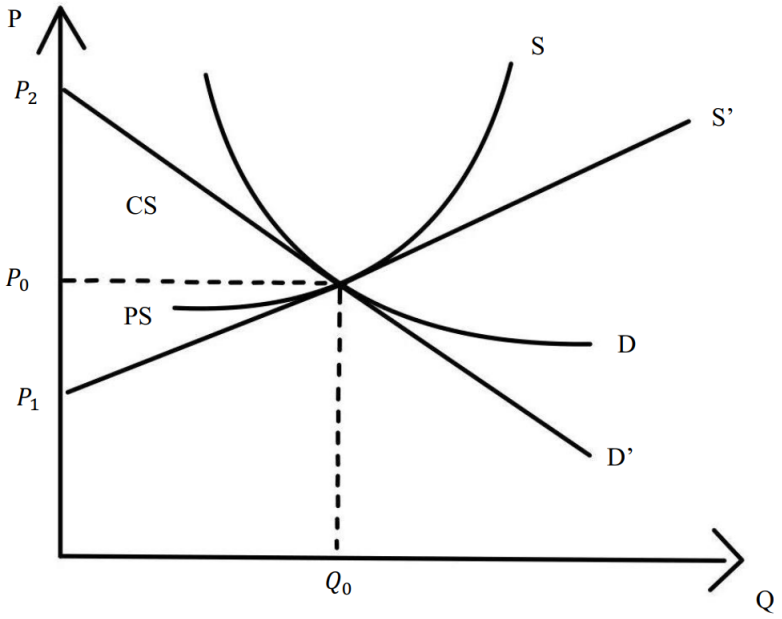


Figure 5.6: Supply and demand curve