DO MEXICAN AMERICANS HAVE A RELATIVE ADVANTAGE IN HEALTH?

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy

in the Graduate School of The Ohio State University

By

Erick Rangel-Gonzalez, M.A., M.S.

* * * * *

The Ohio State University
2005

Dissertation Committee:

Professor Patricia B. Reagan, Adviser

Professor Richard Steckel

Professor Trevon Logan

Approved by

____

Adviser
Graduate Program in
Economics

ABSTRACT

Previous studies found a health advantage (measured by mortality and some morbidity outcomes such as heart disease) of Mexican Americans over non-Hispanic whites after controlling for socioeconomic factors and other elements. This health advantage has been considered as a paradox because Mexican Americans live in more disadvantaged environments and present lower levels of income and human capital than non-Hispanic whites, and numerous studies suggest that these health outcomes are positively correlated with education and income and negatively associated with disadvantaged environments and that these relationships are causal. In order to analyze this paradox I estimate a health production function using physical and mental morbidity as health outcomes to study how human capital, socioeconomic status, health risk behaviors, relative deprivation and social relations affect the health of Mexican Americans and non-Hispanic whites.

The theory of relative deprivation is based on the idea that health is affected not only by the individual's income but also by the income of the rest of the persons in the same reference group. Since I am comparing Mexican Americans with non-Hispanic whites a natural question emerges: do Mexican Americans compare themselves with people living in the United States or do they compare themselves with people living in

Mexico? This dissertation tries to answer what is the relevant reference group for Mexican Americans.

My results indicate that after controlling for individual health related behaviors, socioeconomic status, relative deprivation (regardless of the relevant reference group) and social relations; there is no difference in physical morbidity between Mexican Americans and non-Hispanic whites. However, I find an advantage on mental health outcomes for Mexican Americans over non-Hispanic whites after controlling for health related behaviors and socioeconomic status. This advantage remains after controlling for relative deprivation (regardless of the reference group employed).

After controlling for endogeneity of health endowments, none of the three health related behaviors (smoking, obesity and performing physical activities) affected mental morbidity. However obesity had a huge negative impact on physical morbidity. I found no evidence of a direct impact of education on physical and mental morbidity. However, I found strong evidence of education affecting health related behaviors. I also found evidence suggesting a protective effect of marriage on mental morbidity.

The results of the individual level model suggest a positive effect of log per capita income on physical and mental health. However, these effects disappear when introducing relative deprivation (regardless of the reference group employed). My estimations show that relative deprivation has a negative direct impact on mental morbidity for Mexican Americans and non-Hispanic whites. However, the evidence is not so clear when using physical morbidity as the health outcome. On one hand, relative deprivation affects directly the physical morbidity of Mexican Americans but it does not affect the health related behaviors of this population. On the other hand, relative deprivation has no direct impact on physical morbidity of non-Hispanic whites but it has an indirect effect by modifying the health related behaviors of this population. I was not able to determine which is the relevant reference group for Mexican Americans. Therefore more research is necessary in this area using more disaggregated measures to estimate a reference group for Mexico. Finally, the proportion of Mexican Americans living in the same MSA or county of residence (for rural areas) does not affect neither physical nor mental morbidity or health related behaviors.

Dedicated to my wife Lilia and my daughter Lilian

ACKNOWLEDGMENTS

I wish to thank my Adviser, Patricia B. Reagan, for helping me during all the process of my dissertation with helpful ideas, insightful discussions, encouragement, and for her valuable time and patience to correct my methodological and grammatical errors. She made this research possible and it has been my honor to work under her guidance.

I am grateful to Richard Steckel for helpful ideas and suggestions that substantially improved this work. I am very thankful to Trevon Logan for discussing with me various topics of my dissertation and for providing ideas to improve it. I also wish to thank Joseph Kabosky for his suggestions and comments.

I would like to thank the *Consejo Nacional de Ciencia y Tecnologia (CONACYT)* for the partial financial support that I receive during the period 2002-2005. I also thank the *Univesidad Autonoma de Nuevo Leon* for their complementary financial support during the period 2000-2002.

I thank Peihong Feng for helping me with some of the SAS programming and for her friendship. I am grateful to Mauricio Bittencourt, Alfonso Flores, Tufan Ekici, Ratapol Teratanavat, Samrat Battacharya and Mauricio Ramirez for their friendship. They made my life more enjoyable during my time at the Ohio State University. I also thank my friends of many years Fabian Pino, Genaro Ovalle and Adrian Caceres for their support and friendship.

I am grateful to my parents and brothers for believing in me, and for their moral support during my graduate studies. Finally, a very special thank to my wife Lilia for her support, love and encouragement when I struggle. She has always been there for me. Lilia and my daughter Lilian constitute an endless source of love and motivation in my life.

VITA

August 6, 1975…………………………… Born – Monterrey, Mexico

1997……………………………………… B.A. Economics, Universidad Autonoma de Nuevo Leon.

2001……………………………………… M.S. Industrial Economics, Universidad Autonoma de Nuevo Leon.

2001……………………………………… M.A. Economics, The Ohio State University

1997-2000………………………………... Graduate Teaching and Research Associate, Universidad Autonoma de Nuevo Leon.

2000-2002………………………………... Graduate Research Associate, CHRR - The Ohio State University

2002 – Present…………………………… Graduate Teaching and Research Associate, The Ohio State University

PUBLICATIONS

1. Rangel González, Erick. "La Durabilidad del Empleo en México" Tesis de Maestría de la Facultad de Economía UANL (2001).

2. Rangel González, Erick y Isaura Guzmán Leal. "La situación económica de México en el contexto de la globalización". Entorno Económico Vol. XXXVI, Número 215. Julio-Agosto de 1998. CIE, UANL.

3. Rangel González, Erick "Lecciones de la crisis financiera mexicana". EntornoEconómico Vol. XXXVI, Número 213. Marzo-Abril de 1998. CIE. UANL

FIELDS OF STUDY

Major Field: Economics

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Mexican Americans and immigrants from Mexico constitute a considerable and rapidly growing population in the United States. According to the U.S. census data, Mexican Americans are by far the largest Hispanic (or Latino) group in U.S. They constitute 63.4 % of the Hispanic population and 8.5 % of the total U.S. population (24 millions from 280.5 millions).[1] De la Torre and Estrada (2001) estimate that by the middle of the twenty-first century one of every six Americans will be of Mexican descendent. However, there is a paucity of research on the determinants of health of the Mexican American population.

Mexican Americans are also among the most economically disadvantaged ethnic groups in the US. However, Trejo (1997) shows that they earn low wages mainly because they have lower human capital than other workers. Paradoxically, information from several sources, such as the National Alliance for Hispanic Health (2001), suggest that Mexican Americans (and other Hispanics) have at least as much health capital measured by age adjusted mortality rates as non- Hispanic whites, despite the fact that they have less human capital, are exposed to greater environmental pollutants, are more likely to be employed in occupations requiring heavy manual labor, and live in less advantaged socioeconomic environments. These facts have motivated several researchers (Sorlie et

---

[1] Source: http://www.census.gov/acs/www/Products/Profiles/Single/2002/ACS/Tabular/010/01000US1.htm

al (1993), LeClere et. al. (1997), Abraido-Lanza et al. (1999), Hummer et al (1999), Hummer et al. (2000), Singh and Siahpush (2001), Singh and Siahpush (2002) and Palloni and Arias (2004)) to investigate about the existence (and its explanations) of what is known as the Mexican health paradox (or Hispanic health paradox when analyzing Hispanic population in general).

The paradox of Mexican Americans health capital is puzzling because Mexican Americans have lower human capital than non-Hispanic whites, live in more disadvantaged environments and tend to cluster towards the bottom of the income distribution. Numerous studies including Grossman (1972) and Marmot and Shipley (1996) suggest that positive health outcomes may increase with education and income and that these effects may be causal. In addition, Wilkinson (1996) argues that tall people are usually healthier than short people. He believes that tall people are better physical specimens and are subject to less social pressure and therefore they are healthier than short people. However, the average Mexican American male (female) 20 years and over is 2.7 (2.2) inches shorter than the average non-Hispanic white person.[2]

Evidence on Mortality

Most studies of the Hispanic health paradox use mortality as the health outcome of interest. Using this mortality outcome several researchers have found support for the Hispanic health paradox. For example, Sorlie et al (1993), employing multivariate hazard models and data from the National Longitudinal Mortality Study (NLMS), found that Hispanics have better "all-cause" and selected "specific-cause" outcomes in

---

[2] National Health and Nutrition Examination Survey (1988-1994).

mortality after controlling for age and family income for individuals 25 and older. Similarly, Singh and Siahpush (2001) found that both male and female Hispanics, 25 and older, present lower mortality rates than their non-Hispanic whites counterparts after socioeconomic and demographic status is taken into account. Additionally, Singh and Siahpush (2002) compare mortality outcomes for Hispanic and non-Hispanic whites separately by birthplace. They found that Hispanics born in the US have better mortality outcomes than non-Hispanic whites born in the US. Also, they found that Hispanics born outside the US have better mortality outcomes than Hispanics born inside the US. This suggests that acculturation may play an important role in understanding health of Mexican Americans.

Despite sharing the same language, Hispanics subgroups (Mexican Americans, Puerto Ricans, Cubans and other Hispanics) present differences in average age, marriage rates, socioeconomic characteristics, region of residence and percentage living in central cities (Hummer et al. (2000)). Hispanic subgroups also present heterogeneity in risk behaviors such as smoking and exercise (The National Alliance for Hispanic Health (2001)), and differences in neighborhood segregation (Borjas (1995)). Studies that have analyzed mortality outcomes by disaggregating the Hispanic population have found differences in support for the Hispanic health paradox. For example, Hummer et al. (2000), using NHIS-MCD (National Health Interview survey-Multiple Cause of Death) data for the period 1986-1995 and accounting for socioeconomic factors, found significantly lower mortality rates for Mexican Americans, South and Central Americans and other Hispanics compared to non-Hispanic whites. In contrast, their results also show no significant differences in mortality outcomes for Cubans and Puerto Ricans compared to non-Hispanic whites. Abraido-Lanza et al. (1999) found lower mortality rates for all subgroups of Hispanics, accounting for age, education and family income, but Mexican Americans, South and Central Americans had lower mortality rates than Cubans and Puerto Ricans. Additionally, when controlling for birthplace, they found a mortality advantage of Mexican Americans and other Hispanics born in US (excluding Cubans and Puerto Ricans) over non-Hispanic whites born in the US.

Authors like LeClere et. al. (1997) focused their analysis on Mexican Americans. They used multivariate hazard models and NHIS-MCD data for the period 1986-1991 and found that Mexican Americans have a mortality advantage compared to African Americans and non-Hispanic whites after controlling for socioeconomic and demographic characteristics.

Hummer et al (1999) show that the health of Mexican Americans over non-Hispanic whites varies according to age groups. On one hand, their results suggest that mortality outcomes, after controlling for socioeconomic factors, for young (18 to 44 years old) Mexican Americans and other Hispanics do not differ from mortality outcomes for non-Hispanic whites. On the other hand, their results show that Mexican Americans and other Hispanics, 45 and older (middle age and elderly) present lower mortality rates than non-Hispanic whites. Additionally, their results support more pronounced statistically significant health advantage (measured by mortality rates) for foreign born Mexican Americans and foreign born other Hispanics compared to non-Hispanic whites, for middle age and elderly age adults. They used NHIS-MCD data for the period 1989-1995. Similar results are found by Palloni and Arias (2004). They used parametric hazard models and NHIS-MCD data for the period 1986-1994. Their results also support the existence of the Hispanics mortality health paradox for foreign-born Mexican Americans and other foreign Hispanics but not for the rest of the Hispanic subgroups.

Evidence on Morbidity

Health is a complex concept and can be measured by morbidity as well mortality. Morbidity is reflected in different diseases and depends on many factors such as lifestyle and behaviors affecting health, environmental factors, diet and access to health services. Thus, it is important to make a brief review the similarities and differences in morbidity between Mexican Americans and non-Hispanic whites. According to the National Alliance for Hispanic Health (2001) both Hispanics and non-Hispanic whites have heart disease and cancer as their top two leading causes of death. However, these two diseases accounts for 45% of all deaths among Hispanics, whereas they accounts for 55% of all deaths among non-Hispanic whites. Two of the top ten causes of death for Hispanics do not appear in the top ten list for non-Hispanic whites; "homicide and legal intervention" and "certain conditions originated in prenatal period". These facts reflect in part the differences in age between these two groups (the mean age for non-Hispanic whites is 37.5 and 29.1 for Hispanics)[3].

National Alliance for Hispanic Health (2001) also reports several areas in which Hispanics have a health advantage. Mexican Americans and other Hispanics present lower rates of disease in the four most prevalent cancer types: prostate, breast, lung and bronchus, and colon. This Hispanic advantage may be exaggerated because Hispanics are less likely to be insured and less likely to get screening. For example, American

[3] Population Estimates Program. US census bureau (2001).

Cancer Society (2003) reports that Latinas between 40 and 64 years old have the higher rates of uninsurance than non-Hispanic females in the same range of age (31.5% and 9.1% respectively). Additionally the same source reports that Latinas in the same range of age have lower mammography screening rates than equivalent non-Hispanic females (59.5% and 70.3% respectively).

Additionally, the National Center for Health Statistics (2004) reports that the age-adjusted percents of all types of heart disease among persons 18 years and over is smaller for Mexican Americans (7.9%) compared to non-Hispanic whites (11.5%). The same source also reports that Mexican Americans have smaller age-adjusted percents of emphysema, asthma and other respiratory diseases than non-Hispanic whites.[4] Similar health advantages for Mexican Americans are reported for diseases such as ulcers, arthritis, and chronic joint symptoms. This is not to say that Mexican Americans have a health advantage over non-Hispanic whites along all measured dimensions. Chronic liver disease is a leading cause of death among Hispanics, but not non-Hispanic whites. Rates of obesity, diabetes mellitus, HIV infection among 1-4 year olds and 15-24 year olds, neural tube defects, depression, tuberculosis and homicide are also higher among Mexican Americans and other Hispanics than among non-Hispanic whites (National Alliance for Hispanic Health (2001)).

Other areas where Mexican Americans appears to have a relative advantage in health outcomes include lower levels of hypertension than non-Hispanic whites (Bell, Adar and Popkin (2002) and lower cancer mortality rates (Glanz et al. (2003)). Additionally, The National Alliance for Hispanic Health (2001) cites several behaviors

[4] The National Center for Health Statistics (2004)

that may cause an advantage for Mexican Americans over non-Hispanic whites. For example, they usually have a healthier diet high in fiber and low in animal protein, higher intakes of vitamin A, C, folic acid and calcium, lower rates of smoking, and lower rates of illegal drug use. Hispanics also have a strong family structure, which may be protective of health. The National Alliance for Hispanic Health (2001) also mentions that these advantages are smaller for second and third generation Mexican Americans, who tend to become more acculturated. Conversely, Mexican Americans also present some behaviors that negatively affect their health such as lower number of office visits to the doctor (the National Center for Health Statistics (2004)), lower immunization rates probably as a result of lower socioeconomic status and fear of immigration authorities and higher rates of uninsurance.[5]

Mental health outcomes represent an additional area where Mexican American health paradox seems to be supported and has been analyzed by a number of researchers like Ostir et al. (2003) that find that Mexican Americans present lowers depression levels than non-Hispanic whites and that Mexican Americans living in poor neighborhoods with higher densities of Mexican Americans living in the same neighborhood present lower depressive symptoms than non-Hispanic whites. Ortega et al. (2000) and Escobar et al. (2000) focus on investigating the role of acculturation on mental health in the Hispanic community. They find that mental health of Mexican Americans born in Mexico (and/or less acculturated Mexican Americans) is better than that of more acculturated Mexican Americans. This fact is interesting because for other ethnic groups (including other

[5] National Alliance for Hispanic Health (2001).

Hispanics groups) less acculturated immigrants present worse mental health than more acculturated immigrants.

Another area that has received a lot of attention by some researchers in the health literature is birth outcomes. Collins et al. (1998), Buekens et al (2000) and Pearl et al (2001) observe that Mexican Americans have better birth-weight outcomes than blacks and non-Hispanic whites. However they find conflicting evidence on the effect of neighborhood environment on low birth weight for different ethnic groups. Collins et al. (1998) find that "ecological" factors, such as unemployment rate higher than 19% and homicide rate higher than 1.3/1000 in the "ecologic unit", in the affect the very low birth-weights of Mexican American and Non-Hispanic whites but not African Americans. In contrast, Buekens et al (2000) and Pearl et al. (2001) found that birth-weight increased with less favorable neighborhood characteristics such as poverty and unemployment among foreign-born Latinas.

Possible Solutions to the Paradox

The literature comparing health of Mexican Americans and non-Hispanic whites leaves us with many unresolved questions about why Mexican Americans enjoy relatively good health outcomes, and why econometric models, at least for some health outcomes, that yield intuitively reasonable results for non-Hispanic whites, yield counterintuitive outcomes when applied to Mexican Americans. The National Alliance for Hispanic Health (2001) suggests a couple of solutions that may help to explain the Mexican American health paradox: i) differences in nutrition or food intakes between the two groups[6]; ii) cultural characteristics and social networks are responsible for differences in health outcomes. In other words, the social cohesion and interpersonal support among Mexican Americans may work as a shield for life stress generating better outcomes in health.

Palloni and Arias (2004) mention three "standard" explanations to the Hispanic mortality paradox: data artifacts, cultural effects and migration effects. The first theory states that the Hispanic health paradox is an illusion generated by three data artifacts (ethnic identification, misreporting ages and mismatches of records) when estimating mortality rates. Rosenberg et al. (1999) estimated that around 7% of the Hispanics are not recorded as Hispanics on death certificates and this ethnic identification problem causes underestimation of the Hispanic mortality rates. Additionally, authors like Rosenwaike (1991) argued that older Hispanics tend to overstate their ages generating a reduction on mortality rates for Hispanics. The mismatch problem occurs when mortality rates are created by matching deaths that occurred during a period of time to populations that were enumerated at the beginning of the period. Notice that since this research is using to general measures of physical and mental morbidity (instead of mortality rates) to measure health outcomes none of these data artifacts represent a problem in the present research. The cultural effects theory is based on the idea that culture is reflected in family structure, social networks and behaviors that affect mortality and health in general. I will discuss how health is affected by these elements in the next section.

According to Abraido-Lanza et al. (1999) and Palloni and Arias (2004) the explanation of migration effects is based on two hypotheses: the "salmon bias effect" and

[6] Dixon (2000) analyzes food intakes among Mexican Americans.

the "healthy migrant effect". The first hypothesis is based on the idea that immigrants are more likely to return to their countries when they are ill or present poor health. The second hypothesis is based on the idea migrants are on average healthier than the average individual in the receiving population because migrants are not a random draw from the health distribution in their countries. An additional and very different explanation of why Hispanic immigrants may present different health outcomes than US born Hispanics is presented in Escobar et al. (2000)[7]. They suggest that immigrants have a lower set of expectations than do US born Mexican Americans making them less likely to become demoralized when income success and other achievements are not attained.

Determinants of Health

Health outcomes traditionally have been analyzed using individual-level risk factors (such as age, smoking, obesity, and parent's health) and individual socioeconomic factors (such as education level and family income). In an influential study, Fuchs (1986) argues that personal lifestyle, and not elements such as access to medical care or nutrition intakes, causes most of the variation in health. Evidence on this topic is diverse for different health risk behaviors. For example, Rosenzweig and Shultz (1983) found that maternal smoking and receipt of early prenatal care during pregnancy had significant negative effects on birth-weight outcomes.[8] Additionally, Contoyanis and Jones (2001), using British panel data from 1984 to 1991, found that prudent drinking and not smoking in 1984 were strongly correlated with a higher probability of reporting good and excellent

[7] They focus on mental health outcomes.

[8] When using birth-weight outcomes standardized by gestation they still found that smoking had a negative significant effect on this variable but early prenatal care was not statistically significant.

health in 1991. They also found that exercise, good sleep and breakfast in 1984 do not affect the probability of reporting good health in 1991. In another study, Thornton (2002) found that cigarette consumption but not alcohol consumption affects mortality rates in the USA.

A positive correlation between schooling and good health is well documented (Kenkel (1991), Nayga (2000)). Grossman and Kaestner (1997) even argue that the years of formal schooling completed is the most important correlate of good health regardless of how health levels are measured (by mortality or by morbidity). However, there are several explanations offered in the literature to explain such relationship. The first explanation is given in Grossman (1972, 1999), who argued that schooling increases the efficiency of the production of health generating larger a health output given a set of health inputs. A second explanation is offered in Kenkel (1991). He believes that the positive relationship between schooling and health is due to the fact that schooling helps people to select healthier behaviors by improving their knowledge. In other words, schooling improves allocative (input selection) efficiency in the production of health by improving health knowledge. Notice that if Kenkel explanation is true then schooling should not be positively correlated with healthier risk behaviors after controlling for health knowledge. A third explanation is presented in Fuchs (1982). According to Fuchs the relationship between schooling and healthy behaviors might be due to unobserved differences across individuals like time preferences (persons that discount less the future usually tend to make larger investments in schooling and health). A fourth explanation (which is similar to the previous one) can be found in Kenkel (1991). In this case the positive relationship between schooling and positive health behaviors is due to an omitted but potentially observable variable in the regression analysis. A final explanation is presented in Grossman (1999). In this case the correlation between schooling and education is due to a reverse causality. In other words, this argument states that is better health that causes more schooling and not vice versa.

There is no general consensus about which of these four explanations is the correct one. On one hand, Grossman's explanation (schooling increases the efficiency in the production of health) had received some support from studies like Berger and Leigh (1989), who control for the time preference effect using instrumental variables. In contrast, Farrell and Fuchs (1982) found evidence that supports the time preference hypothesis in the context of cigarette consumption. They conclude that time preferences causes both smoking behavior and schooling and argue that the same mechanism can be extrapolated to the relationship between schooling and health.

Additionally, Kenkel (1991) found a positive significant effect of schooling on exercise and a negative significant effect on smoking and heavy drinking after controlling for health knowledge. These facts suggest that schooling's effect on allocative efficiency in the production of health is not the principal reason to explain the relationship between healthy behaviors and schooling. Conversely, Nayga (2000) used obesity as healthy risk behavior and found that schoolings effect on weight disappears after controlling for health knowledge.

The relationship between income (or wealth) and mortality had been analyzed by many researchers including Duleep (1986), Adler et al. (1994) Pritchett and Summers (1996), and Case et al. (2001). Most of these studies usually found a negative relationship between income and mortality, which is usually known as the social gradient.

According to Pritchett and Summers (1996) there are three possible explanations for the existence of a positive correlation between wealth and health: i) increased income generate better health since individuals with higher incomes can easily purchase health inputs such as drugs, health books, more sophisticated diets and other health inputs; ii) healthier workers are more productive and therefore wealthier (inverse causality); iii) Other factors may cause both higher wealth and better health (incidental relationship). The authors analyzed the relationship between GDP per-capita and infant and child mortality and between GDP per-capita and life expectancy using cross-country time series data. They use an instrumental variable technique to control for incidental association and inverse causality and found a negative significant causal relationship between income (measured by GDP per-capita) and infant and child mortality. However, they did not found a positive significant relationship between income and life expectancy.

An additional individual-level social factor that has been widely identified to have a positive correlation with health (negative with mortality) is marriage (Goldman (1993), Lillard and Panis (1996)). Goldman (1993) argues that there are two possible explanations for this relationship. The first explanation, which is known as marriage protection, assumes that marriage generate social, psychological, economical and environmental advantages that affect health. The second explanation is based on the idea of marriage selection. According to this argument, individuals with better health (both mental and physical) are more likely to get married (positive selection). Using a mathematical simulation model, Goldman (1993) conclude that is almost impossible to the researcher identify causal and selection effects using cross-sectional data. Lillard and Panis (1996) argue that the marriage protection explanation introduce also the possibility of adverse selection. That is, protective effects from marriage generate that individuals with poor health or higher mortality risks will have more incentives to get married, and less incentives to leave the marriage. Estimations of self reported health among men using Panel Study of Income Dynamics (PSID) for the years 1984-1994 made by Lillard and Panis (1996) support the existence of both positive selection and adverse selection effects. In a different study, Horwitz et al (1996), using controls for positive selection, found that young adults who get and stay married have better mental health than those who remain single therefore the authors conclude that marriage has a protective effect on mental health of both men and women.

More recently an enormous literature has developed around the hypothesis that health can be better understood when it is viewed in its social context. Different authors stress different aspects of social context. Wilkinson (1996), using cross-national data, argues that income inequality per se conveys a health disadvantage to people at all levels of the income distribution. Deaton (2001) argues that to the extent that income inequality may play a role in health it is more likely to disproportionately affect the health of people at the bottom of the income distribution. He tests a refinement of the Wilkinson hypothesis using relative deprivation, a concept first introduced by Runcimann (1966) and formalized by Yitzhaki (1979). The idea behind this argument is that relative deprivation (with respect to a reference group like the people living in the same neighborhood or a group of persons with similar characteristics) causes psychological stress, which at the same time causes deterioration of health. In addition, it is believed that less egalitarian societies have social pressures to consume that lead people to divert expenditures away from health towards consumption. However, Deaton found no effect of relative deprivation on mortality rates after controlling for state, ethnicity. Similarly, Sturm and Gresenz (2002) find no evidence of the effect of relative deprivation on a variety of morbidity measures.

Mexican Americans are among the most economically disadvantaged ethnic groups in the United States. Therefore they are among the groups that experience the highest levels of relative deprivation when using US residents as reference group. However, because many Mexican Americans are recent immigrants a question emerges as to what is the relevant reference group in calculating the relative deprivation: US or Mexico.

The analysis of relative deprivation and its relevant reference group represent another path to explain differences in health outcomes between Mexican Americans and non-Hispanic whites, which has not been analyzed in the existent literature. If relative deprivation affects health and Mexican Americans use Mexico as reference group then they will present low levels of relative deprivation (because of the lower incomes levels in Mexico) and therefore they will have a health advantage over non-Hispanic whites, whose uses US residents as reference group.

Another large body of work argues that social context matters through some form of neighborhood effect (Kawachi and Berkman (2003)). People living in more affluent neighborhoods have more health capital either through greater social cohesions that promotes healthy behavior (Sampson, Raudenbush and Earls (1997)) or better access to fresh produce in grocery stores, more safe places to exercise and less environmental pollution. (MacIntyre and Ellaway (2000) and MacIntyre, MacIver and Sooner (1993)). Others, Including Diez-Rouz (1998 and 2001), Kawachi and Beckman (2000), and

Kawachi, Kennedy, Lochner and Prothwrow-Stith (1997), point out that social context also plays role at the state level through the generosity of the social safety net.

A different idea of how social networks matter is presented in Kemp (2004). He argues that medications, including folk and herbal medicine as well as prescription are shared within social networks in Hispanic communities. However, a study conducted by Raji et al (2003) revealed that fewer elderly Mexican Americans living in the Southwest of US used inappropriate medications than similar white and black populations. Furthermore, There are several studies, including Gartner et al (1991) and Ellison et al (2001), that found a positive correlation between several aspects of religiosity and mental health and it has been found that Hispanic patients and their family usually incorporate faith in God as key element to understand the illness and the cure (Zapata and Shippee-Rice (1999)).

Sociologists often try to test the Social Characteristics Hypothesis (LeClere et al. 1997) that states that some ethnic groups are comparatively more likely to live in disadvantaged social environments (i.e. neighborhoods with higher poverty level and lower mean levels of education). The hypothesis predicts that these groups are more likely to have poor health and higher levels of mortality. However they often found that this hypothesis fails when it is applied to Mexican Americans. LeClere et al. (1997) find that Mexican Americans have a mortality advantage compared to African Americans and non-Hispanic whites. They also find that neighborhood characteristics affect mortality of non-Hispanic whites and African Americans but not mortality of Mexican Americans.[9] This contrast with the evidence in Pearl et al (2001) and Buekens et al (2000) who find

[9] Sorlie et al. (1993) found similar results.

that birth-weight increases with less favorable neighborhood characteristics. Additionally, LeClere et al. (1997) find that the mortality of all ethnic groups is lower when they live in a census tract with a Hispanic population higher than the median for all census tracts. Part of this paper deals with the second possibility.

Objectives and Contributions of this Research

The findings of previous studies normally sustain the Hispanic health paradox. However, these studies also present evidence of heterogeneity in socioeconomic and demographic characteristics among Hispanic subgroups that are reflected in variations in support of the Hispanic health paradox. On one hand, differences in health outcomes between non-Hispanic whites and Cubans and Puerto Ricans can be explained by differences in risk factors and socioeconomic characteristics. On the other hand, Mexican Americans and other Hispanics (non Cuban, non Puerto Rican) and Hispanic immigrants frequently present better outcomes in health (at least measured by mortality) compared to non-Hispanic whites, after controlling for these factors.

The main objective of this dissertation is to estimate a production function of health capital (similar to the one estimated by Rosenzweig and Schultz (1983)) and examine how human capital, socioeconomic status, health risk behaviors, relative deprivation and neighborhoods effects affect the health (measured by physical and mental morbidity) of Mexican Americans and non-Hispanic whites.

To estimate the health capital production function I use data from the SF-12 health survey administrated to respondents in the National Longitudinal Survey of Youth 1979 (NLSY79) at age 40. I used two general measures of morbidity as health outcomes:

the Physical Component Summary (PCS) and the Mental Component Summary (MCS), which reflect physical and mental health respectively. The NLSY79 also provides me with several variables employed as health inputs at the individual level. Additionally, I use data from the Public Use Microdata Sample from the 1990 and 2000 5 percent census sample to estimate a relative deprivation measure and the percentage of Mexican Americans living in the same neighborhood. I also use data from the *Encuesta Nacional de Ingreso Gasto* 1998 (ENIGH-98) to estimate a measure of relative deprivation for Mexican Americans using Mexico as a reference group.

One point that distinguishes this dissertation from other research is that I analyze health status for Mexican Americans and non-Hispanic whites using two general measures of health that allow me to distinguish between physical and mental health. Thus, this paper is different from other studies that analyze health status using a specific health outcome such as birth-weight, high blood pressure or mortality rates as a measure of health.

A big part of this dissertation is focused on analyzing the effects of relative deprivation on physical and mental morbidity. Thus, another way in which this research is novel is the analysis of the relevant reference group for Mexican Americans. Since I am comparing Mexican Americans with non-Hispanic whites, a natural question emerges: do Mexican Americans compare themselves with people living in the United States or do they compare themselves with people living in Mexico? At least to my knowledge this is the first research that tries to determine what is the relevant reference group for Mexican Americans.

There is some research about the effects of social networks on health using mortality as a health outcome but little research using measures of physical and mental morbidity. A third contribution of this research is the examination of the effects of social networks among Mexican Americans and their effects on health, which has not been analyzed using PCS and MCS as health outcomes.

This dissertation is organized as follows. Chapter 1 presents the theoretical model used to develop the testable hypotheses of this dissertation. Chapter 2 provides an analysis and explanation of the two general measures of physical and mental morbidity (PCS and MCS respectively) used as health outcomes (dependent variables in the empirical models). Chapter 3 presents a description of the three data sources used in this research as well as detailed information on the construction of the final sample used and the descriptive statistics of the final sample. Chapter 4 contains the empirical model employed to estimate the health production function and to test the theoretical hypotheses developed in chapter 1. Chapter 5 presents the estimations of the health production function focusing the analysis of differences in health between Mexican Americans and non-Hispanic whites on individual level variables such as health related behaviors and schooling and income. Chapter 6 explores the effect of relative deprivation on health and contains the analysis of the relevant reference group for Mexican Americans. Chapter 7 is focused to analyzing the LeClere et al. (1997) finding about segregation effect on health, which will allow me to identify if social cohesion plays a role in health outcomes for Mexican Americans. Finally, chapter 8 contains the main conclusions as well as the limitations and considerations of this dissertation.

CHAPTER 1

THEORETICAL FRAMEWORK

The purpose of this chapter is to provide a general theoretical model that connects the empirical study with a theoretical foundation. A theoretical framework is essential to analyze the determinants of health and differences in health outcomes in an organized manner, to develop hypotheses and to be able to interpret empirical results. Specifically, the framework developed in this chapter will be focused on answering the following questions: i) what is the production process that determines health outcomes? ii) What is the role of different health inputs in the production of health? iii) How important is education in the production of health and what is it representing? iv) How relevant are community environment, family, relative deprivation and social interactions in the production of health? v) What elements may generate differences in health outcomes between the two groups (Mexican Americans and non-Hispanic whites)? vi) What are the problems generated in the transition from a theoretical to an empirical specification?

The chapter is organized as follows. First, I will describe the theoretical specifications used in economics to analyze health. Second I will explain the theoretical model used in this research. Third, based in the theoretical model, I will state the testable hypotheses of this dissertation. Finally, I will talk about the limitations and considerations of the theoretical model.

1.1. Theoretical Frameworks

There are two major types of economic models used in the health literature: the health capital model and the expected utility model (Kenkel 2000). The main difference between the two approaches is the role of uncertainty as an element that influences the consumer's behavior.

The health capital approach is based on the human capital theory that states that increases in the human capital of an individual rise productivity in the labor market (and therefore his wages) and in non-market activities or the household sector. Grossman (1972) was the first to develop the health capital theoretical framework. Grossman not only argued that increases in health capital increase individual productivity but also determine the total amount of time that can used to produce money earnings and commodities. In order to model his idea, Grossman uses the household production model, developed by Becker (1965), in which consumers maximize their utility and at the same time produce commodities using market goods and services and their own time as inputs. In this model consumers can produce outputs that enter directly in their utility function and outputs that determine earnings in a life cycle like human capital investments generated with inputs such as teachers and books. However, he claims that health is special outcome because it enters directly in the utility function and at the same time determines earnings in a life cycle.

According to Grossman the efficiency in the health production process is mainly determined by the individual's stock of human capital, chiefly education. Additionally, the stock of health capital, generated by this production process, depreciates over time and is defined as the total number of healthy days in a year, which generate immediate direct utility, and future indirect utility, since being healthy generate income over the life cycle that can be used to purchase goods and services that increase utility.

It is recognized that Grossman health capital model is deterministic and therefore has been criticized because ignores it the influence of uncertainty (Kiiskinen(2003)). Zweifel and Breyer (1997) state that ignoring the risk of negative stochastic shocks (like accidents and major sickness) that may considerably diminish the stock of health capital lead to overestimates of an individual's control of his own health capital in the long run. Considering stochastic scenarios under the health capital approach is hard and is not in the scope of this research.[10]

Grossman's original model has two special cases: the pure investment model and the pure consumption model (Grossman (1999)). In the first case, health does not enter in the utility function and is just and investment commodity that determines the total amount of time used in market and non-market activities. In the second case, the individual demands health for the simple reason that increases his utility. The theoretical model used in this research is based on the second case.

A relatively large number of studies have adopted modified versions of the Grossman health consumption model (see, for example, Rosenzweig and Shultz (1983),

[10] The use of stochastic shocks in health has been employed by Ehrlich and Becker (1972) to analyze individual's insurance behavior under uncertainty. However, they use the state preference approach instead of the household production model.

Behrman and Deolalikar (1988), Grossman (1999), Contoyannis and Jones (2001), Thornton (2002), Kiiskinen(2003)). All of these studies start from a one period household production model, in which an individual or a household maximizes its utility subject to a health production function, a budget constraint and in some cases also subject to some extra production process and constraints. For example, Kiiskinen (2003) incorporates a health knowledge production function and a medical care production function to the framework. Behrman and Deolalikar (1988) introduce a nutrient intake process to the analysis.

The original utility function assumed by Grossman includes health and consumption of other commodities as elements that directly affect the individual's utility. Rosenzweig and Shultz (1983) distinguish among three types of goods. The first type affects only the utility function (regular goods and services). The second type of good affects not only the utility function but also the production of health (like exercise or smoking). The third type of good affects the production of health but not the utility function (such as medical care, vitamin intake, ect.). Studies like Contoyannis and Jones (2001), Kiiskinen (2003) include a vector of exogenous influences in the utility function. Others like Behrman and Deolalikar (1988) incorporate education and leisure into the utility function.

In summary, differences in modeling the health production process can also be found in the literature. Contoyannis and Jones (2001) model a health production process that depends on a vector of goods and a vector of exogenous influences in health. Rosenzweig and Shultz (1983) assume that the health production function depends of three components: a vector of goods that affect the production of health and also affect directly the utility function such as health risk behaviors; a vector of goods that do not enhance the utility other than through their impacts on health such as medical care; and a vector of health endowments known to the individual or family but unobserved to the econometrician. Kiiskinen (2003) believes that specific inputs such as education and health knowledge play an important role in the health production process. Studies like Behrman and Deolalikar (1988) also point out the relevance of nutrition intakes and the time devoted to health related procedures, as well as individual and household health endowments, as key elements in this production process. Additionally, studies like Thornton (2001) incorporate government medical care expenditures in the analysis.

The ideal theoretical model would incorporate all the elements and variations mentioned in the individual utility function and in the health production function, as well as uncertainty, life cycle benefits of health, government medical care expenditures and other missing elements in this literature review. However, such models would be too complicated to generate a priori testable hypotheses.

1.2. Model

I use a slightly modified version of the Rosenzweig and Shultz (1983) model as the theoretical model for this research. This is a static model in which the benefits of good health are only reflected in the utility function. Even when the idea of health as capital is absent, this model still uses the Becker (1965) health production model as a stating point.

The original model developed by Rosenzweig and Shultz (1983) was used to estimate a production health function using as a main commodity child's health measured by birth-weight outcomes. In my research, the main commodity is adult health, which is produced by individual-level risk factors (such as smoking, obesity), individual socioeconomic behaviors (such as education level and family per-capita income), neighborhood characteristics and other social context variables.

Formally, the individual maximizes the following utility function:

$$U = U(C_i, Y_j, H) \quad \text{for } i= 1,2,\dots.n;\ j=n+1, n+2, \dots,m \tag{1}$$

Where C_i is a vector of n goods or commodities. Y_j is a vector of m-n goods that affect both the utility and the production of health (i.e. smoking, obesity, exercise) and H represents a scalar measure of the individual's health.

Let the health production function for the individual be:

$$H = h(Y_j, X_k, \mu) \text{ for } k= m+1, m+2, \dots,r \tag{2}$$

Where X_k is a vector of r-m health inputs that affect the production of health but do not provide direct utility to the individual (i.e. medical care, vitamin intake). The term μ represents the individual health endowments known to the individual but exogenous to him (i.e. neighborhood characteristics, genetic heritage, cultural heritage, relative deprivation).

The individual's budget constraint is represented by the following equation:

$$I = \sum_t Z_t p_t \quad \text{for } t = 1, 2, \ldots r \tag{3}$$

Where I is exogenous per-capita family income, p_t is a vector of exogenous prices and Z = C ∪ Y ∪ X.

Therefore the individual's problem can be represented by the following Lagrangian function:

$$\underset{Z,H}{Max}\, \zeta = \mathrm{U}(\mathrm{C_i}, \mathrm{Y_j}, \mathrm{H}) + \lambda(I - \sum_t Z_t p_t) - \gamma(H - \mathrm{h}(\mathrm{Y_j}, \mathrm{X_k}, \mu)) \tag{4}$$

Where λ and γ represent the marginal utilities of per-capita family income and health respectively. The first order conditions to this maximization problem are:

$$\frac{\delta\zeta}{\delta C_i} = \frac{\delta U}{\delta C_i} - \lambda p_i = 0 \tag{5}$$

$$\frac{\delta\zeta}{\delta Y_j} = \frac{\delta U}{\delta Y_j} - \lambda p_j + \gamma \frac{\delta h}{\delta Y_j} = 0 \tag{6}$$

$$\frac{\delta\zeta}{\delta H} = \frac{\delta U}{\delta H} - \gamma = 0 \tag{7}$$

$$\frac{\delta\zeta}{\delta X_k} = -\lambda p_k + \gamma \frac{\delta h}{\delta X_k} = 0 \tag{8}$$

$$\frac{\delta\zeta}{\delta\lambda} = I - \sum Z_t p_t = 0 \tag{9}$$

$$\frac{\delta\zeta}{\delta\gamma} = H - h(Y_j, X_k, \mu) = 0 \tag{10}$$

Equation 5 is the standard condition in consumer behavior theory that states that the marginal utility of consumption for the good C_i must be equal to the price of the good measured in utility terms (the marginal utility from income (λ) multiplied by the price of that good). Equation 7 shows that γ is the marginal utility from health. Additionally, if we divide equation 5 by equation 7 we can see that the marginal rate of substitution between the good C_i and Health must be equal to the ratio of the price of the good measured in utility terms and the marginal utility of health.

Equation 6 shows that the optimal consumption level of the commodity Y_j depends of three factors. The first term which represents the direct effect of consuming Y_j on the utility of the individual. The second element reflects the total price of consuming the good Y_j. And the third term in the equation that denotes the indirect effect (via health status) of consuming Y_j on the utility. Notice that this effect can be either positive or negative depending on the nature of the good. For example, if Y_j is a healthy diet or physical aerobic activities then this term is positive. Conversely if Y_j is smoking then this term will be negative. Summarizing, equation 6 shows that the optimal consumption level of Y_j is reached when the total effect on marginal utility (given by the sum of first and the third term) is equal to the full price of consuming that good measured in utility terms (λp_j).

Equation 8 states that the indirect marginal utility from consuming X_k must be equal to the price of the good measured in utility terms. Finally equations 9 and 10 represent the budget constraint and the health production function respectively.

Reduced form demand functions for the r goods (C_i, Y_j and X_k), as well as for the health outcome can be defined implicitly by equations five to ten and they can be written in the following way:

$$C_i = \Phi\ (p, I, \mu) \quad \text{for } i = 1,2,\ldots,n \tag{11}$$

$$Y_j = \Omega\ (p, I, \mu) \quad \text{for } j = n+1, n+2, \ldots, m \tag{12}$$

$$X_k = \theta\ (p, I, \mu) \quad \text{for } k = m+1, m+2, \ldots, r \tag{13}$$

$$H = \psi\ (p, I, \mu) \tag{14}$$

In general, empirical estimation of the reduced form equations 11-14 do not allow us to separately identify preference and technological parameters of the model. In other words, empirical estimation of this set of equations does not provide information of the effect of the Y_j and X_k variables (health inputs) on the production of health. However, this framework allows estimating health input demand functions (equation 13) and reduced form equations from the production of health (equation 14) and their parameters. Because most data sets have information only on a subset of variables that explain the health production function, most researchers have estimated "hybrid" equations with less desirable properties (Rosenzweig and Shultz (1983)). These "hybrid" equations have the following form:

$$H = \phi\,(y, x, p_l, I, \mu) \qquad (15)$$

Where y and x are subsets of the vectors Y_j and X_k respectively. That is, the health production function is estimated using the available health inputs (x and y), the determinants of all the other inputs (p_l and I) and μ. Furthermore, the coefficients estimated for the different health inputs from an equation like 6 are interpreted as the relevant production function parameters from equation 2. However, Rosenzweig and Shultz (1983) show that the partial derivative of a specific health input y_m in equation 15 embodies not only technological properties of the health production function but also characteristics of the individual preferences. Therefore, empirical estimations of a health input on health using the hybrid equation are generally biased estimations of the health production function (equation 2) and the sign of the bias is a function of the individual's utility function (equation 1).

Even when having information of all relevant health inputs an additional problem is presented when estimating equation 15 due to heterogeneity in μ. The existence of exogenous health factors known to the individual but unobserved to the researcher generate an additional complication in estimating unbiased estimates of the health inputs on the health production function. To see this, consider the impact of a marginal change in the input Y_m over the production health function (equation 2) in a population where μ is randomly distributed. Therefore the marginal effect can be approximated by equation 16.

$$\frac{\delta H}{\delta Y_m} = \Gamma_{Y_m} + (\frac{\delta Y_m}{\delta \mu})^{-1} \tag{16}$$

Where

$$\frac{\delta Y_m}{\delta \mu} = -\Gamma_{\mu}\left[\sum_{n+1}^{m} S^{c}_{jm}(U_{Y_j H} + U_{HH}\Gamma_{Y_j}) + \sum_{1}^{n} S^{c}_{im}U_{C_i H} + \sum_{m+1}^{r} S^{c}_{km}U_{HH}\Gamma_{X_k}\right]$$
$$- U_H(\sum_{n+1}^{m} S^{c}_{jm}\Gamma_{Y_j \mu} + \sum_{m+1}^{r} S^{c}_{km}\Gamma_{X_k \mu}) \tag{17}$$

The S^{c}_{ij} represent the relevant compensated price effects from the demand equations given by equations 11 to 13. The term Γ_x corresponds to the marginal products of the factors in equation 2. Thus, equations 16 and 17 clearly show that the observed marginal change of Y_m over H does not correspond to the true marginal effect Γ_{Y_m}, and that the nature of the bias depends of four factors: the characteristics of the individual preferences; the marginal products of all inputs; the effects of μ on the health production;

and the impact of μ on the marginal products of the controllable inputs. The empirical model developed in chapter 4 will deal with this problem.

1.3. Testable Hypotheses

Equations 1, 2 and 3 and how they are reflected in equation 15 represent the starting point for generating hypotheses that can be empirically tested. Therefore, in order to generate testable hypotheses is necessary first to describe the variables contained in the vectors X_k and Y_j from the above model and then determine the theoretical sign of their marginal effect on health. Table 1 present a list of the variables contained in each vector.

Vector X_k	**Vector Y_j**
Education	Smoke
Income	Obese
Height	Physical Activity
Marriage	
Relative Deprivation	
Social Relations	
Acculturation (for Mexican Americans)	

Table 1.1 Vector Definition

The main objective of this dissertation is to estimate a production function of health capital and examine how human capital, socioeconomic status, health risk behaviors, relative deprivation and neighborhoods effects affect the health of Mexican Americans and non-Hispanic whites. Therefore, the first hypothesis to test is:

i) Mexican Americans have a relative advantage in health compared to non-Hispanic whites.

As mentioned in the introduction, there are several studies that support the existence of better health outcomes for Mexican Americans compared to non-Hispanic whites. According to the above framework, Mexican Americans and non-Hispanic whites may have different health outcomes for the following reasons: i) if they have different preferences, which are reflected in the utility function; ii) if they have different socioeconomic status, that is differences in income and education, which are two the variables that form the X_k vector; ii) differences in the rest of the variables that form the X_k vector (height, access to medical care, neighborhood characteristics, social interactions, relative deprivation and acculturation); iv) if they have different health risk behaviors, that is differences in smoking rates, obesity and physical activity (the variables that form the Y_j vector); if they have different health endowments (μ).

Similarly, the theoretical model also allows me to test the following hypothesis related to the mental health of Mexican Americans that has been supported by authors like Ortega et al (2000) and Escobar et al (2000).

ii) Mexican Immigrants (and less acculturated Mexican Americans) have better physical health and mental health than more acculturated Mexican Americans born in USA.

Since health outcomes traditionally have been analyzed using individual-level risk factors, the next hypotheses to formulate are those related with health risk behaviors such as:

iii) Smoking negatively affects physical and mental health.

iv) Obesity has a negative impact on physical and mental health.

v) Lack of physical activities negatively affects physical and mental health.

These three risk behaviors form the Y_k vector and as mentioned in the previous section, the marginal effect of a Y_m variable over health ($\delta H/\delta Y_m$) can be positive or negative depending of the nature of the input. In this particular case for the way in which these risk behaviors are defined (i.e. lack of exercise and not frequent exercise) the three health risk behaviors are expected to have a marginal negative impact on health, as documented in the introduction.

Another set of individual-level hypotheses to be tested, and form part of the effects generated by some of the variables in the X_k vector ($\delta H/\delta X_n$ where n=education, income, marriage, access to medical care and height), is the following:

vi) Education directly increases the efficiency of the production of health given a set of health inputs.

vii) Higher income levels generate better health outcomes.

viii) Marriage generates a protective effect on health.

ix) Taller individuals have better health than shorter individuals.

The final set of hypotheses to be tested in this research also involves variables from the X_k vector. However these are social context variables rather than individual-level variables. The marginal effects of these variables ($\delta H/\delta X_t$ where t = relative deprivation, neighborhood characteristics, social interactions, acculturation) depend of the nature of the relationship between every variable and health. These are the hypotheses to be tested:

x) The Wilkinson Hypothesis (1996) states that income inequality per se conveys a health disadvantage to people at all levels of the income distribution. I will estimate test this hypothesis using the index of relative deprivation following Deaton (2001). Specifically, I will test if health declines with increases in relative deprivation, holding constant individual per capita income.

xi) Mexican Americans living in more segregated neighborhoods have higher levels of health due to the social cohesion and interpersonal support among Mexican Americans living in this neighborhoods.

1.4. Limitations and Considerations

The theoretical model presented here is subject to some conceptual critiques. First, unlike Grossman (1972) in which health also works as a capital good that produces future benefits, the model assumes that health status is generated by a production function and only influences present health through its contemporaneous impact on the individual's utility function. Second, The static model presented above requires that a sequence of causal effects, at one point in time, need to be assumed. Therefore, the theoretical model is subject to critiques of possible simultaneity bias and possible reverse causality in the production of health. For example, medical care and physical activity are two health inputs that are subject this critique since health status is likely to influence the demand for medical care and physical activity.

There are other (more technical) critiques or elements to be considered. For example, the previous theoretical analysis is concentrated on interior solutions. However, corner solutions in some health risk variables are not rare (consider the smoking variable employed in this research, which is a dummy variable that takes values of zero or one). Additionally, the theoretical model assumes that all health inputs are continuous and the dataset used in the empirical analysis uses discrete health risk behaviors such as smoking and obesity.

CHAPTER 2

DEPENDENT VARIABLES

This chapter provides an overview of the two general measures of morbidity employed as dependent variables in this research. These two measures are the Physical Component Summary (PCS) and Mental Component Summary (MCS) and reflect physical and mental morbidity respectively. Thus, this paper is different from other studies that analyze health status using a specific health outcome such as birth-weight, high blood pressure or mortality rates as a measure of health. In particular, this chapter explains what are these two health measures, how to estimate and interpret them, and how good are these two measures as predictors of physical and mental morbidity.

2.1. Construction of PCS and MCS

Physical Component Summary (PCS) and Mental Component Summary (MCS) are two general measures of physical and mental health outcomes across population. An alternative measure of general health is given by a utility index. A utility index achieves a single summary score that aggregate health measures without regard to their inter-relationships. Thus, the construction of PCS and MCS scores has the advantage of distinguishing between physical and mental health.

The PCS and MCS employed here are constructed using the SF-12 health survey that is applied in the NLSY79 survey[11]. PCS and MCS can also be constructed using the SF-36 health survey, which is a more complete and detailed survey than the SF-12 survey. Despite this fact, Ware, Kosinski and Keller (1994) estimate that the component summaries estimated by the SF-12 explain at least 90% of the summary components estimated by the SF-36 health survey.

Figure 2.1 illustrates how these two health scores are constructed. Broadly speaking the idea of constructing PCS and MCS is to explain as much of the variance in the eight SF-12 components as possible with only two general measures. The eight SF-12 components are: Physical Functioning, Role-Physical, Bodily Pain, General Health, Vitality, Social Functioning, Role-Emotional and Mental Health.

PCS and MCS score are formed in three steps: i) the eight scales of the SF-12 are standardized using means and standard deviations from the U.S. population; ii) the scales are aggregated using weights from the general U.S. population; iii) the aggregate PCS and MCS are standardized by a linear T-score transformation to have mean 50 and a 10 points standard deviation, in the general U.S population.

In a non-experimental design, like the one employed in this paper, it is usual to compare individual PCS and MCS scores to the average PCS and MCS scores of a fixed norm, such as the general population. According to Ware, Kosinski and Keller (1994) in order to detect a one-point difference between a group mean and a fixed norm we need at least 786 observations. For a two-point difference the number of required observations is

[11] I will talk about the NLSY79 database in chapter 3.

187. This is important to remember since the number of Mexican Americans in the database employed in this research is 584.

2.2. Interpretation of PCS and MCS

Now it is time to talk about the most relevant question in this section: How PCS and MCS must be interpreted? The answer to this question can be founded looking at Table 2.1. Basically, a high score in the PCS reflects good physical health and low score reflects poor physical health. Similarly, a high MCS score reflects good mental health and a low score a poor mental health. In other words, PCS measure physical morbidity whereas MCS reflects mental morbidity. It is important to note that the absence of physical limitations does not guarantee a high PCS score, it is necessary an evaluation of actual health as excellent. The same logic applies for MCS where it is necessary to have an excellent evaluation of mental health to have a high score.

It is important to remember that because PCS and MCS are norm-based scores then it must be true that any value above (below) 50 is higher (lower) than the mean of general U.S. population. However, because these scores vary with age and gender we need to have a notion of a specific norm that take into account these variables. For example, the mean PCS and MCS scores for the population between 35-44 years are 52.15 and 49.91 respectively, and the mean PCS and MCS scores for the population between 55-64 years are 45.90 and 51.05 respectively (Ware, Kosinski and Keller (1994)). Additionally, the same source reports that if we divide the U.S. population by gender the PCS and MCS scores are 51.05 and 50.73 for male and 49.07 and 49.33 for female.

Scale	Very Low	Very High
PCS	Substantial limitations in self care, physical, social, and role activities; severe bodily pain; frequent tiredness; health rated "poor"	No physical limitations, disabilities, or decrements in well-being; high energy level; health rated "excellent"
MCS	Frequent psychological distress, substantial social and role disability due to emotional problems; health in general rated "poor"	Frequent positive affect; absence of psychological distress and limitations in usual social/role activities due to emotional problems; health rated "excellent"

Table 2.1. Description of PCS and MCS Scores
Source: Ware, Kosinski and Keller (1994).

2.3. PCS and MCS as Predictors of Health

A different but relevant question that emerges when using PCS and MCS as general measures of health is: how good are these two measures at reflecting health conditions? The followings are some of the research that uses PCS and MCS as measures of health. Mapes et al. (2003) find that PCS and MCS are associated with higher risk of death and hospitalization in hemodialysis patients in USA, Europe and Japan. In particular, their estimations show that the adjusted risk of death is 93% (and risk of hospitalization is 56%) higher for patients in the lowest quintile of PCS than for patients in the highest quintile of PCS. Therefore, the authors conclude that PCS is the most efficient summary score that reflects health conditions. In another study, Phillips and Lansky (1992) report on the health profiles of 62 patients before and after a heart valve replacement. They find that the mean PCS (MCS) changes from 35.1 (43.3) to 42.7 (46.5) after the heart valve replacement. In similar research but analyzing hip replacement Katz et al. (1992) find that the mean PCS (MCS) changes from 39.0 (39.7) to 48.5 (43.5) after the hip replacement.[12]

Another application for the PCS and MCS scores can be found in Ware, Kosinski and Keller (1994). They use MCS as a screening tool for clinical depression and PCS as a screening tool for physical disease. The authors also present the norms of PCS and MCS for healthy group with no chronic conditions in the general U.S. population vs. the norms for groups with the following chronic conditions: allergies, angina, arthritis, back pain/sciatica, cancer, congestive heart failure, dermatitis, diabetes, hearing impairment, hypertension, limitations in use of arms/legs, lung disease, myocardial infarction and vision impairment. They find that both the norms for the mental components summary and the physical component summary are higher for the healthy group with no chronic conditions than the norms of any of the other groups with chronic conditions.

[12] Other similar researches are Rampal et al (1994) and Lansky, Butler and Waller (1992).

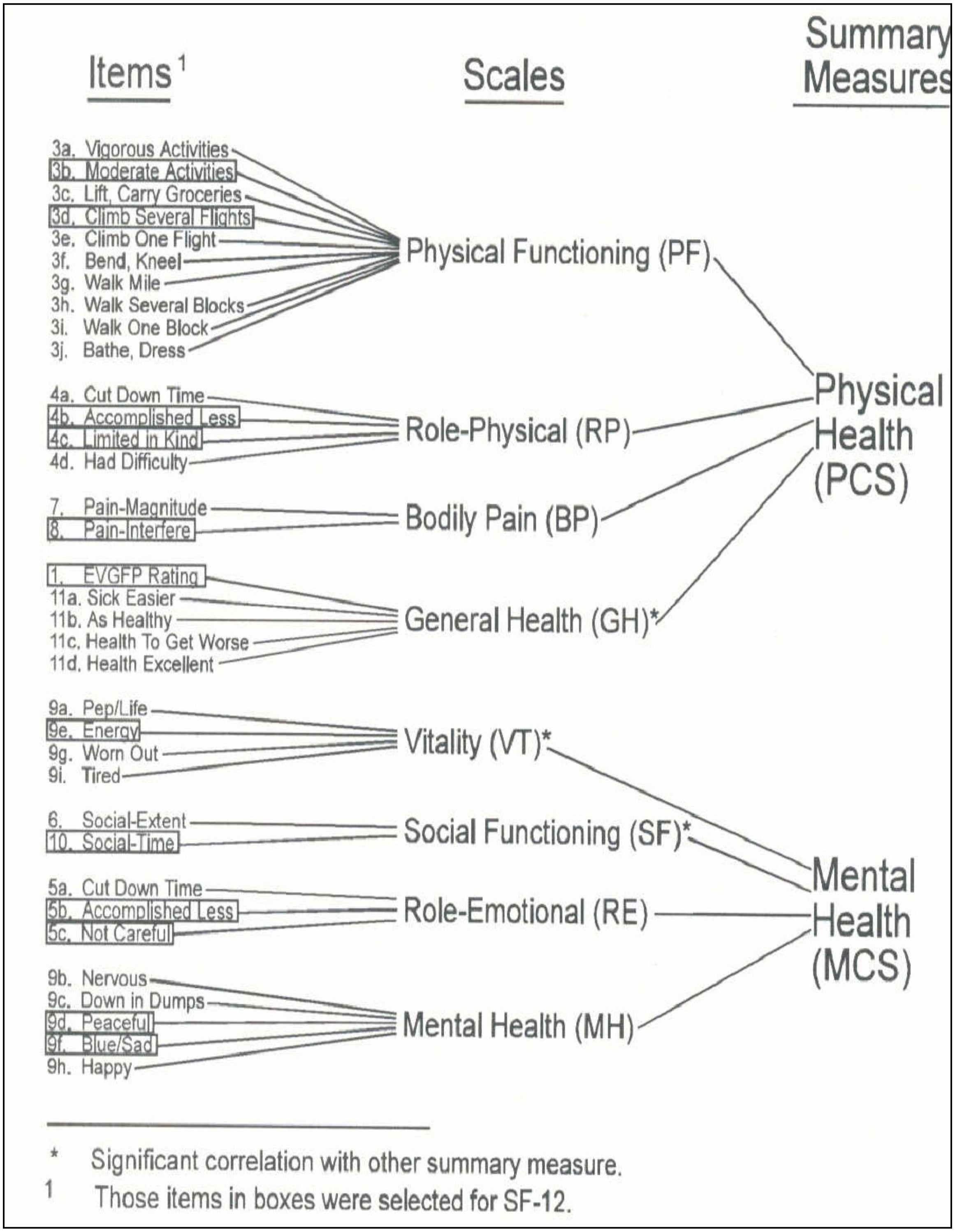

Figure 2.1. Construction of PCS and MCS. Source: Ware, Kosinski and Keller (1995).

CHAPTER 3

DATA

The purpose of this chapter is to describe the data and the selection of variables that is used in the empirical model . I use data from three different sources: the National Longitudinal Survey of Youth, 1979 (NLSY79), the Public Use Microdata Sample from the 1990 and 2000 5 percent census sample and the *Encuesta Nacional de Ingreso Gasto, 1998* (ENIGH-98). Data quality and availability directly influences the econometric modeling. Therefore it is useful to introduce the data before analyzing the empirical model.

This chapter is organized as follows. First, I present a description of the three data sources used in this research. Second, I describe how my final data sample is formed. Third I present a definition of the variables employed and describe how each variable is formed. Finally, I present the descriptive statistics of the final sample.

3.1. Data Sources

The main data source is the National Longitudinal Survey of Youth, 1979 (NLSY79). The NLSY79 is longitudinal database of 12,686 youth individuals living in the United States in 1979 and born between January 1, 1957 and December 31, 1964.

Interviews were conducted annually during the period 1979-1994 and biennially thereafter. The main purpose of the NLSY79 is to collect data on each respondent to understand issues related to the U.S. labor market such as respondent's labor force experience, labor market attachment, and investments in education and training. However, the content of the survey has been increased to cover information about many topics including military participation, vocational aptitude, alcohol and substance abuse, self-reported health, and children's issues among others.

The original NLSY79 applied in 1979 was formed by three subsamples: i) a cross sectional representative sample of non-institutionalized civilian living in the U.S. consisting of 6,111 respondents who were 14-22 years old when they were first surveyed in 1979; ii) a supplemental sample of 5,265 respondents designed to oversample civilian Hispanics, blacks and economically disadvantaged non-Hispanic/non-blacks individuals who were 14-22 years old when they were first surveyed in 1979; iii) a sample of 1,280 respondents designed to representative of the population born between 1957 and 1961, and who were enlisted as of September 30 of 1978 in one of the four branches of the military.

Summarizing the NLSY79 allows us to analyze the socioeconomic history of the individuals in the sample and it is particularly useful for the purpose of this research because was designed to over-sample the civilian Hispanic population. I use data from the 1998, 2000 and 2002 waves, which are the waves in which the SF-12 Health Survey was applied to respondents of age 40 and over.[13]

---

[13] The SF-12 health questionnaire was designed by John Ware of the New England Medical Center Hospital and can be administrated in 2 to 3 minutes. Detailed information can be found in the following website. http://www.sf36.com/

A secondary data source employed is the Public Use Microdata Sample (PUMS) from the 1990 and 2000 5 percent census sample. PUMS are extracts from confidential microdata taken from the Census in a manner that avoids revelation of information about individuals and households. The Public Use Microdata Sample contains records representing 5 percent of the occupied and vacant housing units in the United States and individuals in the occupied units. Records about housing units contain information including family income, family size, household type, available services, and vehicles available just to mention some of the records. Individual records also contain plenty of information including records on age, ancestry, educational attachment, earnings, and language spoken. The Census 5 percent samples are large. For example the PUMS 2000 5 percent sample provide information for over 14 million of people and over 5 million housing units.

I use data from the PUMS 1990 and 2000 to estimate a relative deprivation measure for every individual in the sample using Public Use Microdata Areas (PUMAs) in the US as reference group for the US measure of relative deprivation (see chapter 6 for a detailed explanation). I also use PUMS 2000 data to determine the percentage of Mexican American segregation in every neighborhood (see chapter 7 for a detailed explanation).

Another secondary data source is the The *Encuesta Nacional de Ingreso Gasto, 1998* (ENIGH-98). ENIGH-98 is a national income expenditure survey that is statistically representative for Mexico and that contains detailed information on 10,952 households for several measures of income, expenditure, socio-demographic characteristics of every member in the household such as age, education level, and characteristics of the job. The

ENIGH-98 also contains information of the physical characteristics of the dwelling. This national survey uses houses as sample units and households as units of observation. I use this data source to estimate a relative deprivation measure for Mexican Americans assuming that they use Mexico as a reference group (see chapter 6 for more information).

3.2. Construction of the Sample

First, it is important to mention that over the time the sample size and structure of the NLSY79 have changed. On one side, almost all the respondents from the cross sectional sample and the supplemental oversamples of Hispanics and blacks have been eligible for interview during each NLSY79 survey. However due to funding constraints after the 1990 interview none of the 1,643 the economically disadvantaged non-Hispanic/non-blacks respondents were eligible for interview. Also, for the same reason the military sample was reduced to 201 randomly selected respondents. Table 3.1 presents the number of respondents in the NLSY79 for the first interview the years 1998, 2000 and 2002 (years in which the SF-12 questionnaire was applied).

	1998	2000	2002
Total Respondents	8,399	8,033	7,724
Cross-sectional Sample	5,159	4,949	4,775
Supplemental Sample	3,065	2,921	2,792
Military Sample	175	163	157

Table 3.1. Number of respondents in the NLSY79.

Because the two morbidity measures employed in this research (physical component summary and the mental component summary) are estimated for the respondents in the NLSY at the age of 40, my eligible sample include only respondents aged 40 and over. In 1998 a total of 1,328 respondents in the NLSY79 aged 40 years or more from which 1,322 had valid responses to estimate the PCS and MCS scores. In year 2000 a total 2,102 individuals response the SF-12 questionnaire from which 2,089 had valid responses to estimate the PCS and MCS scores. In 2002 a total of 2,159 individuals response the SF12 survey and 2,145 individuals had valid responses. Therefore, at this point the sample, including the three waves, was formed by a total of 5,589 respondents. However, this research is focused on analyzing health differences between Mexican Americans and non-Hispanic whites therefore I eliminate from the sample other ethnic groups such as blacks, Asians and other Hispanics different from Mexican Americans and ended with 824, 1324 and 1313 respondents for 1998, 2000 and 2002 respectively. Figure 3.1 in the next page shows how the final sample was formed.

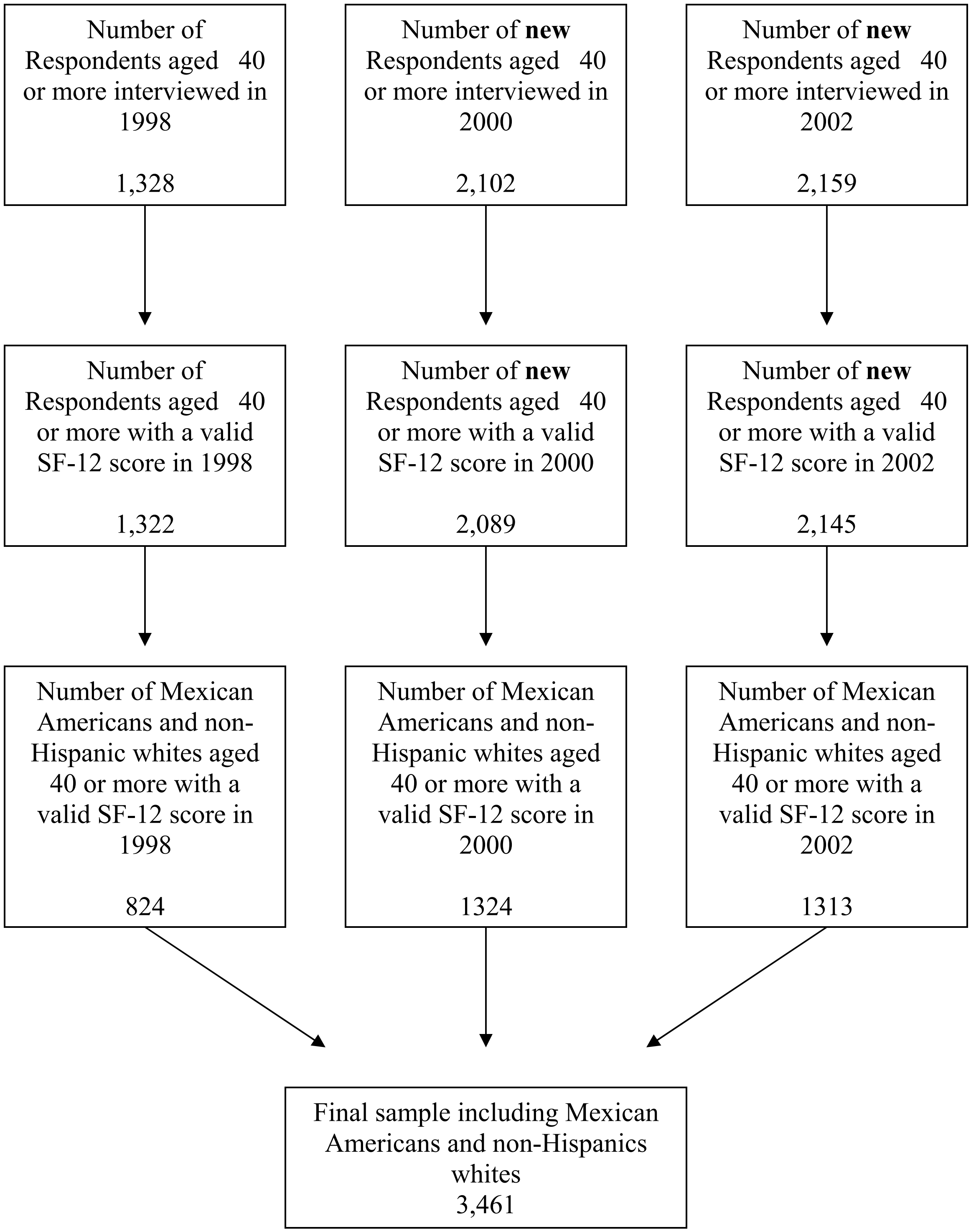

Figure 3.1. Construction of the Sample

The final sample, used in chapters 5 and 6 to estimate the health production function using individual level health inputs and relative deprivation, consist of 3,461 respondents residing in the US at the time of the health interview survey who were either Mexican American or non-black non-Hispanic non-Asian and who had valid responses to all of the data items used in the analysis. Since the overwhelming majority of non-black non-Hispanics are white, these respondents are referred to as non-Hispanic whites. Table 3.2 presents the distribution of the sample according to ethnicity.

Total	Mexican Americans	Non Hispanic White
3,461	584	2,877

Table 3.2 Distribution of the Sample According to Ethnicity in the Base Estimates.

For the analysis in chapter 7, which is focused on the study the effects of social cohesion effects on physical and mental morbidity, I match the previous sample with the 5% census 2000 PUMS data to include the proportion of Mexican Americans living in the same Metropolitan Statistical Area (MSA) if the individual live in an urban area, or the proportion of Mexican Americans living in the same the county (or a group of counties) in the same Public Use Micro Sample Area (PUMA) when the respondent live in a rural area (outside of a MSA). As a result of this match my sample was reduced to 3,250 respondents with valid matches and valid observations. Table 4 presents the distribution of this sample according to ethnicity.

Total	Mexican Americans	Non Hispanic White
3,250	568	2,682

Table 3.3. Distribution of the Sample According to Ethnicity with Neighborhood Characteristics.

3.3. Description of the Data

Before starting the descriptive analysis of the data it is necessary first to define the variables used in this thesis. Table 3.4 in the next page presents a complete list of the variables employed in this research and its definitions.

The variable dummy variable mexam was created equal to 1 if the respondent of the NLSY79 identify Mexican as her primary ethnic ancestry in the year 1979 and was created to be equal to 0 otherwise. I define immigrants as those individuals born outside the United States . Therefore the variable immig is defined to be equal to 1 when the individual is an immigrant and 0 otherwise. As explained in table 3.4 the variables immexam and imother are interacted variables between mexam and immig and between (1-mexam) and immig respectively. Thus immexam and imother are used in the empirical analysis of chapters 5, 6 and 7 to identify Mexican immigrants and non-Hispanic whites immigrants respectively.

Variable	Definitions
mexam	Dummy variable equal to one if the individual is Mexican American.
immig	Dummy variable equal to one if the individual born in other country.
immexam	Interaction of mexam and immig
imother	Interaction of (1-mexam) and immig
obese	Dummy variable equal to one if the individual has a BMI equal to 30 and over.
smoked	Dummy variable equal to one if the individual usually smokes daily
pactivit	Dummy variable equals to one if the respondent realizes physical activities at least once a week.
height	Height of the individual
male	Dummy variable equal to one if the individual is male.
fheight	Interaction of male and height.
fheight	Interaction of (1-male) and height.
hgc12u	Dummy variable equals to 1 if the highest grade completed by respondent is less than 12 years.
hgc12	Dummy variable equals to 1 if the highest grade completed by respondent is equal to 12 years.
hgc12m	Dummy variable equals to 1 if the highest grade completed by respondent is more than 12 years but less than 16 years.
hgc16	Dummy variable equals to 1 if the highest grade completed by respondent is more than 16 years.
married	Dummy variable equal to one if the individual is married with spouse present.
pcinc	Equal to real family income divided by family size (in constant $1998).
lnpcinc	Natural log of per-capita family income
pcincmis	Dummy variable that controls for missing lnpcinc
psusmoking	Mean value of the smoke dummy variable for all other respondents from the same primary sampling unit.
psuobese	Mean value of the obese dummy variable for all other respondents from the same primary sampling unit.
psupacti	Mean value of the pactivit dummy variable for all other respondents from the same primary sampling unit.
hplan	Dummy variable equals to one if the respondent has health insurance
usreldep	Relative deprivation measure constructed for all respondents using the neighborhood of residence as the relevant reference group.*
mereldep	Relative deprivation measure constructed for Mexican Americans using Mexico as the relevant reference group.
whusrel	Interaction of (1-mexam) and usreldep.
meusrel	Interaction of mexam and usreldep.
memerel	Interaction of mexam and mereldep.
usrdmis	Dummy variable that controls for missing usreldep
mmxam	Proportion of Mexican Americans living in the same neighborhood
mexmmx	Interaction of mexam and mmxam
whmmx	Interaction of (1-mexam) and mmxam

Table 3.4 Variable Names and Definitions

Obesity has been widely recognized as a health risk factor that affects the heart and may cause several health problems (Medical Encyclopedia (2003)). Physicians often use BMI to determine if a person has a healthy weight. To construct the obese dummy variable, I used the standard definition of obesity employed by physicians. According the Center for Disease Control guidelines, anyone with a BMI greater than 25 is considered to be overweight. Anyone with a BMI 30 and over is considered to be obese. BMI is equal to weight divided by height squared (measured in kilograms/meters). Thus, to estimate BMI I use the weight of the person at the time he answer the SF-12 survey and the most recent height available (usually 1985) since this variable is not available for every year in the survey.[14] Thus, for example if the respondent took the SF-12 survey in 1998, I construct the BMI using the weight of the individual in 1998 and her more recent height available. Once I estimate the BMI, I construct the dummy variable obese equal to 1 when the BMI of that respondent was 30 and over or 0 otherwise.

The NLSY79 survey asks two questions about how often the respondent undertakes light and vigorous physical activities only for the years 1998 and 2000. Therefore I use the 1998 answers to these questions if the respondent took the SF-12 survey in 1998 and the 2000 answers when the respondent took the SF-12 survey in 2000 and 2002 then I create the dummy variable pactivit equals to one if the individual realizes both light and physical activities at least once a week and zero otherwise.

The NLSY has some questions about smoking but the most recent questions were only asked in 1998. Therefore I use the 1998 answers for all the years in which the

[14] This is a good approximation for current height since in 1985 the youngest individuals in the NLSY79 had 20 years and height does no change much after this age.

respondent took the SF-12 survey. Specifically the dummy variable smoked is equal to one if the individual reports to smoke daily very often and zero otherwise.

The variable pcinc was created using the total net family income variable, provided by in the NLY79 and created by the staff of the Center for Human Resource Research (CHRR), divided by the family size. If the member of the family was less than 14 years then she was counted as half of a family member. If the individual was aged 14 or more she was counted as one individual at the time of estimation of family size.

Variables like male, married, lnpcinc, pcincmis, hgc12u, hgc12, hgc12m, hgc16 and hplan defined above in table 3.4 are very transparent and do not require additional information. However variables like psusmoke, psuobese and psupacti require additional explanation. The variables psusmoking, psuobese and psupacti will be used as instrument variables (see next chapter). These instruments are defined as the mean values of these variables for all other respondents from the same Primary Sampling Unit (PSU), where means are calculated for each respondent excluding his or her own value of the variable.

Primary Sampling Units can be Standard Metropolitan Areas (SMSAs), cities, counties, and part of counties and are based on population and area constraints. PSUs are usually used and selected to generate a representative final sample of a broader population (Eberwein, Olsen and Reagan (2003)). Therefore PSUs are often used in multistage sampling to reduce data collection costs. The selection of the cross sectional sample of the NLSY79 was based on the 102 PSU National Probability Samples developed by National Opinion Research Center (NORC) in 1973. The number of PSUs for non-Hispanic whites and Mexican Americans respondents that potentially have gone through health at 40 is 102 and 93 respectively. The number of PSUs for non-Hispanic whites and Mexican Americans respondents that actually went through health at 40 and have valid PCS and MCS scores is 102 and 74 (in that order).

The variable usreldep is the relative deprivation measure using as reference group the neighborhood of residence, where neighborhood is defined as MSA if the individual lives in an MSA or as county or group of counties in the same PUMA if the respondent live outside of an MSA. The variable mereldep is the relative deprivation measure using Mexico as the relevant reference group. A detail explanation of how these variables are estimated and what is a relevant reference group is provided in chapter 6 of this dissertation. Finally, a description of how mmxam is computed is provided in Chapter 7.

Table 4 presents the means and standard deviation of each variable for the whole sample and the two-subpopulation groups (Mexican Americans and non-Hispanic whites). The standard deviations are presented in parentheses and the t statistics for difference in the means between the two groups are presented in square brackets.

Variable	All	Non Hispanic White	Mexican Americans	Difference in Means
PCS	52.36 (7.90)	52.43 (7.88)	51.85 (8.03)	0.58 [1.63]
MCS	53.07 (8.05)	52.99 (8.02)	53.46 (8.16)	-0.47 [-1.30]
mexam	0.17 (0.37)			
immig	0.09 (0.28)	0.05 (0.21)	0.29 (0.45)	-0.24* [-12.80]
immexam	0.05 (0.21)			
imother	0.04 (0.19)			
obese	0.25 (0.44)	0.23 (0.42)	0.35 (0.48)	-0.12* [-5.62]
pactivi	0.37 (0.48)	0.38 (0.49)	0.27 (0.45)	0.11* [5.44]
height	68.54 (25.28)	69.23 (27.63)	65.38 (3.81)	3.85* [7.06]
mheight	71.47 (24.89)	72.19 (27.32)	68.04 (2.79)	4.15* [5.57]
fheight	65.76 (25.93)	66.38 (28.28)	62.61 (2.55)	3.77* [5.00]
smoked	0.28 (0.45)	0.30 (0.46)	0.19 (0.40)	0.11* [5.70]
male	0.49 (0.50)	0.49 (0.50)	0.50 (0.50)	-0.01 [-0.55]
hgc	13.30 (2.68)	13.56 (2.50)	12.04 (3.08)	1.52* [11.34]
married	0.68 (0.46)	0.70 (0.46)	0.63 (0.48)	0.07* [3.31]
pcinc	23379.45 (23928.22)	24893.08 (24974.66)	15637.32 (15483.37)	9255.76 (10.84)
lnpcinc	9.13 (4.27)	9.31 (3.87)	8.18 (5.84)	1.13* [4.13]
pcincmis	0.24 (0.43)	0.24 (0.43)	0.25 (0.43)	-0.006 [-0.30]
psusmoke	0.28 (0.14)	0.30 (0.14)	0.20 (0.13)	0.10* [17.76]
psuobese	0.25 (0.12)	0.24 (0.11)	0.32 (0.14)	-0.07* [-12.49]
hplan	0.85 (0.36)	0.87 (0.34)	0.77 (0.42)	0.10* [5.40]

Table 3.5. Means and standard deviations for each variable in the sample.

Table 4 shows that the mean values for the PCS and MCS scores are very close to the means values of the total U.S. population (52.15 and 49.91 for PCS and MCS for ages between 35-44 years).[15] Table 4 also shows that MCS (PCS) is slightly higher (lower) for Mexican Americans than for non-Hispanic whites. However, these differences are not statistically significant. The table also shows that the proportion of immigrants among Mexican Americans is higher than the proportion of immigrants among non-Hispanic whites. Consistent with the National Center for Health Statistics (2002), the proportion of Mexican American who smoke is smaller than the proportion of non-Hispanic white smokers, and Mexican Americans present higher rates of obesity compared to non-Hispanic whites. Additionally, Mexican Americans are less likely to perform physical activities than non-Hispanic whites. The composition by sex is almost the same for the two groups in my sample. Consistent with Trejo (1997), the levels of education and income are lower for Mexican Americans than for non-Hispanic whites. In addition, Non-Hispanic whites in the sample have a slightly higher marriage rate compared to Mexican Americans. Finally, Mexican Americans tend to be shorter than non-Hispanic whites and the proportion of Mexican Americans with some kind of health insurance is smaller than the proportion of non-Hispanic whites with some kind of health insurance.

Notice that table 3.5 does not present the means for the relative deprivation measures. However, the descriptive statistics for these variables are presented in chapter 6. Similarly, the descriptive statistics for the proportion of Mexican Americans living in the neighborhood are presented in chapter 7.

---

[15] Ware, Kosinski and Keller (1994).

CHAPTER 4

EMPIRICAL FRAMEWORK

In this chapter I present the empirical framework used to test the hypotheses from the theoretical model (chapter 2). In particular, this chapter is focused on providing a framework for how to estimate the hybrid equation 15 and the marginal effects of the different health inputs on the production of health. First, I present the simple Ordinary Least Square (OLS) and the structural model employed in this research, which accounts for the effect of endogenous unhealthy behaviors explained in chapter 2. Second, I present the list and the analysis of the health inputs used to estimate the health production function. Finally, I speak about the limitations and considerations of the estimation produced by the structural empirical model.

4.1. The Empirical Model

When analyzing health outcomes, researchers in the medical area, usually estimate equations like 1 and 2.

(1) $PCS_i = \alpha_1 + \beta_1 Mexam + \delta_1 Y_i + \gamma_1 X_i + \varepsilon_{i1}$

(2) $MCS_i = \alpha_2 + \beta_2 Mexam + \delta_2 Y_i + \gamma_2 X_i + \varepsilon_{i2}$

Where PCS_i and MCS_i are the measures of physical and mental health respectively for the individual i. Mexam is a dummy variable used to estimate unexplained differences in physical and mental health (reflected in the parameters β_1 and β_2) between Mexican Americans and non-Hispanic whites. This dummy variable is equal to 1 if the individual is a Mexican American and equal to zero otherwise. Y_i is a vector of endogenous health inputs and δ_1 and δ_2 are vectors of their estimated parameters. X_i is a vector of exogenous health inputs and γ_1 and γ_2 are vectors of their estimated parameters (marginal effects). The intercepts are α_1 and α_2 for the physical and mental health equations (in that order). Finally, the term ε_{i1} and ε_{i2} represents the random error terms for equations 1 and 2 respectively.

If the error terms (ε_{i1} and ε_{i2}) are uncorrelated with the health inputs then applying OLS to equations 1 and 2 will yield unbiased estimates (Green (2000)). However, as shown in chapter 2, the error terms ε_{i1} and ε_{i2} containing the health endowment μ_i, are very likely to be correlated with the endogenous variables from vector Y_i. In such case, OLS will yield biased estimations of the parameters contained in vectors δ_1 and δ_2 (marginal effects of the endogenous health inputs). Summarizing, using Ordinary Least Squares (OLS) to estimate equations 3 and 4 is equivalent to treating choices, such as obesity, physical activity and smoking, as exogenous when they are really endogenous behaviors and therefore the estimations will be biased. In order to account for this endogeneity problem I simultaneously estimated the following system of equations using three stage least squares (3SLS):

$$(3)\ PCS_i = a_0 + a_1 Mexam + a_2 Y_i + a_3 X_i + \eta_{i1}$$

$$(4)\ MCS_i = b_0 + b_1 Mexam + b_2 Y_i + b_3 X_i + \eta_{i2}$$

$$(5)\ smoke_i = c_0 + c_1 S_i + \eta_{i3}$$

$$(6)\ obese_i = d_0 + d_1 T_i + \eta_{i4}$$

$$(7)\ pactivi_i = e_0 + e_1 U_i + \eta_{i5}$$

Where Mexam, X_i and Y_i are as defined above. Thus, a_1 and b_1 are the coefficients designed to capture any possible unexplained difference in physical and mental health between Mexican Americans and non-Hispanic whites. Additionally, a_2 and b_2 represent the coefficients containing the marginal effects for the endogenous behaviors on physical and mental health respectively, and a_3 and b_3 are vectors containing the marginal effects for the exogenous health inputs over physical and mental morbidity correspondingly. $Smoke_i$, $obese_i$ and $pactivi_i$ are dummy variables equal to one if the individual smokes, is obese or practice physical activities respectively, and they are constructed as explained in the previous chapter. The terms a_0, b_0, c_0, d_0 and e0 are the intercepts for equations 3 to 7. S is a vector containing all the exogenous health inputs plus $psusmoke_i$ (an instrument variable explained below) and $hplan_i$ (the dummy variable equal to 1 if the individual has some type of health insurance). Therefore, c_1 is a vector of the correspondent estimated coefficients. Similarly, T_i and U_i are vectors containing all the all the exogenous health inputs plus $hplan_i$ and correspondent instrument variable $psuobese_i$ and $psupacti_i$ respectively (also explained below). Consequently, d_1 and e_1 are vectors of the estimated coefficients for vectors T_i and U_i (in that order). Finally, η_{i1}, η_{i2}, η_{i3}, η_{i4} and η_{i5} are random error terms for equations 3 to 7.

The instrument $psusmoke_i$ is the mean value of the smoke dummy variable for all other respondents from the same primary sampling unit. Similarly, $psuobese_i$ is the mean value of the obese dummy variable for all other respondents from the same primary sampling unit. In the same way, $psupacti_i$ is the mean value of the $pactivity_i$ dummy variable for all other respondents from the same primary sampling unit.

Consistent estimates for a physical and mental health production functions (equations 3 and 4) can be obtained applying two stage least squares (2SLS) or three stage least squares (3SLS) to the system of equations 3 to 7. Although, none of these methods is fully efficient, 3SLS is asymptotically more efficient than 2SLS (Green (2000)). Notice that the probability of smoking (and the other endogenous health inputs) is estimated using a linear probability model. However, these estimations can be effectively employed in this framework as showed by Heckman (1978). Specifically, Heckman proved that if the purpose of the analysis is to estimate equations like 3 and 4 (and not 5, 6 or 7) then it is not necessary estimate probit functions at all. He states that it is possible to generate an instrumental variable for a dummy variable like smoke (or obese) by estimating a linear probability model with smoke (or obese) as dependent variable if the regression contains at least all of the variables in equations 3 and 4 (not including the dummy variables to be estimated) and some other exogenous variables as regressors. Heckman affirm that this result is just a restatement of the recognized argument that it is needless to obtain consistent estimators of the reduced form equation in order to consistently estimate structural equations.

4.2. Health Inputs

The empirical structural model composed by equations 3 to 7 assumes 3 endogenous health inputs: smoking, obesity and physical activity. Smoking has been widely recognized as a health risk factor for chronic bronchitis, emphysema, heart attack, cancer and stroke.[16] Thus I expect to find a negative correlation between the variable smoke and physical and mental health. The Medical Encyclopedia (2003) cites that the fact of being overweight strains the heart and may cause several health problems such as type 2 diabetes, heart disease, high blood pressure, sleep apnea, varicose veins and other chronic conditions.[17] Therefore, I expect to find a negative relationship between health outcomes (PCS, MCS) and obesity. In contrast, physical activity it is usually recognized as a factor that improves health (US Department of Health and Human Services (1996)). Thus, I expect a positive correlation between physical activity and physical and mental health.

It is also important to determine the relevant exogenous health inputs assumed by the structural model (the X vector) and the instrumental variables (vector S, T and U) used to estimate the endogenous health inputs. Since I divided the empirical analysis in three chapters the variables contained in each of these vectors varies from chapter to

[16] See The Morbidity and Mortality Weekly Report, September 5, 2003 published by Center For Disease Control and Prevention.

chapter. In particular, chapter 5 is designed to analyze differences in physical and mental morbidity between Mexican Americans and non-Hispanic whites focusing in individual level factors. Chapter 6 is devoted to explain the effects of relative deprivation on health for Mexican Americans and non-Hispanic whites and to analyze the relevant reference group for Mexican Americans. Finally, chapter 7 is will be focus on analyzing the effects of neighborhood disadvantages on health and segregation effects on physical and mental health for Mexican Americans and non-Hispanic whites.

Table 4.1 presents a list of the exogenous variables that will be used in every chapter to estimate a health production function for Mexican Americans and non-Hispanic whites. All these variables are as defined in the previous chapter.

As mentioned above I am expecting to capture unexplained differences in mental and physical health between Mexican Americans and non-Hispanic whites by using the dummy variable mexam. As explained in the introduction, there is a large literature that found differences in health between immigrants and nonimmigrants. In order to account for those differences I use a dummy variable for immigrants and the interacted variables immexam and imother to distinguish between immigrants from Mexico and immigrants from other countries.

Exogenous variables in chapter 5	Exogenous variables in chapter 6	Exogenous variables in chapter 7
mexam	mexam	mexam
immexam	immexam	immexam
imother	imother	imother
height	height	height
male	male	male
hgc12	hgc12	hgc12
hgc12m	hgc12m	hgc12m
hgc16	hgc16	hgc16
married	married	married
lnpcinc	lnpcinc	lnpcinc
pcincmis	pcincmis	pcincmis
	usreldep	usreldep
	mexreldep	mexreldep
		mmxam

Table 4.1 Exogenous Health Inputs

Using height as an independent variable will allow me to test if taller individuals have better health than shorter individuals. Since males and females average different PCS and MCS score (see chapter 2) I use a dummy variable to control for sex. However, remember that the correspondent coefficient cannot be interpreted as a difference in physical and mental morbidity between males and females even when the coefficient results statistically significant. It is most likely a difference by gender perceptions of health. Notice that I do not need to use age as an individual control variable since SF-12 survey is only applied to every individual in the NLSY at the age of 40 years.

Education and income are often used by economists as key elements in the production of health (Grossman 1999, Rosenweig and Schultz 1983). Education is usually positively correlated with health and as mention in the introductory part there are several theories to explain this relationship. The structural model formed by equations 3 to 7 will allow me to test two of these explanations: i) People with higher education are better producer of health given a set of health inputs (Grossman (1972)); ii) Education affects health by changing health behaviors (Kenkel (1992)). Like education, income is usually positively correlated with health. This may be because individuals with higher incomes can easily purchase health inputs such as drugs, health books, more sophisticated diets etc. Notice that by construction the structural model assumes that income is exogenous and thus the variable lnpcinc will capture the effects of log per-capita family income on physical and mental health. However, this model does not control for inverse or incidental causality between income and health.

The dummy variable for married individuals will allow me to identify differences in health between married and non-married individuals. Also as mention in the introductory part it is usual to find better health outcomes for married individuals compared to non-married individuals. Additionally, I am expecting to capture some acculturation effects by using the dummy variable that identifies if the individual was raised using Spanish as the main language (language have been used as proxy for acculturation in several researches (Escobar et al (2000)).

The variables usreldep and mexreldep represent the relative deprivation measures using US census data and Mexican data (ENIGH-1998) respectively to form the reference group. The coefficients of these variables will measure the effects of relative deprivation on physical and mental morbidity. A detail explanation of how these variables are constructed and their interpretation is presented in chapter 6.

Finally, as explained in the previous chapter the variable mmxam represent the proportion of Mexican Americans living in the same neighborhood. This variable is expected to capture social cohesion effects among Mexican Americans that affect health outcomes.

4.3. Limitations and Considerations

The structural model presented in this chapter allows me to estimate unbiased coefficients (marginal effects) for health related behaviors (smoking, obesity and physical activity). However, the model does not allow me to identify the real effects of income on health outcomes since my model does not control for reverse causality and the incidental relationship between income and health. Similarly, the model does not control for marriage selection. Therefore the marriage's coefficient may not reflect the true effect of marriage on health. In addition, the model does not control for a possible reverse causality between schooling and health and for time preferences that might affect the selection of schooling and health among individuals.

CHAPTER 5

RESULTS FROM THE INDIVIDUAL LEVEL MODEL

This chapter presents the estimations of the health production function focusing the analysis on differences in health between Mexican Americans and non-Hispanic whites on individual level variables such as health related behaviors and schooling and income (socioeconomic status).

This chapter is organized as follows. First I present a comparison of the estimations of the health production function using two different estimation techniques: OLS and 3SLS. As explained in chapter 4, OLS is expected to yield biased estimations whereas 3SLS (structural model) is expected to yield unbiased estimations. Second, I explain the impact of using longitudinal data for smoking and obesity on the health production function. Finally, I present a summary and a discussion of the most relevant results from this chapter.

5.1. OLS vs 3SLS

Columns 3 and 4 from table 5.1 presents a comparison between the estimated coefficients from a health production function using OLS and 3SLS using the mental component summary (MCS) measure dependent variable (health outcome). Notice that the differences in estimates between OLS and 3SLS can be interpreted as heterogeneity bias.

The second column of table 5.1 is used as starting point (without behavioral and socioeconomic controls) to identify unexplained differences in mental morbidity between Mexican Americans and non-Hispanic whites (reference group) and between immigrants and non-Hispanic whites. The standard errors in this and in the following tables are presented in parenthesis.

Without any controls estimations from column 2 show that Mexican Americans enjoy a small statistically significant advantage in mental health with respect to non-Hispanic whites. Estimations also show no differences in mental morbidity between immigrants (from Mexico and from other countries) and non-Hispanic whites. OLS estimations of the health production function also illustrate a mental health advantage of 0.87 points in MCS score over non-Hispanic whites that cannot be explained by differences in health related behaviors or differences in socioeconomic factors. Additionally, according to the OLS estimaties there are no differences in mental health between immigrants from Mexico and from other countries and non-Hispanic whites. Daily smoking has a statistically significant negative effect on MCS indicating that people that smoke have lower levels of mental health. OLS estimates also predict that the fact of being obese does not impact mental health. However, estimations show that individuals that perform frequent physical activities have an advantage of 1.39 points on the mental component summary with respect to individuals that do not perform frequent physical activities. In addition, OLS estimations do not support the hypothesis that taller individuals have better mental health. Consistent with the literature (Ware, Kosinski and Keller 1995) males present higher MCS scores than females. However, as explained in Chapter 2 this fact cannot be interpreted as a health advantage of male over female. Also, the estimations show that married individuals seem to enjoy of better mental health compared to non-married individuals (an advantage of 1.87 points in MCS scores) that might be interpreted as a protective effect of marriage on mental health (Goldman (1993)). Another variable that has a statically significant effect on MCS is the log of income indicating that more wealthy individuals have better mental health. This fact supports the idea that individuals with higher income are better producers of mental health assuming that income is really exogenous. However, the estimates do not show a direct correlation between education and mental health since individuals with high school completed and higher levels of education do not present higher statistically significant MCS scores compared to individuals that do not graduate from high school.

Three stage lest squares estimates present a different story. On one side, the mental health advantage between Mexican Americans and non-Hispanic whites increases from 0.88 to 2.01 points in the mental component summary. On the other side, the statistically significant effects of smoking and physical activity on MCS disappear after the heterogeneity bias in these endogenous health behaviors is corrected. A possible explanation of why the coefficient for the smoking variable is not significant is that people that smoke daily are people that usually have more destructive behaviors that affect mental health. A likely explanation of why the effects of physical activity also become statistically insignificant is that people with better mental health endowments are the people that exercise more often and once this is taken into account the positive effects of physical activity on MCS disappears. Technically, there are some unobserved elements (such as unhealthy behaviors and health endowments) in the error term of the MCS equation that are correlated with the smoking and physical activity dummy variables causing that OLS yields estimations biased away from zero.

The 3SLS estimations also show that the obesity dummy remains statistically insignificant. Additionally, estimations indicate that married individuals have an advantage in MCS of 2.17 points over non-married individuals, and that males present higher MCS scores than females. Also, the coefficient for log income remains statistically significant and almost unchanged, reinforcing the idea that individuals with higher incomes are usually better producer of health. The rest of the variables remain statistically insignificant on mental health status.

Table 5.2 present analogous results to the ones of table 5.1 but for PCS scores instead of MCS scores. As can be seen from column 2, without socioeconomic and behavioral health controls Mexican Americans presents lower PCS scores with respect to non-Hispanic whites. Estimations also show no difference in physical morbidity between immigrants (from Mexico and from other countries) and the base group (non-Hispanic whites). Once controls for socioeconomic status and health behaviors are incorporated the OLS estimates predict no difference in physical health between Mexican Americans and non-Hispanic whites. Additionally, OLS estimations also predict higher PCS scores on physical health for Mexican immigrants with respect to non-Hispanic whites (an advantage of 1.30 points at 10% significance level).

Variable	OLS (No Controls)	OLS	3SLS
mexam	0.77** (0.42)	0.88* (0.42)	2.01* (0.98)
immexam	-0.45 (0.73)	-0.14 (0.72)	-0.29 (0.92)
imother	0.43 (0.74)	0.44 (0.72)	0.42 (0.77)
smoked		-1.74* (0.33)	1.78 (4.81)
obese		0.09 (0.31)	-2.91 (5.71)
pactivi		1.39* (0.29)	2.53 (4.20)
mheight		-0.005 (0.01)	-0.01 (0.01)
fheight		0.01 (0.01)	0.004 (0.01)
male		2.84* (0.77)	3.01* (1.19)
married		1.87* (0.29)	2.17* (0.50)
lnpcinc		0.13* (0.03)	0.14* (0.04)
pcincmis		0.49 (0.49)	0.67 (0.54)
hgc12		0.70 (0.47)	1.12 (0.92)
hgc12m		0.76 (0.52)	1.38 (1.50)
hgc16		0.41 (0.54)	1.21 (2.42)
cons	52.96* (0.15)	48.43* (0.76)	47.07* (3.95)
R^2	0.001	0.06	
χ^2			165.44

Table 5.1 Regressions for MCS

* Statistically significant at 5% level.

** Statistically significant at 10% level

Variable	OLS (No Controls)	OLS	3SLS
mexam	-0.73** (0.41)	0.04 (0.41)	0.44 (1.01)
immexam	0.83 (0.72)	1.30** (0.70)	0.29 (0.97)
imother	0.49 (0.73)	0.37 (0.70)	0.31 (0.82)
smoked		-1.53* (0.32)	-6.11 (4.76)
obese		-2.65* (0.30)	-10.63** (5.90)
pactivi		1.86* (0.28)	5.78 (4.16)
mheight		-0.02* (0.01)	-0.01 (0.01)
fheight		0.01 (0.01)	0.004 (0.01)
male		2.76* (0.75)	2.15** (1.23)
married		0.77* (0.28)	0.35 (0.51)
lnpcinc		0.13* (0.03)	0.11* (0.04)
pcincmis		0.52 (0.47)	0.37 (0.57)
hgc12		1.69* (0.46)	0.67 (0.95)
hgc12m		2.12* (0.50)	-0.02 (1.52)
hgc16		2.77* (0.52)	-1.16 (2.44)
cons	52.40* (0.15)	48.09* (0.74)	52.50* (3.91)
R^2	0.001	0.09	
χ^2			142.14

Table 5.2. Regressions for PCS

* Statistically significant at 5% level.

** Statistically significant at 10% level.

OLS estimations also predict that unhealthy behaviors such as smoking and obesity have negative impacts on physical health as reflected in their negative coefficients -1.53 and -2.65 respectively. In contrast, physical activity has a positive statistically significant effect on PCS (increasing PCS scores by 1.86 points). Additionally, results shows that male tall individuals present slightly smaller lower PCS scores with respect to male short individuals. Once again the dummy variable for males is positive and statistically significant but this cannot be considered as a physical health advantage of males over females. Estimations also indicate that married individuals have an advantage on physical health over non-married individuals. Also it can be inferred that higher educated individuals have better physical health than individuals with lower levels of education and that the benefits of education on health are higher for higher levels of schooling. In addition, the coefficient for log income is positive and statistically significant supporting the idea that individuals with higher income and higher education levels are better producers of health.

Three stage least squares estimates show that the coefficient for Mexican Americans remains statistically insignificant indicating that there is no difference in physical health between Mexican Americans and non-Hispanic whites. Additionally, the advantage on physical health of Mexican immigrants over non-Hispanic whites disappears after controlling for heterogeneity bias. Notice that the smoking dummy variable becomes statistically insignificant indicating no effects of daily smoking on physical health. The same explanation used above of why this happens can be applied here. However, the coefficient for the obesity dummy variable is still statistically significant (at least at a 90% confidence level) and increases (in absolute value) from –

2.65 to –10.63 indicating a large negative impact of obesity on physical morbidity. In addition, the dummy variable for physical activity becomes statistically significant suggesting that physical activity does not influence physical morbidity. As mentioned, this might be explained by the fact that individuals with better endowments of physical health usually perform more physical activities compared to individuals with lower health endowments. Once again the coefficient for male individuals is positive and statistically significant but any interpretation must be cautious. Also, 3SLS estimates show that log income remains positive and statistically significant. Conversely, the education dummy variables become statistically insignificant indicating no direct effect of schooling on physical health. However, as shown below schooling will play a very important role on health related behaviors. The rest of the variables remain statistically insignificant.

Table 5.3 present the full results for the structural model (standard errors are presented in parenthesis).[18] Columns two and three are the same estimates presented on tables 5.1 and 5.2 (model 2). Columns 4, 5 and 6 present the estimations (of equations 5, 6 and 7 from the empirical model) for smoking, obesity and physical activity. The results in column 4 show that Mexican Americans are less likely to smoke compared to non-Hispanic whites. The coefficients for immigrants (either from Mexico or from other countries) are not statistically significant. The structural model also shows that male taller individuals have a slightly higher probability of smoking. Conversely, married individuals are less likely to smoke. Also, it is possible to observe that there is not a statistical difference in the probability of smoking between males and females. Estimates

[18] Results for the reduced form equations are presented in table A1 of the appendix.

also demonstrate that the log of income and highest grade completed are negatively related with the probability of smoking which is consistent with McLaughlin et al. (2001). In particular, the results show that the probability of smoking decreases at an increasing rate with the level of schooling. Additionally, the indicator variable for having health insurance (used as instrument) affects negatively the probability of smoking. Finally, the instrumental variable psusmoke is statistically significant showing that it is not a weak instrument.

Column 5 in table 7 clearly shows that Mexican Americans present higher rates of obesity compared to non-Hispanic whites (This is consistent with National Center for Health Statistics (2002) data). However, the results also suggest that immigrants from Mexico (less acculturated Mexican Americans) present lower obesity rates than non-Hispanic whites. Additionally, the results show that there is no difference in obesity rates between males and females. However, both taller males and females are less likely to be obese compared to shorter males and females respectively. The structural model also demonstrates that individuals with college and higher levels of education have smaller obesity probabilities possibly because they have more healthy diet, more healthy behaviors and are better informed from the health problems caused for obesity. The rest of the variables do not have any statistical significant effects on obesity rates. Finally, the estimates show that the psuobese variable is not a weak instrument for the obese dummy variable.

Consistent with the National Alliance for Hispanic Health (2001) and the National Center for Health Statistics (2002) estimates reported in the last column from table 7 show that Mexican Americans are less likely to perform physical activities compared to non-Hispanic whites. Results also show that the probability of performing physical activities for males slightly decreases with height. Additionally, the estimates indicate that males are more likely to perform physical activities than females. Estimations also show that individuals with 12 years of education, with individuals between 12 and 16 years of education and individuals with more than 16 years of education presents 0.11, 0.19 and 0.33 (in that order) higher probabilities of performing physical activities than individuals with less than 12 year of education. Finally, the instrument variable psupactivi is positive and statistically significant. The rest of the variables are statistically insignificant.

5.2. Robustness of the Results

A joint test of all over identifying restrictions can be performed by comparing full information estimates (3SLS) vs. limited information estimates (2SLS) (Hausman (1978)). This is possible because 2SLS yield less efficient but consistent estimates and its specification is derived from economic theory (Rosenzweig and Shultz (1983) demonstrated that OLS yields biased estimations due to the correlation between the endogenous health inputs and the health endowment). The Hausman (1978) test consist of measuring how large is the difference in estimates ($\widehat{q} = \widehat{\beta}_{2SLS} - \widehat{\beta}_{3SLS}$) with respect to its variance ($M(\widehat{q}) = M(\widehat{\beta}_{2SLS}) - M(\widehat{\beta}_{3SLS})$).[19] The results of the test reject evidence of misspecification in the 3SLS model at the 1% level of significance.

[19] The test is estimated by m=$\widehat{q}' M(\widehat{q})^{-1} \widehat{q}$

Variable	MCS	PCS	Smoke	Obese	Pactivi
mexam	2.01* (0.98)	0.44 (1.01)	-0.17* (0.02)	0.11* (0.02)	-0.05* (0.03)
immexam	-0.29 (0.92)	0.29 (0.97)	-0.04 (0.04)	-0.08* (0.04)	0.03 (0.04)
imother	0.42 (0.77)	0.31 (0.82)	-0.002 (0.04)	-0.02 (0.04)	-0.04 (0.04)
smoked	1.78 (4.81)	-6.11 (4.76)			
obese	-2.91 (5.71)	-10.63** (5.90)			
pactivi	2.53 (4.20)	5.78 (4.16)			
mheight	-0.01 (0.01)	-0.01 (0.01)	0.001* (0.0004)	-0.001* (0.0004)	-0.001* (0.0005)
fheight	0.004 (0.01)	0.004 (0.01)	0.0002 (0.0004)	-0.001* (0.0004)	0.0004 (0.0004)
male	3.01* (1.19)	2.15** (1.23)	-0.07 (0.04)	0.05 (0.04)	0.18* (0.05)
married	2.17* (0.50)	0.35 (0.51)	-0.08* (0.02)	-0.004 (0.02)	0.01 (0.02)
lnpcinc	0.14* (0.04)	0.11* (0.04)	-0.003 (0.002)	0.0001 (0.002)	0.002 (0.002)
pcincmis	0.67 (0.54)	0.37 (0.57)	-0.04 (0.03)	0.003 (0.03)	-0.01 (0.03)
hgc12	1.12 (0.92)	0.67 (0.95)	-0.14* (0.02)	0.01 (0.03)	0.11* (0.03)
hgc12m	1.38 (1.50)	-0.02 (1.52)	-0.24* (0.03)	-0.03 (0.03)	0.19* (0.03)
hgc16	1.21 (2.42)	-1.16 (2.44)	-0.39* (0.03)	-0.10* (0.03)	0.33* (0.03)
hplan			-0.06* (0.02)	0.05* (0.02)	0.02 (0.02)
psusmokd			0.18* (0.05)		
psuobese				0.17* (0.06)	
psupactiv					0.24* (0.06)
cons	47.07* (3.95)	52.50* (3.91)	0.56* (0.04)	0.19* (0.04)	0.01 (0.05)
χ^2	165.44	142.14	496.66	97.34	282.99

Table 5.3 Results of the Structural Model (3stage least squares)

* Statistically significant at 5% level.

** Statistically significant at 10% level.

5.3 Longitudinal Effects of Smoking and Obesity

The results from the structural model presented above suggest that current daily smoking does not affect either mental or physical health. However, some researchers may argue that smoking through the lifetime is the real relevant determinant of mental and physical health.[20] Similarly, current obesity was not a relevant variable in explaining mental health but it may be the case that obesity through the lifetime will be a better predictor of the mental component summary (MCS).[21] A similar claim might be made with respect to physical activity. However, The NLSY just allows me to identify longitudinal effects of smoking and obesity and not for physical exercise.

In order to test the previous claims I estimate the same structural model but using different variables for smoking and obesity. I define a new dummy variable for smoking: smokea, which is equal to 1 if the individual smoked daily in 1992 and also smoked daily in 1998 and zero otherwise (this variable will approximately capture the effects of smoking for at least 7 years). Similarly I define a new obesity variable: obesea, which is equal to 1 if the individual was obese (with a BMI$\geq$ 30) in the early 80's and was also obese in the year that he took the SF-12 survey (1998 or 2000 or 2002) and zero otherwise (this variable will work as a proxy for being obese for at least 14 years).

The OLS regressions with using the new variables smokea and obesea yield very similar results compared to the ones presented above. The same coefficients were statistically significant with very similar values. The three stage least square regressions

[20] National Center For Chronic Disease Prevention and Health Promotion (2004) affirm that lifetime smoking causes several diseases such as bladder cancer, cervical cancer, lung cancer, respiratory diseases, etc.

[21] Bell et al (2002) affirm that the only way to truly test the association of BMI and hypertension is by monitoring people over time.

also yield similar results compared to its equivalent counterpart. The coefficients were similar but with two differences: i) the coefficient for Mexican Americans (mexam) become statistically non significant at the 10% level to explain mental health; ii) a difference from obese the variable obsea present a smaller coefficient that was not statistically significant at the 10% level to explain physical morbidity (a possible explanation is that the number of persons that were obese for at least 14 years is 248 which is small to be able to detect differences in PCS an MCS scores) . These regressions are presented in the appendix in tables A2 and A3.

5.4 Summary and Discussion

After controlling for health risk behaviors and socioeconomic status the results from the structural model show a mental health advantage of 2 points in the MCS (which represents about 25% of one standard deviation in MCS) of Mexican Americans over non-Hispanic whites. However, the model also predicts no statistically significant differences in physical morbidity between these two groups. Additionally, after controlling for the same factors the structural model predict no differences in physical and mental health between immigrants (from Mexico and from other countries) and non-Hispanic whites. This fact suggests no effect of acculturation on physical and mental health.[22] However, it must be considered that all these immigrants arrive to United States when they were very young and therefore it is difficult to expect big differences in behaviors between those born in the US and the immigrants. Additionally, have in mind

[22] I incorporate also spoken language at home as a measure of acculturation into the model but the results did not change.

that the total number of immigrants in my sample is 292 (169 from Mexico and 123 from other countries), which is very small to detect small differences in PCS and MCS scores.

None of the three health risk behaviors employed (smoking, obesity and physical health) affect the production of mental health for the individuals in my sample after controlling for unobserved effects (heterogeneity in health endowments and heterogeneity in health related behaviors). Additionally, neither smoking nor physical activity was correlated with better physical morbidity using the structural model. A possible explanation of why the coefficient for the smoking variable is not significant is that people that smoke daily are people that usually have more destructive behaviors that affect mental health. Similarly, the reason why performing physical activities is not statistically significant might be explained by the fact that individuals with better endowments of physical health usually perform more physical activities compared to individuals with lower health endowments. However, the structural model predicts a large negative impact of obesity on physical health outcomes. In fact, the coefficient for the obesity dummy variable increases in absolute value from –2.65 to –10.63 when moving from OLS to 3SLS. One possible explanation is that many of the people that become obese have better health endowments than the average individual, and once this health endowment bias is taken into account the real negative effects of obesity are higher. Another possible explanation is that individuals that know that their family has problems of health related to obesity (such as diabetes and high blood pressure) decide to avoid obesity.

The results of this chapter support the hypothesis that income has a positive impact on both physical and mental morbidity possibly explained by the fact that higher levels of income allow the individuals to easily purchase health inputs such as drugs, health books, etc. Additionally I found no direct effect of schooling on physical and mental morbidity. However, I found strong evidence that schooling affects health related behaviors by decreasing the probability of smoking and obesity and by increasing the likelihood of performing physical activities. In other words, evidence suggest that schooling affects health by influencing the selection of endogenous health inputs rather than by increasing health production by making more efficient the production of health given a set of health inputs.

I found no direct correlation between height and physical and mental health. However, I found that taller individuals are slightly more likely to smoke and slightly less likely to be obese and perform physical activities. The results also show a mental health advantage of married individuals with respect to non-married individuals as reflected by a difference of about 2 points in MCS scores (25% of a standard deviation in this measure). In contrast, the estimations do not support differences in physical health between married and non-married individuals. Additionally, I found a negative correlation between being married and the probability of smoking but no correlation between being married and the likelihood of obesity and performing physical activities. Finally, I found a positive correlation between having some type of health insurance and the likelihood of obesity and a negative correlation between having some type of health insurance and the likelihood of smoking.

CHAPTER 6

RELATIVE DEPRIVATION AND HEALTH

This chapter has two main objectives. The first objective is to analyze the effects of relative deprivation on health outcomes for Mexican Americans and non-Hispanic whites. The second objective is to identify the relevant reference group for Mexican Americans.

The chapter is organized as follows. First, I present a literature review of the relationship between income inequality measures (including relative deprivation) and health. Second, I present a detailed explanation of the concept of relative deprivation and how is estimated. Third, I provide a discussion of the pathways linking relative deprivation and health. Fourth, I present the estimations of the effects of relative deprivation on health outcomes for non-Hispanic whites. Fifth, I provide an empirical analysis of the relevant reference group for Mexican Americans and the analysis of the effects of relative deprivation on physical and mental health for the same group. Finally, I present a summary and a discussion of the findings of this chapter.

6.1. Inequality and Health

The relationship between income and mortality had been analyzed by many researchers including Adler et al. (1994) and Case et al. (2001). Most of these studies usually found a negative relationship between income (or other socioeconomic variables) and mortality, which is usually known as the social gradient. However, more recent literature analyzes the relationship between income inequality and health[23]. Part of this literature is based in Wilkinson's (1996) hypothesis that states that inequality is itself a health hazard. According to Wilkinson, the absolute level of a country's income influences population health only up to a certain level. Therefore, in richer income countries, like United States, income inequality is the primary determinant of health

There is no general consensus about the effects of inequality on health. Numerous studies have reported no causal effect of current income inequality on individual health (Muller (2002), Osler, Prescott, Gronbaeck, Christensen, Due, and Engholm (2002), Strum and Gresenz (2002) Mellor and Milyo (2002)). Other studies have claimed that adverse effects of income inequality, if they really exist, occur with a lag. However, literature investigating this idea presents also diverse outcomes. On one side, Subramanian, Kawachi and Kennedy (2001) and Subramanian, Blakely and Kawachi (2003) found that state level measures of lagged inequality were negatively associated whith self reported health. On the other side, Mellor and Milyo (2003) found no effect of lagged income inequality over self reported health once controlling for individual characteristics and five-census regions. In other study Reagan and Salsberry (2005) found direct effects of cumulative esposure to low income inequality on preterm birth for

[23] Wilkinson (1996), Merva and Fowles (1996), Kawachi, Kenedy and Wilkinson (1999), Deaton (2001). Reagan and Salsberry (2003)

Hispanics but not for blacks and non-Hispanic whites. However, they identified indirect effects of cumulative exposure to income inequality for blacks and whites through behaviors like short interval pregnancies and drug use.

The idea that income inequality is associated with poor health has been documented as the income inequality hypothesis (Mellor and Milyo (2002)). Mellor and Milyo (2002) also mention that there are really two different versions of this income inequality hypothesis (IIH): i) strong IIH that states that inequality is a public bad for all members of the society; ii) weak IIH states that inequality only affects the more economically disadvantaged segment of the population.

There is not a unique measure to study the effects of inequality and health. Some authors like Reagan and Salsberry (2005) and Merva and Fowles (1996) study the relationship between a health outcome and inequality using the Gini coefficient. Mellor and Milyo (2002) use three different measures of income inequality: the coefficient of variation, the ration of the 90th and 10th percentiles of household income and the share of income going to the top 50% of households. Other authors like Deaton (2001) and Eibner and Evans (2001) use the concept of relative deprivation to study the same relationship. This dissertation follows this last path of research. A detailed information of what is and how the concept of relative deprivation is estimated is explained below.

6.2. Relative Deprivation

The concept of relative deprivation was first introduced by Runcimann (1966) and formalized by Yitzhaki (1979) using income as the object of relative deprivation. According to Yitzhaki income can be considered as an index that reflects the individual's ability to consume goods and services. In general, this theory claims that health status is not only affected by the individual's income level but also the income levels of the rest of the people in the same community. Therefore, if the gap between the income of a person and the average community income is large, then the individual will feel deprived for having a lower standard of living compared to the community's standard of living.

A similar theory is what is known as the relative rank hypothesis (Subramanian and Kawachi (2004)) or social hierarchy (Mellor and Milyo (2002)). According to this theory, it is not the commodities and services that money can buy that improves health but the social status or rank that additional income provides in the social hierarchy that determines health. There is robust evidence in scientific experiments on nonhuman primate societies that supports this theory. In particular, it has been found that lower ranked animals within a troop develop depression, coronary disease and other diseases (Subramanian and Kawachi (2004)).

Following Yitzhaki (1979) the range of potential income for every individual is (0, y*), where y* is the income of the richest person in the reference group. This range can be decomposed in two segments; $(0, y_i)$ the range of income below the individual i's income, and (y_i, y^*) the range of income above the individual's income. Formally, the relative deprivation function of person i is estimated according to the following formula:

$$(10) \quad D(yi) = (1/\mu)\int_{yi}^{y^*} [y - y_i] f(y)dy$$

Where f(y) is the probability density of income, and μ is the mean income in the reference group. Another way to understand relative deprivation is presented in Deaton (2001) who show that equation 10 can be written in the form:

$$(11) \qquad D(y_i) = (1/\mu)[1 - F(y_i)] * [\mu(y_i) - y_i]$$

Where $\mu(y_i)$ is the average income of those whose incomes are higher than y_i. Using equation 11 it is possible to observe that a specific health outcome for an individual with a determined level of income is a function of the fraction of people with a greater income than his multiplied by the difference between their average incomes and his. In other words, the health outcome (PCS or MCS in this research) depends of the number of people above the individual in question and how much richer these people are than the individual in question.

The index of relative deprivation can take values between zero and one. If the index is closer to one, the individual is highly deprived (in terms of income) with respect to the rest of the people living in the same reference group. Conversely, if the index for one individual is closer to zero, the individual has a relatively high income with respect to the rest of the people living in the same reference group. Therefore, relative deprivation is expected to be negatively correlated with physical and mental health.

Relative deprivation has three general properties (Reagan et al (in progress)): i) Relative deprivation is a convex function of income. In other words, holding constant the distribution of income, relative deprivation decreases with income at a decreasing rate (Yitzhaki (1979)); ii) with no changes in the absolute income of the individual and no changes in the mean income of the reference group, relative deprivation increases with higher levels of income inequality (Hey and Lambert (1980), Reagan et al (in progress)); iii) Yitzhaki (1979) shows that total relative deprivation is equal to the Gini coefficient, which is one of the most common measures of income inequality, multiplied by the mean income in the reference group. These three properties show how absolute income, relative deprivation and income inequality are directly related to each other. Furthermore, Reagan et al (in progress), using a lognormal distribution, prove that it is not possible to identify in a regression the three parameters at the same time since the lognormal distribution is completely defined by its first two moments and therefore has only two degrees of freedom.[24]

In order to address the income inequality hypothesis using relative deprivation, one must consider how individuals define reference groups. Eibner and Evans (2001) mention two main selection methods suggested in the psychology literature[25]: i) based on geographic proximity; ii) based on similarity.[26] While the first method is comparatively easy to determine, similarity is a more indefinable concept due to the fact that it is possible to define similarity according to many criteria such as ethnicity, sex, education level and friendship. According to Eibner and Evans (2001) using geographic boundaries as reference groups makes sense when relative deprivation (or inequality) affects health by its impact on public investment in human and social capital. They also state that if Wilkinson's argument that psychosocial stress is responsible for differences in health,

[24] To avoid this problem this research only uses income and relative deprivation but not income inequality as regressors.

[25] Singer (1981).

[26] An additional criteria for defining is reference group is used in Merva and Fowles (1996). They use a historical criteria (i.e. the individuals compare themselves with respect their position 10 years ago).

then it’s not obvious that reference groups should be restricted to geographical margins. In such case, individuals will compare themselves to others of similar demographic backgrounds, in spite of geographical location.

Since I am comparing Mexican Americans with non-Hispanic whites a natural question emerges: do Mexican Americans compare themselves with people living in the same county of residence in the United States (in which case the index of relative deprivation employed in the previous section is the most adequate) or do they compare themselves with familiar, friends or people living in Mexico? For this reason I constructed two indexes of relative deprivation, one using US data and one using Mexican data. The construction of these two measures is explained below.

Evidence that might support the idea that Mexican Americans (or at least immigrants from Mexico) compare themselves with people in Mexico is presented by Stark and Taylor (1991). They found that immigrants from Mexico that are more deprived in their village of residence are more likely to migrate to the United States. They claim that Mexican immigrants use their village of residence as reference group. Additionally, Escobar et al (2000) suggest that immigrants from Mexico usually has a lower set of expectations than US born Mexican Americans.

6.3. Pathways Linking Relative Deprivation and Health

The first pathway linking health outcomes and relative deprivation (or income inequality in general) is presented by Wilkinson (1996). He argues that relative deprivation affects health mainly through psychosocial stress. Individuals who feel they are economically disadvantaged compared to a reference group may feel depressed, frustrated and/or irritated, conditions that influence health both directly (via infection, heart disease, high blood pressure, and suicide) and indirectly (via increased smoking, poor eating habits, and alcohol abuse).

A second pathway is given by the idea that income inequality may deteriorate social cohesion and obstruct the formation of social capital (social relations), which in turn affects health outcomes via destructive health behaviors, crime, and public services (Kennedy, Kawachi and Prothrow-Sith (1996) and Wilkinson (1996)).

A third pathway linking inequality and health is what is called structural pathway (Subramanian and Kawachi (2004)). According to Kawachi (2002) and Lombmayer and Wilkinson (2002) the relationship between income inequality and social segregation is causal. Therefore income inequality may generate spatial concentrations of poverty and racial segregation, which in turns affect health.

A fourth pathway known as the policy pathway is presented by Subramanian and Kawachi (2004). They argue that the implementation of social and health related policies might generate negative effects of income inequality on health since different policy variables such as welfare expenditure, health insurance, vocational training and tax policy could influence the relation between these two variables.

6.4. Results

The US relative deprivation was constructed comparing NLSY per-capita family income with per-capita income of the reference group. To construct the reference group for the US, I use the 1990 and 2000 5 percent Census sample. I use as a reference group the Metropolitan Statistical Area (MSA) if the NLS respondent lives in a MSA. If the individual in the sample lives outside of a MSA then the reference group was the county (or a group of counties) in the Public Use Micro Sample Area (PUMA). The 1998 US measure of relative deprivation was a weighted average from the 1990 census and the 2000 census. The US relative deprivation estimation for the respondents interviewed in 2000 and 2002 was based solely in the 2000 census data. Given that I was not able to identify the community, city, town or state of origin for the Mexican American NLS respondents I constructed the Mexican index of relative deprivation at a national level (i.e. the whole country is the reference group). In order to construct the Mexican index of relative deprivation, I use data from the "Encuesta Nacional de Ingreso Gasto 1998 (ENIGH-98)" and the Purchasing Power Parity (PPP) estimations (to transform Mexican pesos into US dollars) of the OECD[27]. The ENIGH-98 is a national income expenditure survey that contains detailed information on several measures of income, expenditure, socio-demographic characteristics of every member in the household, and physical characteristics of the dwelling for 10,952 households.

In order to evaluate which is the relevant reference group for Mexican Americans I estimate (using OLS) the equations of the individual behavioral risk model presented in the previous section (using observations just for Mexican Americans) adding first the Mexican index of relative deprivation (mereldep) as an independent variable. Then I estimate exactly the same equations but substituting mereldep by the US index of relative deprivation (usreldep). Finally I compare the goodness of fit for the estimated equations using mereldep with the goodness of fit of the estimated equations using usreldep. I use as a measure of the fit of the models the coefficient of determination (R^2). R^2 measures

[27] see the PPP site http:/www.oecd.org/std/ppp/ for more details on PPPs.

the proportion in variation in the dependent variable that is explained by variation in the regressors (Green (2000)).

Before presenting the estimation of the individual behavioral risk model I present the mean values for the indexes of relative deprivation. The standard deviations are presented in parentheses and the t statistics for differences in means are presented in square brackets. Table 6.1 shows that the US neighborhood relative deprivation mean value is higher for Mexican Americans than for non-Hispanics whites, this result makes perfect sense since the mean per-capita family income for non-Hispanics whites is about \$9,2556 higher than mean per-capita family income for Mexican Americans (see table 3.5). Table 6.1 also present the mean value of the Mexican measure of relative deprivation for Mexican Americans (0.22), which is relatively low but not illogic since the annual mean per-capita family income in the ENIGH-98 is \$3,267 and the correspondent measure for Mexican Americans in the NLSY is \$15,637. Notice also that the mean Us neighborhood relative deprivation is .14 higher for Mexican Americans than the mean US neighborhood relative deprivation for non-Hispanic whites (a difference of approximately 64 % of one standard deviation in relative deprivation).

Variable	Non-Hispanic whites	Mexican Americans	Difference in means
US relative Deprivation	0.42 (0.23)	0.56 (0.23)	-0.14 [-11.35]
Mexican Relative Deprivation		0.22 (0.22)	

Table 6.1 Mean Relative Deprivation Measures.

Table 6.2 presents the OLS estimates of the individual risk behavioral model, including the two measures of relative deprivation, for mental health. Column 2 contains the estimations of the effects of relative deprivation on non-Hispanic whites (whusrel) and the effects of relative deprivation on Mexican Americans (meusrel) when using the US neighborhood of residence as reference group. Column 3 shows the effects of relative deprivation on non-Hispanic whites (whusrel) using the US neighborhood of residence as reference group, and the effects of relative deprivation on Mexican Americans using Mexico as reference group (memerel). I mentioned in the previous chapter that OLS yield biased estimations. However it is useful to look at the coefficient of determination (R^2) to determine which measure of relative deprivation fits better the model.

Variable	MCS (US reference group)	MCS (Mexican reference group)
mexam	1.15** (0.65)	0.67 (0.55)
immexam	0.06 (0.73)	0.01 (0.72)
imother	0.62 (0.72)	0.59 (0.72)
smoked	-1.65* (0.33)	-1.68* (0.33)
obese	0.11 (0.31)	0.11 (0.31)
pactivi	1.34* (0.29)	1.34* (0.29)
mheight	0.00 (0.01)	0.00 (0.01)
fheight	0.01 (0.01)	0.01 (0.01)
male	2.73* (0.77)	2.72* (0.77)
married	1.78* (0.29)	1.79* (0.29)
lnpcinc	0.07** (0.04)	0.04 (0.04)
pcincmis	0.87 (1.01)	0.17 (1.06)
hgc12	0.54 (0.47)	0.52 (0.47)
hgc12m	0.52 (0.52)	0.53 (0.52)
hgc16	-0.03 (0.55)	-0.01 (0.55)
whusrel	-2.55* (0.80)	-2.50* (0.79)
meusrel / memerel	-2.89* (1.23)	-4.45* (1.83)
usrdmis	-2.15* (1.04)	-1.57 (0.99)
_cons	50.44* (0.96)	50.66* (0.99)
R^2	0.065	0.065

Table 6.2 OLS Regressions for the Mental Component Summary

* Statistically significant at 5% level.

** Statistically significant at 10% level.

The results show that both indexes of relative deprivation (meusrel and memerel) are statistically significant. However, the coefficient of determination is identical for the model using the Mexican index of relative deprivation and for the model using the US neighborhood relative deprivation measure. Therefore it is not possible to determine which is the relevant reference group for Mexican Americans using mental morbidity as a health outcome. Notice that the relative deprivation measures have a negative statistically significant effect on mental morbidity for both Mexican Americans and non-Hispanic whites.

Table 6.3 presents analogous estimates to the ones in table 6.2 using PCS as health outcome. Once again, the results show that both indexes of relative deprivation (meusrel and memerel) are statistically significant with a negative effect. Also, the coefficient of determination is almost the same for the model using the Mexican index of relative deprivation compared to the model using the US neighborhood relative deprivation measure. Notice also that the OLS estimations suggest that relative deprivation has a statistically significant negative effect on physical morbidity for non-Hispanic whites. It is worth to mention that I also test the hypothesis that both measures of relative deprivation have different effects on Mexican immigrants and non-immigrants Mexican Americans. However, I found that the data do not support such hypothesis.

Table 6.4 presents the unbiased estimations (3SLS) for the health production model using the US neighborhood of residence as reference group. The estimation shows that after controlling for individual health related behaviors, socioeconomic status and relative deprivation Mexican Americans present higher MCS scores than non-Hispanic whites (a difference of 2.54 points). Additionally, it is possible to observe an advantage of 2.12 points in the mental component summary for married individuals compared to non-married individuals. The estimations also show a negative statistically significant effect of relative deprivation for both Mexican Americans and non-Hispanic whites. The rest of the variables remain statistically insignificant in explaining physical morbidity.

One way to measure the effect of relative deprivation is by estimating the impact on the health outcome of one standard deviation change in the relative deprivation measure (Reagan et al (in progress)). Therefore an increase of one standard deviation on relative deprivation decreases the mental component summary in 0.63 points for non-Hispanic whites and decreases MCS scores in 0.71 points for Mexican Americans.

The estimations on table 6.4 also show no difference in physical morbidity between Mexican Americans and non-Hispanic whites. The results as well show that obesity has big negative statistically significant impact on physical morbidity. Additionally, it is possible to observe that relative deprivation does not directly affect physical health for non-Hispanic whites but it has a statistically negative effect oh health related behaviors by increasing the probability of smoking and being obese and decreasing the probability of performing physical activities. In contrast, relative deprivation has a direct negative and statistically significant effect on physical morbidity for Mexican Americans but it does not affect their health related behaviors. Specifically, one standard deviation increase in relative deprivation decreases the physical component summary of Mexican Americans in 0.66 points.

Variable	PCS (US reference group)	PCS (Mexican reference group)
mexam	0.29 (0.63)	-0.65 (0.53)
immexam	1.54* (0.70)	1.42* (0.70)
imother	0.61 (0.70)	0.54 (0.70)
smoked	-1.40* (0.32)	-1.43* (0.32)
obese	-2.60* (0.30)	-2.60* (0.30)
pactivi	1.78* (0.28)	1.79* (0.28)
mheight	-0.02* (0.01)	-0.02* (0.01)
fheight	0.01 (0.01)	0.01 (0.01)
male	2.58* (0.74)	2.60* (0.74)
married	0.64* (0.28)	0.66* (0.28)
lnpcinc	0.04 (0.04)	0.03 (0.04)
pcincmis	0.40 (0.98)	-0.14 (1.02)
hgc12	1.47* (0.46)	1.50* (0.46)
hgc12m	1.78* (0.50)	1.87* (0.50)
hgc16	2.11* (0.53)	2.24* (0.53)
whusrel	-3.83* (0.77)	-3.41* (0.76)
meusrel / memerel	-3.97* (1.18)	-3.61* (1.77)
usrdmis	-2.43* (1.00)	-1.54 (0.96)
_cons	51.02* (0.92)	50.80* (0.95)
R^2	0.094	0.092

Table 6.3 OLS Regressions for the Physical Component Summary

* Statistically significant at 5% level.

** Statistically significant at 10% level.

Variable	MCS	PCS	Smoke	Obese	Pactivi
mexam	2.54* (1.10)	1.36 (1.17)	-0.13* (0.03)	0.14* (0.04)	-0.09* (0.04)
immexam	-0.12 (0.94)	0.37 (1.00)	-0.04 (0.04)	-0.07** (0.04)	0.04 (0.04)
imother	0.64 (0.78)	0.47 (0.84)	-0.01 (0.04)	-0.02 (0.04)	-0.03 (0.04)
smoked	2.49 (5.17)	-6.98 (5.06)			
obese	-3.95 (5.78)	-11.66** (6.06)			
pactivi	2.58 (4.22)	6.54 (4.19)			
mheight	-0.01 (0.01)	-0.01 (0.01)	0.0009* (0.0004)	-0.001* (0.0004)	-0.001* (0.0005)
fheight	0.003 (0.01)	0.003 (0.01)	0.0002* (0.0004)	-0.001* (0.0004)	0.0004 (0.0004)
male	2.98* (1.20)	1.98 (1.26)	-0.06 (0.04)	0.06 (0.04)	0.17* (0.05)
married	2.12* (0.50)	0.23 (0.51)	-0.07* (0.02)	-0.002 (0.02)	0.001 (0.02)
lnpcinc	0.07 (0.04)	0.07 (0.05)	0.001 (0.002)	0.001 (0.002)	-0.002 (0.002)
pcincmis	1.82 (1.30)	1.84 (1.41)	-0.05 (0.05)	0.15* (0.06)	-0.06 (0.06)
hgc12	1.04 (0.93)	0.37 (0.96)	-0.13* (0.02)	0.01 (0.03)	0.10* (0.03)
hgc12m	1.23 (1.52)	-0.59 (1.53)	-0.23* (0.03)	-0.03* (0.03)	0.18* (0.03)
hgc16	0.87 (2.39)	-2.09 (2.38)	-0.36* (0.03)	-0.08* (0.03)	0.30* (0.03)
hplan			-0.05* (0.02)	0.06* (0.02)	0.01 (0.02)
whusrel	-2.76** (1.69)	-0.80 (1.71)	0.20* (0.04)	0.12* (0.04)	-0.19* (0.05)
meusrel	-3.07* (1.41)	-2.87* (1.50)	0.09 (0.06)	0.04 (0.07)	-0.06 (0.07)
usrdmis	-3.09* (1.32)	-2.46* (1.42)	0.13* (0.05)	-0.10** (0.06)	-0.05 (0.06)
psusmokd			0.18* (0.05)		
psuobese				0.15* (0.06)	
psupactiv					0.24* (0.06)
cons	49.22* (3.41)	54.14* (3.38)	0.41* (0.05)	0.12* (0.06)	0.14* (0.06)_
χ^2	178.45	165.14	524.87	112.46	299.44

Table 6.4 3SLS Regressions Using the US Neighborhood as Reference Group
* Statistically significant at 5% level.
** Statistically significant at 10% level.

Table 6.5 shows the estimations of the structural model using Mexico as a reference group for Mexican Americans and the US neighborhood for non-Hispanic whites. The results are very similar to the estimations presented in table 6.4. After controlling for individual health related behaviors, socioeconomic status and relative deprivation Mexican Americans present an advantage of 1.93 points in the mental component summary compared to non-Hispanic whites. Additionally, married individuals present higher mental scores than non married individuals (an advantage of 2.15 points on MCS scores). Relative deprivation has a direct impact on mental morbidity for both groups (Mexican Americans and non-Hispanic whites). In particular, a one standard deviation increase in relative deprivation decreases the mental component summary of Mexican Americans by 0.86 points and decreases MCS scores for non-Hispanic whites by 0.61 points.

Table 6.5 also shows that after controlling for health related behaviors, socioeconomic status and relative deprivation there is no difference in physical morbidity between Mexican Americans and non-Hispanic whites. Once again, it is possible to observe a big and statistically significant negative impact of obesity on physical health. Like the results presented in table 6.4 it is possible to visualize a direct effect of relative deprivation on physical health (an increase of one standard deviation in relative deprivation decreases PCS in 0.82 points) but not on health related behaviors for Mexican Americans. In contrast, there is no direct impact of relative deprivation on physical morbidity for non-Hispanic whites but there is an effect of relative deprivation on health related behaviors by increasing the probability of smoking and obesity and decreasing the probability of performing physical activities.

Variable	MCS	PCS	Smoke	Obese	Pactivi
mexam	1.93* (0.99)	0.84 (1.05)	-0.09* (0.03)	0.15* (0.03)	-0.11* (0.03)
immexam	-0.16 (0.92)	0.35 (0.97)	-0.04 (0.04)	-0.07** (0.04)	0.03 (0.04)
imother	0.60 (0.78)	0.43 (0.83)	-0.01 (0.04)	-0.02 (0.04)	-0.04 (0.04)
smoked	2.65 (5.08)	-6.45 (4.95)			
obese	-3.79 (5.80)	-11.63** (6.05)			
pactivi	2.52 (4.22)	6.29 (4.19)			
mheight	-0.01 (0.01)	-0.01 (0.01)	0.001* (0.0004)	-0.001* (0.0004)	-0.001* (0.0005)
fheight	0.003 (0.01)	0.003 (0.01)	0.0002 (0.0004)	-0.001* (0.0004)	0.0004 (0.0004)
male	2.99* (1.20)	2.05 (1.25)	-0.06 (0.04)	0.06 (0.04)	0.17* (0.05)
married	2.15* (0.50)	0.29 (0.50)	-0.07* (0.02)	-0.003 (0.02)	0.001 (0.02)
lnpcinc	0.05 (0.05)	0.05 (0.05)	-0.001 (0.002)	0.002 (0.002)	-0.001 (0.003)
pcincmis	1.20 (1.35)	1.27 (1.45)	-0.07 (0.05)	0.16* (0.06)	-0.06 (0.06)
hgc12	1.08 (0.94)	0.47 (0.96)	-0.13* (0.02)	0.01 (0.03)	0.10* (0.03)
hgc12m	1.33 (1.54)	-0.37 (1.54)	-0.24* (0.03)	-0.03 (0.03)	0.18* (0.03)
hgc16	1.03 (2.41)	-1.74 (2.40)	-0.37* (0.03)	-0.08* (0.03)	0.31* (0.03)
hplan			-0.05* (0.02)	0.06* (0.02)	0.01 (0.02)
whusrel	-2.65** (1.53)	-0.81 (1.55)	0.17* (0.04)	0.11* (0.04)	-0.17* (0.05)
memerel	-3.90* (1.96)	-3.72** (2.09)	-0.11 (0.09)	0.04 (0.10)	-0.03 (0.11)
usrdmis	-2.44* (1.24)	-1.92 (1.33)	0.10* (0.05)	-0.10* (0.05)	-0.03 (0.06)
psusmokd			0.18* (0.05)		
psuobese				0.16* (0.06)	
psupactiv					0.24* (0.06)
cons	49.17* (3.58)	54.01* (3.52)	0.46* (0.05)	0.12* (0.06)	0.13* (0.06)
χ^2	177.13	161.32	524.88	112.47	299.44

Table 6.5 3SLS Regressions Using Mexico as Reference Group

* Statistically significant at 5% level.

** Statistically significant at 10% level.

6.5. Summary and Discussion

Since the results from this chapter are very similar to the results presented in last chapter I focus the summary and discussion to the effects of relative deprivation on health. The results show that relative deprivation has a negative direct impact on mental morbidity for Mexican Americans and non-Hispanic whites. This fact might support Wilkinson's hypothesis that inequality (in this case measured by relative deprivation) affects health via psychological stress. However, the evidence is not so clear when using physical morbidity as health outcome. On one hand, relative deprivation affects directly the physical morbidity of Mexican Americans but it does not affect the health related behaviors (smoking, obesity and performing physical activities) of this population. On the other hand, relative deprivation has no direct impact on physical morbidity of non-Hispanic whites but it has an indirect effect by modifying the health related behaviors of this population. In particular, relative deprivation increases the probability of smoking and the probability of obesity for non-Hispanic whites. Additionally, relative deprivation decreases the likelihood of performing physical activities for this population.

Estimates also show that the effects of log per capita income on health and health related behaviors disappears when introducing relative deprivation, as can be seen by comparing the results of the previous chapter with the results of this chapter. The results from the previous chapter indicate a statistically significant effect of log per capita income on both physical and mental morbidity. In contrast, the results of this chapter indicate no effect of log per capita income on physical morbidity regardless of the reference group employed. The results also show no effect of log per capita income on mental morbidity when using Mexico as reference group for Mexican Americans and the

US neighborhood of residence for non-Hispanic whites. Log per capita income is only statistically significant (at a 90% level) in the mental morbidity equation when using the US neighborhood of residence for all individuals in the sample but even in this case the coefficient drops from 0.14 (see previous chapter) to 0.07. And if we consider that relative deprivation has a statistically significant direct effect on mental health for both Mexican Americans and non-Hispanic whites, and a direct impact on physical morbidity of Mexican Americans as well as an indirect effects (via health related behaviors) for non-Hispanic whites, then these facts together support Wilkinson's hypothesis that inequality (measured in this case by relative deprivation) is a more important determinant of health than income.

Based on the estimates of this chapter it is not possible to determine which is the relevant reference group for Mexican Americans. Therefore, more research is necessary in this area. A good way to investigate this topic is by using data that allows the researcher to determine the State or geographic area of origin in Mexico of the Mexican American population in order to identify a more precise reference group for this population.

CHAPTER 7

NEIGHBORHOOD EFFECTS AND HEALTH

The main objective of this chapter is to analyze the role of neighborhood effects on physical and mental morbidity. In particular, I use the proportion of Mexican Americans living in the neighborhood (where neighborhood is defined as MSA if the individual lives in a MSA and as a county or a group of counties in the same PUMA if the individual lives in a rural area) as a proxy to determine possible effects of social cohesion or social relations on health. I test the hypothesis that social relations or social networks play an important role on Mexican American health outcomes.

This chapter is organized as follows. First, I present a brief analysis of the role of neighborhood effects on health outcomes. Second, I explain the two major econometric problems involved in estimating neighborhood effects. Third, I examine some possible pathways linking social relations and health. Fourth, I present the 3SLS estimations of the model including the effect of social relations among Mexican Americans. Finally, I present a summary and speak about the limitations and considerations of the estimations produced by the structural model.

7.1. Neighborhood Effects

An increasing number of economists, sociologists, psychologists and physicians analyze how neighborhood characteristics, the average behavior of the people living in the neighborhood, and other exogenous characteristics of the neighborhood's population affect individual outcomes. A variety of outcomes have been studied including work behavior (Weinberg, Reagan and Yankow (2000)), teenage behavior (Evans et al. (1992)), children's educational outcomes (Aaronson (1998)), birth weight outcomes (Collins et al. (1998), Buekens et al (2000) and Pearl et al (2001)) and mortality rates (LeClere et. al. (1997)).

Following Manski (1993) neighborhood effects can be categorized in to three types: endogenous, exogenous and correlated effects. Endogenous effects are present when the behavior of the group of individuals living in a neighborhood affects the behavior of an individual within the group. In contrast, exogenous effects depend on exogenous non-behavioral characteristics of their neighbors such as religious background, ethnicity and family background. Finally, correlated effects occurs when exogenous characteristics of the neighborhood itself impact the behavior of an individual (causal effect) or when individuals in the same neighborhood behave similarly because they have similar characteristics but there is no causality in their similarity of behaviors (no causal effect).

An example of an endogenous neighborhood effect, applied to the health capital production function model employed in this research, is when the behavior (or the average behavior) of the people living in the same neighborhood such as smoking affects the decision to smoke of a particular individual. Similarly, an example of an exogenous neighborhood effect is when the ethnicity of the population in the neighborhood affects the decision to smoke or to perform exercise by an individual. An example of a correlated neighborhood effect occurs when the price of purchasing a healthy diet in the neighborhood affects the nutritional choices of people in the neighborhood. Their dietary choices are correlated because they face the same prices.

7.2. Econometric Problems

Estimation of the effects of a neighborhood on an individual behavior presents two major problems: i) neighborhood choice in endogenous. Unobservables in the outcome equation may be correlated with neighborhood characteristics (Weinberg, Reagan and Yankow (2000)); ii) the reflection problem (Manski (1993)). The first complication emerges because people are heterogeneous (in preferences, and other unobservables) and often decide to live in neighborhoods with people that have similar characteristics. The problem of endogenous neighborhood choice had been widely analyzed in economics. Techniques for addressing omitted variables bias (such as neighborhood selection) are standard but in many cases they require a very good data source and implementing those techniques is hard. Another solution is given by Aaronson (1998), Weinberg, Reagan and Yankow (2000) that employ panel data to control for unobserved heterogeneity, using fixed effects or first difference estimators. A third solution is to employ experimental and quasi experimental data (Katz, Kling and Liebman (2002). All these techniques have advantages and disadvantages.

In his seminal paper Manski (1993) proved that is not possible, at least using a linear regression model, to identify and distinguish between endogenous neighborhood effects, the effect on individual behavior of mean reference group behavior, and the other two effects (exogenous and correlated effects) and he calls this the reflection problem. Notice that if a person's behavior depends of the behavior of his or her neighbors, then a policy intervention that impact the behavior of a person will eventually impact others generating a multiplier (feedback) effect. No such effects occur with exogenous and correlated effects. Thus the estimation of the feedback effects is fundamental for policy interest.

The estimation in this chapter does not present a reflection problem since mean reference group behavior is not used as regressor. Instead I use the fraction of the population in the neighborhood that is Mexican American as an independent variable to capture a different sort of contextual effect, which provides an idea of the effect of social interactions or social relations on health among Mexican Americans. However, my estimation does not correct for the potential endogenous neighborhood selection mentioned above, this is a limitation that must be take into account. Notice therefore that the coefficient of mmxam will not only measure the effects of social relations on health but also some of the characteristics of the neighborhood such as poverty levels, criminality rates and unhealthy environments that tend to be higher in neighborhoods where Mexican Americans are concentrated.

7.3. Social Relations and Health

LeClere et al (1997) find that the mortality of Mexican Americans is lower when they live in a census tract with a Hispanic population higher than the median for all census tracts. This chapter is focused on analyzing if this effect is also true in my data and using physical and mental morbidity as health outcomes. This protective effect on mortality rates found by Leclere et al (1997) might be due to social cohesion or positive social relations among Mexican Americans. In order to test the existence of social cohesion effects I construct the variable mmxam. The variable mmxam represents the proportion of Mexican Americans living in the same neighborhood, where neighborhood is defined as a MSA if the individual lives in an MSA and as the county or the group of counties in the PUMA if the individual lives outside of a MSA. This variable was constructed using data from the Public Use Microdata Sample (PUMS) from the 2000 5 percent census sample. I match the estimated proportion of Mexican Americans with the respondents in the NLSY by MSA or PUMA depending of the place of residence (urban or rural). Finally I create the interacted variables mexmmx (interaction of mmxam and mexam) and whmmx (interaction of mmxam and (1-mexam)) to capture differences in the effects of social relations for Mexican Americans and non-Hispanic whites respectively.

Ideally, I would like to estimate also the effect of several neighborhood variables like criminality rates, safety of the environment and other neighborhood characteristics. However, none of the data sources employed provide these variables.

Before presenting the empirical analysis is useful to ask: what are the pathways linking social relations and health? Cohen (2004) discusses three pathways linking socials relations and health through different mechanisms: social support, social integration and negative integration. Social support refers to the help provided by a social network to manage stress via emotional support, instrumental support (helping with material aid) and informational support (helping with relevant information to solve a particular problem). Social integration refers to the ability of the individuals to integrate and participate in the social networks. Social networks might influence positive health behaviors by promoting exercise, healthy diets, and smoking cessation. In contrast, negative integration refers to the way in which social integration might also provide an opportunity to spread diseases, disagreement and conflict, feelings of rejection and irresponsible attempts to help.

7.4. Results

Since I mentioned before that the OLS estimations are biased I only present the results of the structural model. Also, because I was not able to identify the relevant reference group for Mexican Americans in the previous chapter I present the results of the structural model using both reference groups.

Table 7.1 presents the full results of the structural model. In particular, notice that the fraction of the population that is Mexican Americans is not statistically significant for either PCS or MCS or any of the health related behaviors. In general, the estimations are very similar to the results founded in the previous two chapters. It is possible to identify a health advantage (of about 2 points or 25% of a standard deviation in MCS) in mental morbidity for Mexican Americans over non-Hispanic whites. However, there is no statistically significant difference in physical morbidity between these two groups. The estimates also show that married individuals present higher MCS scores compared to non married individuals. As in the previous chapter, relative deprivation has a statically significant negative direct impact on mental health of both groups (Mexican Americans and non-Hispanic whites). The rest of the variables show no effect on mental morbidity with the exception of the sex dummy variable. However, as it was explained this cannot be interpreted as an advantage on mental health of males over females. Additionally, the results show that obesity has a strong negative effect on physical health (statistically significant at 90% level). In contrast, frequent physical activity has a large positive effect on physical health (statistically significant at 90% level). The rest of the variables show no statistically significant effect on physical morbidity. Notice that the results of the previous chapter support a negative correlation between relative deprivation (in this case using the US neighborhood of residence as reference group) and PCS. However this effect disappears when adding the proxy variable for social relations.

Estimates reported in the fourth column of table 7.1 show that Mexican Americans are less likely to smoke than non-Hispanic whites, married individuals are also less likely to smoke compared to non married individuals. Conversely, male, tall individuals are slightly more likely to smoke. Notice also that the higher the level of education the smaller the probability of smoking. Relative deprivation has a strong effect by increasing the probability of smoking for non-Hispanic whites. However, relative deprivation does not modify smoking behavior of the Mexican Americans. Additionally, individuals with some type of health insurance present smaller probabilities of smoking compared to individuals with no health insurance.

Estimates reported in the fifth column of table 7.1 show that Mexican Americans are more likely to be obese but immigrants from Mexico are less likely to be obese compared to non-Hispanic whites. Individuals with college or more education are less likely to be obese. Conversely, individuals with some type of health insurance are more likely to become obese compared to those with no health insurance. In addition, relative deprivation increases the probability of obesity for non-Hispanic whites but it does not affect the probability of obesity for Mexican Americans. The variable mmxam has no effect on the probability of being obese neither for Mexican Americans nor for non-Hispanic whites.

Estimates reported in the last column of table 7.1 indicate that Mexican Americans are less likely to perform physical activities compared to non-Hispanic whites. Males are more likely to perform physical activities than females. Results also show that the higher the level of education the higher the probability of performing physical activities. Once again relative deprivation has an important effect (negative) on the probability of performing physical activities for non-Hispanic whites but not for Mexican Americans. Finally, the variable mmxam has no effect on the probability of performing physical activities for Mexican Americans or for non-Hispanic whites.

Table 7.2 presents the full results of the structural model but using Mexico as reference group for Mexican Americans and the US neighborhood as reference group for non-Hispanic whites. Since the results are similar to the estimations of table 7.1 I will focus the analysis to the differences between the two tables. Once again the proportion of Mexican Americans in the neighborhood of residence is not statistically significant to explain neither physical nor mental morbidity or any of the health related behaviors.

Additionally, almost the same variables that have a statistically significant effect on mental morbidity on table 7.1 (male, married, whusrel and relative deprivation for Mexican Americans) also have a statistically significant effect in table 7.2 (with very similar coefficients) with one big exception: the statistically significant advantage of Mexican Americans on mental morbidity over non-Hispanic whites disappears when the proportion of Mexican Americans in the neighborhood is introduced in conjunction with the relative deprivation measure using Mexico as reference group (notice that this advantage was also present in the results of the previous chapter when the relative deprivation measure using Mexico as reference group was used in the model but not the effects of the proportion of Mexican Americans in the neighborhood). The disappearance of the mental health advantage of Mexican Americans over non-Hispanic whites is puzzling because the proxy variable for social relations is not itself statistically significant. This result suggests the need for further research on how neighborhood context affects the health of Mexican Americans.

When comparing the results of table 7.1 and 7.2 it is clear that the same variables that affect physical morbidity in table 7.1 also affect physical morbidity in table 7.2 and with very similar coefficients.[28] Additionally, the same variables that affect the likelihood of smoking, obesity and performing physical activities in table 7.1 also affect the probabilities of smoking, obesity and performing physical activities in table 7.2.

[28] You might notice that physical activities is statistically significant in 7.1 (at 90 % level) but not in table 7.2. However, the variable for performing physical activities is statistically significant at 89% level in 7.2

Variable	MCS	PCS	Smoke	Obese	Pactivi
mexam	2.13* (1.06)	1.53 (1.27)	-0.11* (0.04)	0.14* (0.04)	-0.08* (0.04)
immexam	-0.25 (0.91)	0.12 (1.09)	-0.03 (0.04)	-0.07** (0.04)	0.03 (0.04)
imother	0.50 (0.78)	0.64 (0.97)	0.004 (0.04)	-0.02 (0.04)	-0.04 (0.04)
smoked	1.64 (5.53)	-10.15 (5.70)			
obese	-4.13 (5.51)	-14.89* (6.39)			
pactivi	2.16 (4.48)	7.76* (4.63)			
mheight	-0.01 (0.01)	-0.01 (0.01)	0.001* (0.0004)	-0.001 (0.0004)	-0.001 (0.0005)
fheight	0.01 (0.01)	-0.001 (0.01)	0.0001 (0.0004)	-0.001 (0.0005)	0.0004 (0.001)
male	3.09* (1.21)	1.66 (1.41)	-0.07 (0.04)	0.06 (0.05)	0.16* (0.05)
married	2.10* (0.53)	-0.07 (0.59)	-0.07* (0.02)	-0.004 (0.02)	0.001 (0.02)
lnpcinc	0.07 (0.04)	0.08 (0.05)	0.001 (0.002)	0.001 (0.002)	-0.002 (0.002)
pcincmis	1.74 (1.33)	2.34 (1.61)	-0.02 (0.05)	0.14* (0.06)	-0.07 (0.06)
hgc12	0.72 (1.01)	-0.21 (1.11)	-0.13* (0.02)	-0.002 (0.03)	0.11* (0.03)
hgc12m	0.78 (1.65)	-1.55 (1.77)	-0.23* (0.03)	-0.04 (0.03)	0.18* (0.03)
hgc16	0.16 (2.61)	-3.89 (2.74)	-0.36* (0.03)	-0.09* (0.03)	0.30* (0.03)
whusrel	-3.02** (1.83)	0.42 (1.98)	0.20* (0.04)	0.11* (0.05)	-0.19* (0.05)
meusrel	-3.65* (1.48)	-1.87 (1.77)	0.10 (0.06)	0.05 (0.07)	-0.06 (0.07)
usrdmis	-3.29* (1.29)	-2.31 (1.59)	0.10** (0.06)	-0.08 (0.06)	-0.04 (0.07)
mexmmx	1.69 (2.17)	-2.19 (2.56)	-0.15 (0.09)	-0.01 (0.10)	-0.13 (0.11)
whmmx	-1.30 (1.41)	-2.68 (1.74)	-0.02 (0.07)	-0.04 (0.07)	-0.003 (0.08)
psusmokd			0.18* (0.05)		
psuobese				0.13* (0.06)	
psupactiv					0.23* (0.06)
hplan			-0.04* (0.02)	0.08* (0.02)	0.01 (0.02)
_cons	50.26* (3.64)	56.24* (3.84)	0.41* (0.06)	0.13* (0.06)	0.15* (0.07)
χ^2					

Table 7.1 3SLS Regressions Using the US Neighborhood as Reference Group and Including Social Relation effects

* Statistically significant at 5% level.

** Statistically significant at 10% level.

Variable	MCS	PCS	Smoke	Obese	Pactivi
mexam	1.47 (1.00)	1.41 (1.18)	-0.07* (0.03)	0.15* (0.04)	-0.09* (0.04)
immexam	-0.31 (0.90)	0.12 (1.07)	-0.03 (0.04)	-0.07** (0.04)	0.03 (0.04)
imother	0.46 (0.78)	0.62 (0.96)	0.01 (0.04)	-0.02 (0.04)	-0.04 (0.04)
smoked	1.64 (5.46)	-9.78 (5.60)			
obese	-4.15 (5.56)	-15.20* (6.40)			
pactivi	2.03 (4.49)	7.47 (4.62)			
mheight	-0.01 (0.01)	-0.01 (0.01)	0.001* (0.0004)	-0.001* (0.0004)	-0.001 (0.0005)
fheight	0.01 (0.01)	-0.001 (0.01)	0.00005 (0.0004)	-0.001 (0.0005)	0.0004 (0.001)
male	3.12* (1.21)	1.73 (1.41)	-0.07 (0.04)	0.06 (0.05)	0.16 (0.05)
married	2.12* (0.53)	-0.03 (0.58)	-0.07* (0.02)	-0.004* (0.02)	0.001 (0.02)
lnpcinc	0.05 (0.05)	0.06 (0.06)	-0.001 (0.002)	0.001 (0.002)	-0.001 (0.003)
pcincmis	0.99 (1.37)	1.74 (1.66)	-0.03 (0.06)	0.15 (0.06)	-0.07 (0.07)
hgc12	0.75 (1.02)	-0.15 (1.12)	-0.13* (0.02)	-0.003* (0.03)	0.11* (0.03)
hgc12m	0.87 (1.68)	-1.43 (1.79)	-0.24* (0.03)	-0.04 (0.03)	0.18* (0.03)
hgc16	0.29 (2.65)	-3.69 (2.78)	-0.37* (0.03)	-0.09* (0.03)	0.30* (0.03)
whusrel	-2.80* (1.64)	0.24 (1.79)	0.17 (0.04)	0.11 (0.04)	-0.18* (0.05)
memerel	-4.36* (1.95)	-3.73 (2.38)	-0.10 (0.10)	0.06 (0.10)	-0.02 (0.11)
usrdmis	-2.42* (1.22)	-1.98 (1.49)	0.07 (0.05)	-0.10 (0.06)	-0.02 (0.06)
mexmmx	1.13 (2.12)	-2.45 (2.50)	-0.13 (0.09)	-0.01 (0.10)	-0.14 (0.11)
whmmx	-1.32 (1.41)	-2.71 (1.73)	-0.02 (0.07)	-0.04 (0.07)	-0.003 (0.08)
psusmokd			0.18* (0.05)		
psuobese				0.13* (0.06)	
psupactiv					0.23 (0.06)
hplan			-0.05 (0.02)	0.08 (0.02)	0.01 (0.02)
_cons	50.27* (3.85)	56.50* (4.02)	0.46* (0.06)	0.13* (0.06)	0.14* (0.07)
χ^2	171.21	127.64	490.43	105.59	270.34

Table 7.2 3SLS Regressions Using Mexico as Reference Group and Including Social Relation effects

* Statistically significant at 5% level.
** Statistically significant at 10% level.

7.5. Summary and Discussion

I found that the proportion of Mexican Americans living in the same MSA or county of residence (for rural areas) does not affect PCS or MCS or health related behaviors (smoking, obesity and performing physical activities). Including this proxy variable for social cohesion does alter by much the results found in the individual level model including relative deprivation when using the US neighborhood of residence as reference group. However, the mental health advantage for Mexican Americans disappears when using the proxy variable for social cohesion in conjunction with the measure of relative deprivation that uses Mexico as reference group. The disappearance of the mental health advantage of Mexican Americans over non-Hispanic whites is puzzling because the proxy variable for social relations is not itself statistically significant in explaining health outcomes (PCS and MCS) or health related behaviors. This result suggests the need for further research of how neighborhood context affects the health of Mexican Americans.

The results from the previous chapter support a negative correlation between relative deprivation (regardless of the reference group employed) and physical morbidity for Mexican Americans. However, this negative effect disappears when adding the proxy variable for social relations. Notice that the proportion of Mexican Americans living in the same MSA or county of residence (for rural areas) does not affect the significance of the variables that explain health related behaviors (the same variables that affect these behavior in the previous chapter also are significant when including mmxam).

Estimates reported in this chapter do not correct for the potential endogenous neighborhood selection. This is a limitation that must be take into account. Notice therefore that the coefficient of mmxam will not only measure the effects of social relations on health but also some of the characteristics of the neighborhood such as poverty levels, criminality rates and unhealthy environments that tend to be higher in neighborhoods where Mexican Americans are concentrated.

CHAPTER 8

CONCLUSSIONS

Differences in health outcomes between racial and ethnic groups are likely generated by various factors; i) Socioeconomic factors (e.g., age distribution, educational attainment, and income) and relative deprivation; ii) lifestyle behaviors (e.g., lack of physical activity, obesity, and cigarette smoking); iii) aspects of the social environment (e.g., educational and economic opportunities, neighborhood and work conditions, pollution rates, segregation and social networks); iv) elements affecting the health-care system (e.g., access to health care, and cost and availability of screening for diseases).

I analyze health status for Mexican Americans and non-Hispanic whites using two general measures of health that allow me to distinguish between physical and mental health. Thus, this paper is different from other studies that analyze health status using a specific health outcome such as birth-weight, high blood pressure or mortality rates as a measure of health. As mentioned before PCS and MCS have the advantage that they can be used across different diseases as summary measures of overall health status. To some extent PCS and MCS reflect morbidity across individuals and across different groups in the population. However, the nature of the physical and mental component summaries (of working as measures of general health) makes them less useful at the time of analyzing the specific details of one disease.

8.1 Hypotheses Tested

The main question that this dissertation was trying to answer is if Mexican Americans have a relative advantage on health. My results indicate that after controlling for individual health related behaviors, socioeconomic status, relative deprivation (regardless of the relevant reference group) and social relations; there is no difference in physical morbidity between Mexican Americans and non-Hispanic whites. However, I found an advantage in mental health outcomes for Mexican Americans over non-Hispanic whites after controlling for health related behaviors and socioeconomic status. This advantage remains after controlling for relative deprivation (regardless of the reference group employed). The existence of this morbidity advantage produced mixed results when controlling for social cohesions effects. On one side, the mental morbidity advantage of Mexican Americans over non-Hispanic whites remains when controlling for social relations and relative deprivation using the US neighborhood of residence as reference group. On the other side, the advantage disappears when controlling for social relations and relative deprivation using Mexico as reference group.

The results also show no difference in health outcomes (neither in physical morbidity nor in mental morbidity) for immigrants from Mexico and from other countries with respect to non-immigrants. This fact suggests no effect of acculturation on physical and mental health. However, it must be considered that all the immigrants in this sample arrived in the United States when they were very young and therefore it is difficult to expect big differences in behaviors between those born in the US and the immigrants. Additionally, have in mind that the total number of immigrants in my sample is 292 (169 from Mexico and 123 from other countries), which is very small to detect small differences in PCS and MCS scores.

OLS estimations seem to support the hypothesis that smoking negatively affects health. However, the results of the structural model fail to support such hypothesis. A possible explanation of why the coefficient on the smoking variable is not significant is that people that smoke daily are people that usually have more unobserved destructive behaviors that affect mental health. A more technical explanation is that there are some unobserved elements (such as unhealthy behaviors and health endowments) in the error term of the MCS and PCS equations that are correlated with the smoking dummy variable causing that OLS yields estimations biased away from zero.

I found no evidence of negative effects of obesity on mental morbidity. However, I found a large negative impact of obesity in physical health. Furthermore, the effect is even larger in the structural model than in the OLS model. One possible explanation for this is that many of the people that become obese have better health endowments than the average individual, and once this health endowment bias is taken into account the real negative effects of obesity are higher. Other possible explanation is that individuals that know that their family has problems of health related to obesity (such as diabetes and high blood pressure) decide to avoid obesity.

After controlling for socioeconomic status and relative deprivation OLS estimates seem to support the hypothesis that performing physical activities positively affects health (measure by both physical and mental morbidity). However, the results of the structural model fail to support the hypothesis. A possible explanation is that individuals with good health endowments usually perform more physical activities than individuals with poor health endowments.

I found no evidence of a direct impact of education on physical and mental morbidity. However, I found strong evidence of education affecting health related behaviors (smoking, obesity and performing physical activities). This might be interpreted as evidence of education affecting the selection of health related inputs in the production of health rather than education affecting health by increasing efficiency given a set of health inputs.

The results of the individual level model support the hypothesis that income has a positive impact on both physical and mental morbidity, possibly explained by the fact that higher levels of income allow the individual to easily purchase health inputs such as drugs, health books, etc. However, the effects of log per capita income on health (PCS and MCS) and health related behaviors disappear when introducing relative deprivation (regardless of the reference group employed).

My estimation supports the hypothesis that married individuals have better mental health outcomes (or that they are better producers of mental health) than non-married individuals, which suggests a protective effect of marriage on mental morbidity. However, I found no evidence supporting better physical morbidity for married individuals compared to non-married persons.

I found no direct correlation between height (neither for male nor for females) and physical or mental morbidity. However, I found a small positive correlation between male height and the probability of smoking and a small negative correlation between male height and obesity and performing physical activities. I also found a small negative relationship between female height and the probability of being obese.

My estimation shows that relative deprivation has a negative direct impact on mental morbidity for Mexican Americans and non-Hispanic whites. This fact might support Wilkinson's hypothesis that inequality (in this case measured by relative deprivation) affects health via psychological stress. However, the evidence is not so clear when using physical morbidity as health outcome. On one hand, relative deprivation affects directly the physical morbidity of Mexican Americans but it does not affect the health related behaviors of this population. On the other hand, relative deprivation has no direct impact on physical morbidity of non-Hispanic whites but it has an indirect effect by modifying the health related behaviors of this population.

Considering that the effects of income on health disappear when introducing relative deprivation, and considering that relative deprivation has the mentioned effects on health of Mexican Americans and non-Hispanic whites, these two facts together might support Wilkinson's hypothesis that inequality (measured in this case by relative deprivation) is a more important determinant of health than income. Additionally, I was not able to determine which is the relevant reference group for Mexican Americans. Therefore more research is necessary in this area. A good way to investigate this topic is by using data that allows the researcher to determine the state or geographic area of origin in Mexico of the Mexican American population in order to identify a more precise reference group for this population.

I found that the proportion of Mexican Americans living in the same MSA or county of residence (for rural areas) does not affect either physical or mental morbidity or health related behaviors. This proxy variable for social cohesion effects does not change the results found in the individual level model including relative deprivation when using the US neighborhood of residence as reference group. However, the mental health advantage for Mexican Americans disappears when using the proxy variable for social cohesion in conjunction with the measure of relative deprivation that uses Mexico as reference group. The disappearance of the mental health advantage of Mexican Americans over non-Hispanic whites is puzzling because the proxy variable for social relations is not itself statistically significant in explaining health outcomes (PCS and MCS) or health related behaviors. This result suggests the need for further research on how neighborhood context affects the health of Mexican Americans.

8.2 Health Related Behaviors

I found that Mexican Americans are less likely to smoke than non-Hispanic whites, married individuals are also less likely to smoke compared to non married individuals. Conversely, male, tall individuals are slightly more likely to smoke. My estimations also show that the higher the level of education the smaller the probability of smoking. On one side, I found that relative deprivation has a strong effect by increasing the probability of smoking for non-Hispanic whites. On the other hand, relative deprivation does not modify smoking behaviors of the Mexican Americans. Additionally, individuals with some type of health insurance presented smaller probabilities of smoking compared to individuals with no health insurance. Finally, the results show that Mexican Americans living in neighborhoods with higher proportions of Mexican American are less likely to smoke.

My estimation demonstrates that Mexican Americans are more likely to be obese but immigrants from Mexico are less likely to be obese compared to non-Hispanic whites. Additionally, individuals with college or more education were less likely to be obese. Conversely, individuals with some type of health insurance were more likely to become obese compared to those with no health insurance. In addition, I found a small negative correlation between height and obesity, and that relative deprivation increases the probability of being obese for non-Hispanic whites but it does not affect the probability of obesity for Mexican Americans. Finally, I found no evidence linking the proportion of Mexican Americans in the neighborhood with the probability of being obese either for Mexican Americans or for non-Hispanic whites.

I found that Mexican Americans are less likely to perform physical activities compared to non-Hispanic whites. Conversely, males were more likely to perform physical activities than females. Results also indicated that the higher the level of education the higher the probability of performing physical activities. Like the other two health behaviors I found that relative deprivation has an important negative effect on the probability of performing physical activities for non-Hispanic whites but not for Mexican Americans. Finally, a proxy variable for social cohesion had no effect on the probability of performing physical activities for either Mexican Americans or for non-Hispanic whites.

Notice that these findings provide evidence that suggests that Mexican Americans and non-Hispanic whites select different amounts of endogenous health inputs (different health related behaviors) in their production of health.

8.3 Limitations and Considerations

The estimation presented in this research present has several limitations. First, PCS and MCS are truncated variables that theoretically take values between 0 and 100 and empirically usually take values between 20 and 70. This contrasts with the assumptions of OLS and 3SLS that the distribution of the errors is normal.[29] Second, I have 598 valid observations on Mexican Americans. However, I need 786 observations on Mexican Americans in order to detect one point difference (compared to non-Hispanic whites) in sample means on PCS and MCS scores. The number of observations in this research is sufficient to detect a two-point difference on PCS and MCS scores.

Other factors that must be considered are the following. The structural model employed in this dissertation allows me to estimate unbiased coefficients (marginal effects) for health related behaviors (smoking, obesity and physical activity). However, the model does not allow controls for inverse causality and incidental relationship between income and health. Similarly, the model does not control for marriage selection. Therefore the marriage coefficient might not reflect the true effect of marriage on health. In addition, the model does not control for a possible reverse causality between schooling and health and for time preferences that might affect the selection of schooling and health among individuals.

I use the fraction of the population in the neighborhood that is Mexican American as an independent variable to capture a different sort of contextual effect, which provides an idea of the effect of social interactions or social relations on health among Mexican Americans. However, my estimation does not correct for the potential endogenous

---

[29] Error distribute normally between minus infinite and infinite.

neighborhood selection mentioned above and is a limitation that must be take into account. Notice therefore that the coefficient of mmxam will not only measure the effects of social relations on health but also some of the characteristics of the neighborhood such as poverty levels, criminality rates and unhealthy environments that tend to be higher in neighborhoods where Mexican Americans are concentrated.

Finally, my data contains information about physical and mental morbidity at the age of 40. However, there is some evidence (Leclere et al (1997) Humer (1999)) that suggest that Mexican Americans have a health advantage over non-Hispanic whites in populations 45 and older rather than in young and middle age populations. Thus this paper only analyzes individuals at the age of 40 and extrapolation of the results to other age groups in the US population might not be valid.

8.4 Future Research

Since I was not able to determine the relevant reference group for Mexican Americans, future research is necessary in this area. A good starting point will be to construct a Mexican relative deprivation measure based on more disaggregated reference group than the whole country. Additionally, I found no evidence that social relations or social cohesion (measured by the proportion of Mexican Americans in the same MSA or county of residence for rural areas) affect the health of Mexican Americans. This suggests the necessity of investigating deeply the role of social cohesion on the physical and mental morbidity for Mexican Americans. A couple of paths to follow in this topic are: i) measuring the effects of the proportion of Mexican Americans at a more disaggregated level such as the census track or block group; ii) and analyzing the effects of the Absolute number of Mexican Americans in the same geographical area.

Hispanics have higher fertility rates than non-Hispanic whites. In 2001 the fertility rate was 96 live birth per 1,000 women aged 15-44 years for Hispanic and 57.7 per 1,000 women aged 15-44 years in non-Hispanic whites, Ventura et al (2003). Therefore, it will be interesting in future research to analyze the effects of the size and age composition of the household on the production of health and the demand for health inputs, as well as the possible existence of scale economies in the production of health. Finally, I found strong evidence that education positively affecting the probability of performing physical activities. However, it will be interesting to observe if this result hold after controlling for occupation since more educate individuals usually perform jobs that require less heavy manual work (which could be a substitute of performing physical activities) and therefore decide to perform more physical activities.

BIBLIOGRAPHY

Aaronson, Daniel. “Using Sibling Data to Estimate the Impact of Neighborhoods on Children’s Educational Outcomes”. Journal of Human Resources. Volume 33. No.4 (Fall 1998): 915-946.

Abraido-Lanza, Ana F, Dohrenwed, Bruce P, Ng-Mak, Dysy S, and Blake Tuner. “The Latino Mortality Paradox:a Test of the Salmon Bias and Healthy Migrant Hypotheses”. Journal of Public Health. Volume 89. No.10 (October 1999);1543-1548.

Adler, Nancy E., Boyce, W Thomas., Chesney, Margaret A., Folkman, Susan., and Syme, Leonard. “Socioeconomic Inequalities in Health”. Journal of the American Medical Association. Volume 269, No. 24. (June 1993): 3140-3145.

Adler, Nancy E., Boyce, W Thomas., Chesney, Margaret A., Cohen Sheldon, Folkman Susan and S. Leonard Syme. “Socioeconomic Status and Health: the Challenge of the Gradient”. American Psychology. Volume 49,(1994): 15-24.

American Cancer Society. “Cancer Facts and Figures for Hispanics/Latinos 2003-2005”. Atlanta GA: American Cancer Society. (2003)

Bailey K. V., and A. Ferro-Luzzzi. “Use of Body Mass Index of Adults in Assessing Individual and Community Nutritional Status. Bull World Health Organ. 73(5) (1995): 673-680.

Becker, G. S. “A Theory of the Allocation of Time”. The Economic Journal. Volume 75. (1965):493–517.

Bell, Colin A., Linda S. Adair, and Barry M. Popkin. “Ethnic Differences in the Association between Body Mass Index and Hypertension”. American Journal of Epidemiology. Volume 155. No.4. (2002): 346-353.

Behrman Jere R and Anil B Beolaikar. “Health and Nutrition”. Handbook of Development Economics. Edited by Hollia Chenery and T N Srisivasan. North Holland. Elsevier Science Publishers B V (1998).

Borjas, George J. “Ethnicity, Neighborhoods, and Human-Capital Externalities”. The American Economic Review. Volume 85, Issue 3 (June 1995): 365-390.

Borjas, George J. “Long-Run Convergence of Ethnic Skill Differentials, Revisited”. Demography. Volume 38, No. 3. (August 2001): 357-361.

Borjas, George J. “To Ghetto or Not to Ghetto: Ethnicity and Residential Segregation”. Journal of Urban Economics (1998): 228-253.

Berger, M C and J P Leigh. “Schooling Self Selection and Health”. Journal of Human Resources. Volume 24. (1989); 433-455.

Centers of Disease Control and Prevention. “Cigarrete Smoking-Attributable Morbidity ---United States 2000”. Morbidity and Mortality Weekly Report. (September 5, 2003): 842-844.

Cohen, Sheldon. “Social Relations and Health”. American Psychologist. (November 2004): 676-684

Collins, James W., Fisher Schulte, Nancy., and Drolet, Aimee. “Differential Effect of Ecologic Risk Factors on the Low Birthweight Components of African-American, Mexican-American, and Non-Latino White Infants in Chicago”. Journal of the National Medical Association. Volume 90, No. 4. (1998):223-229.

Contoyannis, P and A M Jones(2001). “Socio-economic status, health and lifestyle”. Discussion Paper. Deprtment of Economics and Related Studies, University of York. (December 2001).

Deaton, Angus. “Relative Deprivation, Inequality and Mortality”. NBER Working Paper No. 8099. (January 2001).

Deaton, A. and C. Paxson.. "Mortality, Education, Income, and Inequality Among American Cohorts." NBER Working Paper.(1999).

De la Torre, Adela and Antonio Estrada. “Mexican Americans and Health”. The University of Arizona Press. (2001).

Diez-Roux, Ana V. “Bringing Context Back into Epidemiology: Variables and Fallacies in Multilevel Analysis”. American Journal of Public Health. Volume 88, No. 2 (February 1998): 216-222.

Diez-Roux, Ana V. “Investigating Neighborhood and Area Effects on Health”. American Journal of Public Health. Volume 91, No. 11 (November 2001): 1783-1789.

Dixon, Lori Beth., Sundquist, Jan and Winkleby, Marilyn. “Differences in Energy, Nutrient, and Food Intakes in a US Sample of Mexican-American Women and Men: Findings from the Third National Health and Nutrition Examination Survey, 1988-1994”. American Journal of Epidemiology. Volume 152, No. 6. (2000): 548-557.

Duleep, Harriet O. “Measuring the Effects of Income on Adult Mortality Using Longitudinal Administrative Record Data”. The Journal of Human Resources. Volume 21. No.2. (Spring 1986); 238-251.

Eberwein, Curtis, Randall J. Olsen, and Patricia B. Reagan. “Intracluster Correlation and Complex Sampling: Do Geographic Data Lessen the Problem?” Working Paper. (2003)

Ellison, Christopher G, Boradman Jason D, Williams David R and James S. Jackson. “Religiuos Involvment, Stress, and Mental Health: Findings from the 1995 Detroit Area Study”. Social Forces. Volume 80. No.1. (September 2001); 215-249.

Eibner Christine E. and William N. Evans. “Relative Deprivation, Poor Health Habits and Mortality” Working paper. Center for Health and Well Being. Woodrow Wilson School of Public and International Affarirs. Princeton University.

Escobar, Javier, Hoyos Nervi, Constanza and Michael A. Gara. “Immigration and Mental Health: Mexican Amercians in the United States.” Harvard Rev Psychiatry. Vol 8. No.2. (July/August 2000): 64-72.

Evans, William N, Oates Wallace E and Robert M Schwab. “Measuring Peer Group Effects: A Study of Teenage Behavior”. Journal of Political Economy. Volume 100. (October 1992): 966-991.

Farrel P and V R Fuchs. “Schooling and Health: The Cigarette Connection”. Journal of Health Economics. Volume 1. (1982); 217-230.

Fuchs, Victor R. “ Time Preference and Health: an Exploratory Study”. In Economic Aspects of Health Edited by Victor R Fuchs. Chigago. University of Chicago Press (1982).

Fuchs, Victor R. “The Health Economy”. Harvard UP Cambbridge, Massachusetts. Firs Edition (1986).

Glanz, Karen., Croyle, Robert T., Chollette, Veronica Y., and Pinn, Vivian W. “Cancer-Related Health Disparities in Women”. American Journal of Public Health. Volume 93, No. 2. (February 2003): 292-298.

Goldman, Noreen. “Marriage Selection and Mortality Patterns: Inferences and Fallacies”. Demography. Volume 30. No. 2 (May 1993); 189-208.

Green William H. “Econometric Analysis”. Fourth edition. Prentince Hall (2000).

Grossman, Michael. “On the concept of Health Capital and Demand for Health”. The Journal of Political Economy. Volume. 80, No. 2. (Mar. - Apr., 1972):223-255.

Grossman, Michael and R. Kaestner. "Effects of Education on Health". The Social Benefits of Education. Edited by J R Behrman and N Stacey. University of Michigan Press. (1997); 69-123.

Grossman, Michael. "The Human Capital Model of the Demand for Health". National Bureau of Economic Research (April 1999).

Haskinson, John L., John R. Odencrantz, and Kathleen B. Fedan. "Spirometric Reference Values from a Sample of the General U.S. Population". Am. J. Respir. Crit. Care Med. 159 (1999): 179-187.

Hausman, J A. "Specification Tests in Econometrics". Econometrics. Volume 46. No.6. (November 1978); 1251-1271/

Heckman, James, J. "Dummy endogenous Variables in a Simultaneous Equation System". Econometrica. Vol.46. No.4. (July 1978): 931-959.

Hey, J and P Lambert. "Relative Deprivation and the Gini Coefficient: Comment". The Quarterly Journal of Economics. Volume 95. No.3. (1980): 567-573.

Horwitz, Allan V, White Helene R and Sandra Howell-White. "Becoming Married and Mental Health: a Longitudinal Study of a Cohort of Young Adults. Volume 58. No. 4 (November 1996); 895-907.

Hummer, Robert A, Rogers, Rhichard, Nam, Charles B, and Felicia B LeClere. "Race/Ethnicity, Nativity and US Adult Mortality". Social Science Quarterly. Volume 80. No.1 (March 1999);137-153.

Hummer, Robert A, Rogers, Rhichard, Amir, Sarit H, Forbes Douglas and Frisbie W. Parker. "Adults Mortality Differentials Among Hispanic Subgroups and non-Hispanic Whites". Social Science Quarterly. Volume 81. No.1. (March 2000);459-476.

Jamrozik, Konrad and Dobson, Annette. "Please Put Out that Cigarette, Grandpa". Tobacco Control Online. (1999): 125-126.

Jorgensen, Carsten Krogh., Fink, Per., and Olesen, Frede. "Patients in General Practice in Denmark Referred to Physiotherapists: A Description of Patient Characteristics Based on General Health Status, Diagnoses, and Sociodemographic Characterictics". Physical Therapy. Volume 81, No. 3. (March 2001): 915-923.

Katz, J. N., M. G. Larson, C. B. Phillips, A.H. Fossel, and M. H. Liang. "Comparative Measurement Sensitivity of Short and Long Health Status Instruments. Medical Care. 30(10). (October 1992): 917-925.

Katz, Lawrence F, King Jeffrey R and Jeffrey B Liebman. “Moving to Opportunity in Boston: Early Results of Randomized Mobility Experiment. Forthcoming in Quarterly Journal of Economics.

Kawachi, I., B. P. Kenedy, K. Lochner, and D. Prothrow-Smith. “Social Capital Income Inequality, and Mortality. American Journal of Public Health. 87(9). (1997): 1491-1498.

Kawachi, I., and L. F. Beckman. “Social Cohesion, Social Networks, Social Support, and Health In L.F. Berkman and I. Kawachi (Eds.). Social Epidemiology. Oxford:Oxford University Press. (2000): 174-190.

Kawachi, Ichiro. “Income Inequality and Economic Residential Segregation (Editorial). Journal of Epidemiological Community Health. Volume 56 (2002):165-166.

Kawachi, Ichiro, and Lisa F. Berkman. “Neighborhoods and health”. Oxford ; New York: Oxford University Press, 2003.

Kemp, Charles. “ Mexican and Mexican Americans: Health Beliefs and Practices”. (2004). http://www3.baylor.edu/~Charles.Kemp/hispanic_health.htm
Kenkel, Donald S. “Health Behavior, Health Knowledge, and Schooling”. Journal of Political Economics. Volume 99. No. 21 (April 1991); 297-305.

Kennedy, S, Kawachi I and D Prothrow-Stith. “Income Distribution and Mortality: Cross Sectional Ecological Study of Robin Hood Index in the United States”. British Medical Journal. Volume 312. (1996): 1004-1007

Kenkel, Donald S. “Prevention” Handbook of Health Economics. Volume 1B. edited by Culyer, A. J. and Newhouse, J. P. Elsevier Amsterdam (2000).

Kiiskinen, Urpo. “A Health Production Approach to the Economic Analysis of Health Promotion”. Publications of the National Health Institute (2003).

Lansky, D., J. B. V. Butler, and F. T. Waller. “Using Health Status Measures in the Hospital Setting: From Acute Care to Oucomes Management”. Medical Care (1992): MS57-MS73.

LeClere, Felicia., Rogers, Richard G and Peters, Kimberley D. “Ethnicity and Mortality in the United States: Individual and Community Correlates”. Social Forces. Volume 76, Issue 1 (September 1997): 169-198.

Lilllard, Lee A and Panis W A Constantijn. “Marital Sattus and Mortality: The Role of Hralth”. Demography. Volume 31. No.3. (August 1996); 313-327.

Lynch, John., Kaplan, George A., and Shema, Sarah J. "Cumulative Impact of Sustained Economic Hardship on Physical, Cognitive, Psychological, and Social Functioning". The New England Journal of Medicine. Volume 337(26). (December 1997): 1889-1895.

Lombayer P and R G Wilkinson. "Inequality, Residential Segregation by Income, and Mortality in the US cities. Journal of Epidemiological Community Health. Volume 56. (2002): 183-187.

MacIntyre S., S. MacIver, A. Sooman. "Area, Class and Health: Should we be Focusing on Places or People?". Journal of Social Policy. Volume 22. (1993): 213-234.

MacIntyre, S., and A. Ellaway. "Ecological Aproaches: Rediscovering the Role of the Physical and Social Environment". In L.F. Berkman and I. Kawachi (Eds.). Social Epidemiology. Oxford:Oxford University Press. (2000): 332-348.

Manski, Charles F. "Identification of Endogenous Social Effects: the Reflection Problem". The Review of Economic Studies. Volume 60. (1993): 531-542.

Mapes, Donna L., Lopes, Antonio Alberto., Satayathum, Sudtida., McCullough, Keith P., Goodkin, David A., Locatelli, Francesco., Fukuhara, Shunichi., Young, Eric W., Kurokawa, Kiyoshi., Saito, Akira., Bommer, Jurgen., Wolfe, Robert A., Held, Philip J., and Port, Friedrich K. "Health-Related Quality of Life as a Predictor of Mortality and Hospitalization: The Dialysis Outcomes and Practice Patterns Study (DOPPS)". Kidney International. Volume 64. (2003): 339-349.

Marmot and Shipley. "Do socioeconomic differences in mortality persist after retirement? 25 year follow up of civil servants from the first Whitehall study". Clinical research ed. Volume. 313. No. 7066 (1996 Nov 9): 1177-1180.

McLaughlin, Tara L., O'Keefe, Eileen and Rose Maljanian. "Behavioral Risk Factor Reduction Special Report." (2001). Institute for Outcomes Research and Evaluation at Hartford Hospital.

Medlineplus, Health Information. Meical Encyclopedia (2003). http: www.nlm.nih.gov /medlineplus/ency/article/007196.htm

Mellor, J., and J. Milyo. "Is Exposure to Income Inequality a Public Concern? Lagged Effects of Income Inequality on Individual and Population Health." Health Service Research. 38(1). (2003): 137-151.

Merva, Mary and Richard Fowles. "Economic Outcomes and Mental Health." Working Paper. (1996). http://www.econ.utah.edu/fowles/outcomes.pdf

Mitchell, Almasy, Rainwater, Schneider, Blangero, Stern and MacCluers. "Diabetes and Hypertension in Mexican American Families: Relation to cardiovascular Risk." American Journal of Epidemiology. Volume 149. No.11. (1999): 1047-1056.

Muller, A. "Education, Income Inequality, and Mortality: a Multiple Regression Analysis. British Medical Journal. 324(7328). (2002):23-25
Nayga, Rodolfo M. "Schooling, Health Knowledge and Obesity". Applied Economics. Volume 32 (2000);815-822.

National Health and Nutrition Examination Survey (1988-1994). Anthropometrics Reference Data. Available at http://www.cdc.gov/nchs/about/major/nhanes/Anthropometric%20Measures.htm

National Center For Chronic Disease Prevention and Health Promotion. The health consequences of smoking. A report from the Surgeon General. (2004). http://www.cdc.gov/tobacco/sgr/sgr_2004/index.htm

National Center of Health Statistics. "Vital and Health Statistics: Summary Health Statistics for U.S.Adults:National Health Interview Survey,2002" Series 10. Number 222. Hyattsville,Maryland. (July 2004). DHHS Publication No.(PHS)2004-1550

Neal, D. A., and W. R. Johnson. "The Role of Premarket Factors in Black-White Wage Differences". The Journal of Political Economics. Volume 104 No.5. (1996): 869-895.

Oropesa, R. S., Lichter, Daniel T., and Anderson, Robert N. "Marriage Markets and the Paradox of Mexican American Nuptiality". Journal of Marriage and the Family. Volume 56, Issue 4. (November 1994): 889-907.

Ortega, Alexander N., Rosenheck Robert, Alegria, Margarita and Rani A. Desai. "Acculturation and Lifetime Risks of Psychiatric and Substance Use Disorders among Hispanics. The Jourtnal of Nervous and Mental Disease. Vol. 188. No.11 (2000): 728-735.

Osler, M.,Pesscott E., Gronbaek, M., Christensen, U., Due, P., and G. Engholm. "Income Inequality, Individual Income , and Mortality in Danish Adults: Analysis of Pooled Data from two Cohort Studies. British Medical Journal. 324(7328). (2002):13-16.

Ostir G V, Eschabach K, Markides K S and JS Goodwin. "Neighborhood Composition and Depressive Symptoms Among Older Mexican Americans". Journal of Epidemiology and Community Health. Volume 57 (2003);987-992.

Palloni, Alberto and Elizabeth Arias. "Paradox Lost: Explaining The Hispanic Adult Mortality Advantage". Demography. Volume 41. No.3. (August 2004); 385-415.

Pearl, Michelle., Braveman, Paula and Abrams, Barbara. “The Relationship of Neighborhood Socioeconomic Characteristics to Birthweight among 5 Ethnic Groups in California”. American Journal of Public Health. Volume 91, No. 11. (November 2001): 1808-1814.

Phillis R.C. and D.J. Lanski. “Outcomes Management in Heart Value Replacement Surgery: Early Experience”. Journal of Heart Value Disease. (1992): 42-50.
Pritchett, Lant and Lawrence H Summers. “Wealthier is Healthier”. The Journal of Human Resources. Volume 31. No.4 (Autumn 1996); 841-868.

Public Policy Institute of California. “The Economic Progress of Mexican Americans”. Research Brief. Issue No. 59. (May 2002).

Rainwater, David L., Mitchell, Braxton D., Comuzzie, Anthony G., VandeBerg, John L., Stern, Michael P., and MacCluer, Jean W. “Associations among 5-Year Changes in Weight, Physical Activity, and Cardiovascular Disease Risk Factors in Mexican Americans”. American Journal of Epidemiology. Volume 152, No. 10. (2000): 974-82.

Rampal, P., C. Martin, P. Marquis, J. E. Ware, and S. Bonfils. “A Quality of Life Study in Five Hundred and eighty-one Duodenal Ulcer Patients: Maintenance versus Intermittent Treatment with Nizatidine. Scandinavian Journal of Gastroenterology. (1994):44-51.

Rauh, Virginia A., Andrews, Howard F., and Garfinkel, Robin S. “The Contribution of Maternal Age to Racial Disparities in Birthweight: A Multilevel Perspective”. American Journal of Public Health. Volume 91, No. 11. (November 2001): 1815-1824.

Reagan, Patricia B and Olsen, Randall J. “You Can Go Home Again: Evidence from Longitudinal Data”. Demography. Volume 37, No. 3. (August 2000): 339-350.

Reagan, Patricia B and Pamela J Salsberry. “Black/White Differences in Birthweight: Broadening the Social Context”. Social Science and Medicine. Forthcoming.

Reagan, Patricia B, Salsberry Pamela J and Randall J Olsen. “Relative Deprivation and Health: the Mediating Influence of Healing Behaviors”. Working Paper. The Ohio State University. (2005).

Raji, M A, Ostirs G V, Markides K S, Espino David V and James S Goodwin. “Potentially Innapropiate Medication use by Elderly Mexican Americans”. Annals of Pharmacotherapy. Volume 37 (2003): 1197-1202.

Rosenberg, H. M, Maurer J D, Sorlie N J, Johnson M F, MacDorman D L, Hoyert D L, Spitler J F and C Scott. “Quality of Death Rates by Race and Hispanic Origin: A Summary of Current Research, 1999”. Vital and Health Statistics, Series 2. National Center for Health Statistics.

Rosenzweig, Mark R and Schultz, Paul T. “Estimating a Household Production Function: Hetereogeneity, the Demand for Health Inputs, and Their Effects on Birth Weight”. The Journal of Political Economy. Volume 91, Issue 5. (October 1983): 723-746.

Rosenwaike, I. “Mortality Experience of Hispanic Populations”. Mortality of Hispanic Populations. Edited by I. Rosenwaike . New York: Greenwood Press.

Runciman, W.G. “Relative Deprivation and Social Justice”. London. Routledge and Kegan Paul. (1966).

Sampson, R.J., S. W. Raudenbush and F. Earls. Neighborhoods and Violent Crime: a Multilevel Study of Collecive Efficacy. Science 277 (1997): 918-924.

Singh, Gopal K, and Mohammad Singhpush. “All Cause and Cause Specific Mortality of Immigrants and Native Born in the United States”. American Journal of Public Health. Volume 91. No. 3. (March 2001);392-399.

Singh, Gopal K, and Mohammad Singhpush. “Ethnic-Immigrant Differentials in Health Behaviors, Morbidity, and Cause Specific Mortality in the United States: An Analysis of two National Data Bases”. Human Biology, Volume 74. No.1. (February 2002); 83-109.

Singer, E. "Reference Groups and Social Evaluations." in M. Rosenberg & R.H. Turner (eds.)Social Psychology: Sociological Perspectives. (1981)New York: Basic Books, Inc.

Sorlie, Paul D., Eric Blacklund, Nornan J. Jhonson, and Eugene Rogot. “Mortality by Hispanic Status in the United States.” The Journal of the American Medical Association. (1993):2464-2468.

Stark Oded and J Edward Taylor. “Migration Incentives, Migration Tyoes: The Role of Relative Deprivation”. The Economic Journal. Volume 101. (September 1991): 1163-1178.

Sturm Roland and Carole Roan Gresenz. “Relations of Income Inequality and Family Income to Chronic Medical Conditions and Mental Health Disorders: National Survey”. BMJ. (Jan 2002) 324: 20.

Suarez, Lucina., Hendricks, Katherine A., Cooper, Aharon P., Sweeney, Anne M., Hardy, Robert J., and Larsen, Russell. “Neural Tube Defects among Mexican American Living on the US-Mexico Border: Effects of Folic Acid and Dietary Folate”. American Journal of Epidemiology. Volume 152, No. 11. (2000): 1017-23.

Subramanian, S., Kawachi, I., and B., P., Kennedy. “Does the State you Live in Make a Difference. Multilevel Analysis of Self-Rated Health in the US.” Social Science and Medicine. 53(1) (2001): 9-19.

Subramanian, S., Blakely, T., and I. Kawachi. "Income Inequality as a Public Health Concern: Where do we Stand? Commentary on: Is expose to Income Inequality a Public Health Concer?" Health Service Research. 38 (1). (2003): 153-167.

Subramanian, S and I. Kawachi. "Income Inequality and Health: What Have we Learned so Far?", Epidemiologic Review. Volume 26 (2004):78-91.

Thornton, James. "Estimating a Health Production Function for the US: Some New Evidence". Applied Economics, Volume 34. (2002); 59-62.

Trejo, Stephen J. "Why do Mexican Americans Earn Low Wages?". The Journal of Political Economy. Volume 105, Issue 6. (December 1997): 1235-1268.

U.S. Department of Labor and Center for Human Resource Research, The Ohio State University. "NLSY79 User's Guide". (2001).

Ventura, Stephanie, Hamilton Brady E and Paul D. Sutton. "Revised Birth and Fertility Rates for the United States, 2000 and 2001." National Vital Satistics Reports. Volume 51 No. 4 (February 3003).

Ware, John E. Jr., Mark Kosinski, and Susan D. Keller. "SF-12: How to Score the SF-12 Physical and Mental Health Summary Sacales". The Health Institute, New England Medical Center, Boston Massachusetts. (March 1995).

Ware, John E. Jr., Mark Kosinski, and Susan D. Keller. "SF-36 Physical and Mental Health Summary Scales: A User's Manual". The Health Institute, New England Medical Center, Boston Massachusetts. (December 1994).

Warren, John Robert. "Educational Inequality among White and Mexican-Origin Adolescents in the American Southwest: 1990". Sociology of Edication. Volume 69 (April 1996): 142-158.

Waters, Mary C., and Karl Eschbach. "Immigration and Ethnic Inequality in the United States". Annual Review of Sociology. Volume 21.(1995): 419-446.

Weinberg, Bruce A, Reagan Patricia N and Jeffrey Yankow. "Do Neighborhoods affect Work Behavior? Evidence from the NLSY79". Forthcoming in the Journal of Labor Economics.

Wilkinson, Richard G. "Unhealthy Societies. The Afflictions of Inequality". London; New York: Routledge (1996).

Wolfe, Frederick. "The Psychometrics of Functional Status Questionnaires: Room for Improvement". The Journal of Rheumatology. (2002).

Yitzhaki, Scholomo. “Relative Deprivation and the Gini Coefficient”. Quarterly Journal of Economics. Volume 93. (1979):321-324.

Zapata J and R Shippee-Rice. “The Use of Folk Healing and Healers by Six Latinos Living in New England”. Journal of Transcultural Nursing. Volume 10. No.2 (1999):136-142.

Zweifel, P. and Breyer, F. “Health Economics”. Oxford University Press, Oxford. (1997).

APPENDIX A

	MCS	PCS	Smoke	Obese	Pactivi
mexam	1.28* (0.45)	-0.10 (0.44)	-0.17* (0.02)	0.11* (0.02)	-0.05** (0.03)
immexam	-0.04 (0.73)	1.54* (0.71)	-0.04 (0.04)	-0.08** (0.04)	0.03 (0.04)
imother	0.39 (0.73)	0.28 (0.71)	-0.003 (0.04)	-0.02 (0.04)	-0.04 (0.04)
mheight	-0.01 (0.01)	-0.02* (0.01)	0.001* (0.0004)	-0.001 (0.0004)	-0.001 (0.0005)
fheight	0.01 (0.01)	0.01 (0.01)	0.0002 (0.0004)	-0.001 (0.0004)	0.0004 (0.0004)
male	3.20* (0.77)	3.05* (0.76)	-0.07** (0.04)	0.05 (0.04)	0.18* (0.05)
married	2.05* (0.30)	0.93* (0.29)	-0.08* (0.02)	-0.003 (0.02)	0.01 (0.02)
lnpcinc	0.14* (0.04)	0.14* (0.03)	-0.003 (0.002)	0.0001 (0.002)	0.001 (0.002)
pcincmis	0.57 (0.49)	0.59 (0.48)	-0.04 (0.03)	0.003 (0.03)	-0.01 (0.03)
hgc12	1.12* (0.48)	2.09* (0.47)	-0.14* (0.02)	0.01 (0.03)	0.11* (0.03)
hgc12m	1.50* (0.52)	2.95* (0.51)	-0.24* (0.03)	-0.03 (0.03)	0.19* (0.03)
hgc16	1.61* (0.53)	4.218 (0.52)	-0.39* (0.03)	-0.09* (0.03)	0.33* (0.03)
hplan	-0.12 (0.40)	-0.34 (0.39)	-0.06* (0.02)	0.04* (0.02)	0.02 (0.02)
psusmokd	0.46 (1.04)	-1.74 (1.02)	0.17* (0.05)		
psuobese	-0.68 (1.12)	-1.12 (1.09)		0.20* (0.06)	
psuavtiv	0.48 (0.98)	1.77** (0.96)			0.24* (0.06)
_cons	47.53* (0.97)	47.00* (0.95)	0.57* (0.04)	0.19* (0.05)	0.005 (0.05)
R^2	0.05	0.05	0.13	0.03	0.08

Table A.1. Reduced Form Equations
* Statistically significant at 5% level.
** Statistically significant at 10% level.

Variable	MCS	PCS
mexam	0.99* (0.42)	-0.14 (0.41)
immexam	-0.13 (0.72)	1.31* (0.70)
imother	0.43 (0.72)	0.34 (0.70)
smokea	-1.33* (0.36)	-1.49* (0.35)
obesea	-0.05 (0.52)	-3.27* (0.51)
pactivi	1.43* (0.29)	2.01* (0.28)
mheight	-0.01 (0.01)	-0.02* (0.01)
fheight	0.01 (0.01)	0.01 (0.01)
male	2.90* (0.77)	2.74* (0.75)
married	1.94* (0.29)	0.76* (0.28)
lnpcinc	0.13* (0.03)	0.13* (0.03)
pcincmis	0.54 (0.49)	0.54 (0.48)
hgc12	0.83 (0.47)	1.68* (0.46)
hgc12m	0.95 (0.52)	2.06* (0.50)
hgc16	0.69 (0.53)	2.87* (0.52)
_cons	48.00* (0.75)	47.43* (0.73)
R^2	0.06	0.08

Table A.2. OLS Regressions for Longitudinal Effects.
* Statistically significant at 5% level.
** Statistically significant at 10% level

Variable	MCS	PCS	Smoke	Obese	Pactivi
mexam	1.66 (1.06)	-0.28 (1.01)	-0.16* (0.02)	0.04* (0.01)	-0.05* (0.03)
immexam	-0.05 (1.28)	1.01 (1.22)	-0.04 (0.03)	-0.06* (0.02)	0.03 (0.04)
imother	0.45 (0.92)	0.39 (0.87)	-0.01 (0.03)	-0.02 (0.02)	-0.04 (0.04)
smokea	2.06 (6.30)	-3.78 (5.97)			
obesa	-0.72 (14.65)	-4.78 (13.94)			
pactivi	1.77 (5.15)	5.21 (4.99)			
mheight	-0.01 (0.01)	-0.01 (0.01)	0.001** (0.0004)	-0.0003 (0.0002)	-0.001 (0.0005)
fheight	0.01 (0.01)	0.01 (0.01)	0.0003 (0.0003)	-0.0001 (0.0002)	0.0004 (0.0004)
male	2.98* (1.40)	2.12 (1.34)	-0.04 (0.04)	0.03 (0.03)	0.18 (0.05)
married	2.14* (0.59)	0.58 (0.56)	-0.05* (0.01)	-0.01 (0.01)	0.01 (0.02)
lnpcinc	0.14* (0.04)	0.13* (0.04)	-0.001 (0.002)	0.001 (0.001)	0.002 (0.002)
pcincmis	0.63 (0.54)	0.49 (0.51)	-0.02 (0.02)	-0.002 (0.02)	-0.01 (0.03)
hgc12	1.08 (0.80)	1.07 (0.76)	-0.08* (0.02)	-0.02 (0.02)	0.11* (0.03)
hgc12m	1.49 (1.62)	0.90 (1.54)	-0.18* (0.02)	-0.06* (0.02)	0.19* (0.03)
hgc16	1.59 (2.35)	0.92 (2.24)	-0.29* (0.02)	-0.08* (0.02)	0.33* (0.03)
hplan			-0.07* (0.02)	0.03* (0.01)	0.02 (0.02)
psusmokd			0.22* (0.05)		
psuobese				0.18* (0.06)	
psupactiv					0.258* (0.06)
cons	46.60* (4.36)	48.23* (4.15)	0.41* (0.04)	0.07* (0.03)	0.01 (0.05)
χ^2	155.45	162.67	421.56	77.16	283.48

Table A.3. 3SLS Regressions for Longitudinal Effects.
* Statistically significant at 5% level.
** Statistically significant at 10% level