ABSTRACT

COOMER, NICOLE MICHELLE. Bilingualism, Wage Differentials and the Minimum Wage--Three Essays in the Economics of Labor and Health. (Under the direction of Walter J. Wessels.)

This study analyzes three separate topics in labor economics. The first essay examines bilingual registered nurses (RNs). Bilingual RNs are found to earn higher wages than monolingual nurses. A direct measure of fluency in a language other than English is used to examine the source of the bilingual wage premium. Two avenues for the premium are examined, (1) a response to demand for bilingual workers and (2) a response to accounting for a portion of innate ability and skills that would otherwise have been unobserved by the firm. Regressing interactions of various language regions and fluency indicators provides limited evidence for the premium arising from an increase in demand for bilinguals. The premium is found to be due to accounting for levels of skill and ability that would otherwise be unknown to the firm.

The second essay analyzes the wage differential between black and white nurses. The average observed wage of black RNs is higher than that of white RNs in the National Sample Survey of Registered Nurses (NSSRN). This result is diametrically different from what is seen in most studies of the black-white wage differential. This paper examines the wage differential between black and white nurses in the NSSRN to determine the sources of the differential. Several potential explanations are examined including differing endowments, differing returns to endowments, concentration effects, distribution effects, differences in distaste for positions, shift work, and actual experience. A decomposition of the differential showed that black nurses have on average better endowments than white nurses which leads to higher wages. However, white nurses receive better returns to their endowments on average, an indication of discrimination against blacks. Support is found for a demand side effect and self-selection.

The third essay examines the effect of the minimum wage on teenage employment. Unlike previous studies of the minimum wage which have focused on its effect on overall employment, including uncovered jobs paying less than the minimum wage this study examines the loss of covered jobs paying the minimum wage or higher. Concurrently systematic error in the dependent variable is addressed. The minimum wage elasticity of labor supply for covered employment is significantly more elastic than that for total employment even after correcting for systematic error. The effect of the minimum wage on covered employment is at a minimum three times as large as the effect on total employment.

Bilingualism, Wage Differentials and the Minimum Wage--Three Essays in the Economics of Labor and Health

by
Nicole M. Coomer

A dissertation submitted to the Graduate Faculty of
North Carolina State University
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

Economics

Raleigh, North Carolina

2008

APPROVED BY:

Peter Arcidiacono	Daniel Phaneuf
Steven Allen	Walter J. Wessels Chair of Advisory Committee

DEDICATION

This dissertation is dedicated to my parents, Sue Clifford and Don Coomer. I am grateful for their unwavering support and encouragement.

BIOGRAPHY

Nicole M. Coomer was born in Louisville, KY on June 8th, 1981 to Sue Clifford and Don Coomer. While attending Louisville Male High School she ran for the track and cross country teams. Nicole attended Bellarmine University in Louisville, KY where she received a Bachelor of Arts in Economics with a minor in Mathematics in May 2003. While at Bellarmine University Nicole was a member of the track and field team and was selected for the Academic All Conference Team in 2000, 2001, 2002 and 2003. Nicole was also a member of the professional fraternity of Delta Sigma Pi. In the fall of 2003 she entered the Economics PhD program at North Carolina State University. Nicole worked as a teaching assistant from 2003 to 2005 and as an instructor from 2005 to 2008 for the economics department. In July of 2006 Nicole presented at the 6th Annual European Conference on Health Economics in Budapest, Hungary. She also performed research for the University of North Carolina Board of Governors in 2006. Nicole presented at the Capitalism and Markets Seminar at Clemson University in August of 2008. Upon receipt of her PhD Nicole looks forward to starting a career in consulting and health and labor policy analysis.

ACKNOWLEDGEMENTS

I am deeply indebted to my advisor, Professor Walter Wessels. This dissertation would not have been possible without his support and invaluable contributions. He provided clarity and showed enthusiasm throughout this endeavor. Special thanks are also due to Peter Arcidiacono for his support, contributions and positive perspective. I would also like to thank Daniel Phaneuf and Steven Allen for their assistance and helpful input.

On a personal level I would like to thank my family, particularly my parents Sue and Tom Clifford and Don and Evell Coomer, for their understanding, support and unconditional love. In addition, the friendships of many of my fellow graduate students helped contribute to my success and made graduate school bearable, principally Kristen Collett-Schmitt, Nasim Lari, Christina Robinson, Mitchell Dudley, and Anton Bekkerman. Thanks are also due to my friends, who are not necessarily interested in economics for their patience and tolerance over the past five years, especially Cindy Guinn, Jennifer Mayabb, Adam Jenkins, Jessica Elliott and Jennifer Dimitri. Professors Myra McCrickard and Frank Raymond at Bellarmine University are owed a debt of gratitude for encouraging me to follow this path and supporting me along the way. I would also like to thank Samuel V. Noe for his encouragement and belief in my ability. Finally, I thank God for allowing me this opportunity and providing the means for me to succeed.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

Returns to Bilingualism in the Nursing Labor Market – Demand or Ability?

Introduction

In recent decades the composition of the United States population has changed, progressing towards a larger fraction of non-native English speakers and individuals with limited English proficiency. The portion of the population that is foreign born or speaks a language other than English at home has increased steadily since the 1990's. While previous studies have shown that immigrants speaking English earn more, this essay examines whether persons fluent in languages other than English earn more in the United States labor market. The recent increase in immigration brings both a demand for people speaking non-English languages as well as a supply. This paper examines whether nurses who speak a foreign language earn more. It finds that they do, then examines if the source of the higher wages is due to added productivity from being able to communicate with individuals with limited English proficiency or whether it is due to those having the ability to speak two languages being more able.

It is clear that bilingualism has value in the labor market as bilinguals receive a premium when compared to monolinguals. Among registered nurses, those who are bilingual earn 11% more than monolinguals.[1] However, it is not clear how the influence of this ability on earnings arises. Recent literature focuses primarily on immigrants and the returns received from learning English. This paper differs from the current literature by

[1] Table 1.1: Summary Statistics

examining the returns to knowledge of a language other than English, given that English is spoken fluently. This approach allows inclusion of native English speakers who have learned a second language as well as those who have learned English as a second language. By limiting the analysis to those who are fluent in English, it is possible to discern the effects of the non-English language on earnings.

Registered nurses are an ideal group to use to investigate the issue. They are a highly homogenous group; all have post-secondary education and the majority of nurses are married white women. By using a homogeneous group, the amount of heterogeneity in unobserved skills is reduced allowing more precise estimation of the effects of bilingualism. Additionally, in the medical field, communication between staff and patients is of upmost importance. Consider the Bureau of Labor Statistics description of nursing:

> Registered nurses (RNs), regardless of specialty or work setting, perform basic duties that include treating patients, educating patients and the public about various medical conditions, and providing advice and emotional support to patients' family members. RNs record patients' medical histories and symptoms, help to perform diagnostic tests and analyze results, operate medical machinery, administer treatment and medications, and help with patient follow-up and rehabilitation.
>
> RNs teach patients and their families how to manage their illness or injury, including post-treatment home care needs, diet and exercise programs, and self-administration of medication and physical therapy. Some RNs also are trained to provide grief counseling to family members of critically ill patients. RNs work to promote general health by educating the public on various warning signs and symptoms of disease and where to go for help. RNs also might run general health screening or immunization clinics, blood drives, and public seminars on various conditions.

The emphasis on communication in nursing provides opportunity for bilingualism to be an important skill to possess. To date there is no explanation for why increased earnings arise for bilingual individuals who speak English fluently as one of the languages.

There are two main avenues that may bring about the increased wages. They may occur as a response to an increase in demand for bilingual workers, or knowledge of a foreign language may signal a higher level of unobserved ability. This paper develops an empirical method to test the plausibility of each avenue, utilizing data on registered nurses.

The methodology is based in standard human capital theory. The data on individuals is used to estimate wage equations, controlling for observable characteristics including knowledge of a language in addition to English as well as controlling for the demand of bilinguals. The results provide limited support for the increased wages arising from an increase in demand. Specifically, they show that Spanish-speaking bilinguals working in a metropolitan statistical area (MSA) earn higher wages in areas with higher proportions of Hispanics. The results are robust across several specifications and various controls for the demand of bilinguals.

This essay is organized as follows: The second section provides an overview of the human capital literature and background information on the nursing market. The next section discusses the data. The fourth section presents the empirical specification and is followed by a presentation of the results in the fifth section. A conclusion and suggestions for future research end the essay.

Background

Human Capital

Human capital refers to the skills, knowledge and abilities that an individual possesses and is an important factor in determining wages of individuals. Some forms of human capital are observable to the researcher, such as education, on the job training and experience, while many other forms are hard to measure or unobservable. These forms of human capital include innate ability, interpersonal skills, motivation and work ethic. Many studies have found unobserved human capital to be an important wage determinant. These studies have utilized various proxies for unobserved ability such as test scores (Blackburn and Neumark, 1992; Taber, 2001; Blackburn and Neumark, 1993), family background variables (Blackburn and Neumark, 1992), literacy (Green and Riddell, 2002), as well as dowries and the age of a man's wife (Behrman et al 1995).

A form of human capital that is receiving mounting attention in the literature is bilingualism. In the United States this has been brought about by increases in immigration over the past decade. Recent immigration has changed the composition of the labor force, with the percentage of the labor force that is foreign born increasing from 9.7% in 1999 to 14.4% in 2005.[2] Many of these immigrants speak a language other than English at home. The percentage of the population with a non-English home language rose from 13.8% in

[2] BLS Labor Force Characteristics of Foreign-Born Workers Summary

1990 to 18.7% in 2004.[3] Indeed many businesses are now advertising their ability to communicate in Spanish in commercials and store windows.

Communication between consumers and producers is important to the functioning of markets. With the growing number of non-native English speakers, the ability to communicate in languages other than English is becoming increasingly necessary. The Wall Street Journal published an article on bilingual employees in 1996 in which these employees claimed to deserve a wage premium because they performed work above and beyond their standard duties. Many employers including the U.S. Customs Service paid premiums to their bilingual workers. The premium ranged up to 18% among employers in the article, covering a large range of occupations.[4] As the composition of the population continues to change towards a larger portion of non-English speaking individuals, we should expect to see returns to knowledge of a second language.

The literature on language fluency has focused primarily on immigrants learning the language of their destination country.[5] The typical result of these studies is that increased fluency in the destination language increases earnings. This result has been shown to hold across different origin and destination countries. Lopez (1999) examined the impact of speaking two languages proficiently on the earnings of males who did not speak English prior to entering school. European and Asian language destination bilinguals who reported being very proficient in English received higher wages than English monolinguals. This did

[3] Census Language Use Data and The American Community Survey
[4] Occupations include but are not limited to receptionist, flight attendant, phone operators, and brokers.
[5] These individuals are referred to as destination bilinguals.

not hold true for Spanish language destination bilinguals. Even after controlling for characteristics such as age, race and marital status, Spanish speaking destination bilinguals performed worse in the U.S. labor market than monolingual English speakers (Bloom and Grenier 1993). Moreover, the gap is larger for men than it is for women. Compared to monolinguals, those who speak Spanish as their usual language earn wages that are 23% lower than those who speak English. Those who speak Spanish as a second language and English as their first earn wages that are 9% lower (Grenier 1984). Hispanics typically have lower levels of education than non-Hispanic whites which may account for part of the gap. Lopez (2002) shows that there is neither improvement in educational attainment nor closure in the earnings gap for non-native English speakers that participate in English language classes.

In Germany, married immigrants who report higher levels of German fluency and education earn more than other immigrants (Dustmann and vanSoest 2001). Fry and Lowell (2003) show that nominal wages of bilinguals exceed those of monolinguals; however after accounting for human capital differences there is no statistical difference. Educational attainment explains the earnings gap, while the presence of language enclaves and occupation do not affect the results. The relation between language and earnings is complicated. As Chiswick and Miller (1995) report, the two are often endogenous, at least among immigrants. They show that individuals who anticipate higher earnings are more likely to become fluent in the destination language. At the same time those fluent in the destination language are more likely to receive higher returns from schooling and training.

Various studies examine the effects of language proficiency in a bilingual economy, often where bilingualism is subject to state protection, such as Wales and Canada (Henley and Jones, 2005; O'Leary et al. 2001; Carliner, 1981; Shapiro and Stelcner, 1981, 1982). Typically the results show an increase in raw earnings for learning a second language. There is less of a gap between bilingual and monolingual women than men. Among Canadian men, English speakers for whom English is their mother tongue earn the most. Other factors that are important include human capital, discrimination and migration effects. The United States is different from these countries as it is not a bilingual nation. More than half the states have laws declaring English as the official language.[6]

The Nursing Market

The labor market for nurses is unique in several ways. Nursing is a predominately female field. In 1977, 1.92% of nurses were male. This number has risen to 5.8% in 2004.[7] There are also strict requirements to become a RN. All RNs must complete one of three educational paths and obtain a license from a state agency in order to be employed. There exists variation in licensing schemes across states but nurses nationwide face the same educational choices. They may (1) earn a nursing diploma, (2) obtain an associate degree or (3) obtain a bachelor's degree. All three options require education beyond high school. The nursing diploma typically takes three years to earn and is completed in a hospital. Associate degree programs typically take two years to complete and require course and clinical work

[6]English in the 50 States: http://www.proenglish.org/issues/offeng/states.html
[7] From the 1977 and 2004 National Sample Survey of Registered Nurses (NSSRN)

in practical patient care. The final option, the bachelor's degree, on average takes four years to complete. Similar to the associate degree, the bachelor's degree requires course and clinical work, but in both practical and theoretical patient care. There are also several advanced degrees that nurses may obtain including master's degrees, nurse practitioner degrees and doctorate degrees. The advanced degrees are not required to become a registered nurse, though they are required for many administrative positions.

In the nursing industry, RNs have several choices of work environments. The most common are hospitals, physician offices and nursing homes. Each of these settings has different workloads and different job requirements. RNs working in hospitals typically face higher levels of responsibility, greater physical demands and more shift work than nurses in other settings (Lehrer et al. 1991). There exists a premium to hospital work for RNs. Schumacher and Hirsch (1997) find premiums of 20% and 23% for hospital work when compared to nursing homes and physicians offices. From 33% to 50% of the premium is due to hospitals attracting nurses with higher levels of unobserved ability, 10% is due to shift work and the majority of the remainder is due to other work conditions. Further, among nurses with five years or less experience those with Bachelor degrees have an 88% probability of working in a hospital and those with an Associate degree have an 81% probability. From 1977 to 2004 roughly 50% of nurses worked in hospitals.

Booton and Lane (1985) show that the returns to education in nursing are not persistent through time for degree nurses. They also vary across the experience profile. For RNs with less than five years of experience, those with Bachelor degrees have the highest

return, followed by diploma RNs and then those with Associate degrees. After five years of experience, those with Associate degrees have higher returns than diploma RNs (Lehrer et al. 1991). The latter result is again found among nurses without looking across the experience profile, as well as, small returns to non-nursing education (Schumacher 1997). Returns to experience are quadratic with the turnaround after 20 years of experience (Schumacher and Hirsh 1997). Foreign nurses also experience a wage penalty of 4% for the first several years they work in the U.S. The penalty and the length that it is present vary by country of origin (Schumacher 2006).

Data

The data for this study come from the 2000 and 2004 National Sample Survey of Registered Nurses (NSSRN) General Public Use Files. The NSSRN is collected by the Health Resources and Services Administration (HRSA) every four years with the exception of the second survey which occurred three years after the first. The data have been collected since 1977 and provide information on RNs throughout the country. This information includes but is not limited to standard demographics, education, labor force status, income and specialty. The 2000 and 2004 surveys ask if the respondent is fluent in a language other than English. The 2000 survey specifies Spanish, French and Other. The 2004 survey provides more detail. Individuals may specify up to three separate foreign languages. The survey classifies Spanish, French, Filipino and other Asian languages as separate variables

in addition to three other language variables that specify 14 different language groups.[8] The target population of the survey is all RNs with active licenses. The survey is administered via postal mail to a probability sample of the target population.

There are several reasons for utilizing this data. First, all respondents are proficient in English: to become a nurse, native or immigrant, one must pass a licensing exam. Second, the survey explicitly asks if the nurse is fluent in a language other than English. Third, in the medical field, communication between nurses, doctors and patients is paramount. Kuo et al. (2007) shows that patients with limited English proficiency are at risk for impaired health from increased stays in emergency departments, a greater number of adverse events during hospitalization, and decreased adherence to prescribed medicine, treatments and follow-ups. Further, among pediatricians, 70% regularly use family members and 58% bilingual staff to communicate with limited English proficiency patients. Only 40% use professional interpreters. Practices that are small in size, located in rural areas or located in states with higher proportions of limited English proficiency speakers use the fewest professional interpreters. The registered nurse (RN) labor market is a prime place to examine the returns to bilingualism given the importance of communication in conjunction with the increases in the non-native English-speaking population and the homogeneity of required skills and education of nurses.

[8] The language groups are African, American Sign Language, Semitic (Arabic, Hebrew), Asian Pacific (excluding Philippines and Chinese dialects), Filipino, Scandinavian (Danish, Norwegian, Swedish), Germanic (Dutch, German, Yiddish), Baltic/Uralic (Estonia, Latvia, Lithuania/Finish, Hungarian), Romantic (excluding French and Spanish), French, Chinese (Cantonese, Mandarin), Slavic, Spanish and Other

The 2000 and 2004 NSSRN together contain a total of 71,303 records. Only nurses employed in a nursing position in the United States during the survey period without missing observations are included in this study, leaving a sample size of 49,958[9]. A measure of experience is constructed equal to the nurse's age minus schooling minus five (Schumacher 1997). [10] Race is limited to identifying if a person is white, black, or other. For both years a variable, *other language*, is created to indicate fluency in a language other than Spanish.

Table 1.1 contains summary statistics for the sample. The majority of the nurses are female (94%), white (86%), and live in a metropolitan statistical area (84%). Roughly 71% of the nurses are married and 11% have never been married. The average age is 44 years and the average years of experience is 24 years. About 16% of the sample has a non-nursing degree and the most common nursing degree is an associate degree (45%), followed by a bachelor degree (32%), then a diploma (24%). Approximately 60% of the RNs work in a hospital. With regards to fluency, 9% of the nurses speak a language in addition to English, 3.3% speak Spanish and 5.6% speak another language. While the average income of all nurses is $43,123 per year, the average among bilinguals is $47,496 and among monolinguals $42,715. Nearly 92% of the bilingual nurses reside in MSAs.

Data are also taken from the Census Bureau. The data include the percentage of the population that speaks a language other than English at home and the percentage of the

[9] Some RNs with active licenses work outside of the nursing field. These nurses are not employed in nursing positions and thus not included in the sample.
[10] Years of schooling are assigned as, 14 for associate degree, 15 for diploma, 16 for bachelor degree and 18 for a graduate degree.

population that is Hispanic, both by state. These variables are used to define language regions within the United States as discussed below. The data are presented in Tables 1.A3 and 1.A4 in the appendix.

Method

Motivation

It is possible that the positive returns to bilingualism are due to two factors. First, the returns could be a response to an increased demand for bilingual workers. As the population diversifies in primary languages workers with those language skills may provide an additional service to firms. If the demand for bilingual nurses is directly related to the foreign speaking population, then we would expect bilingual nurses to earn more where they are relatively scarce. Table 1.A1 in the appendix illustrates where bilingual nurses are relatively scarce by comparing the percentage of nurses that are bilingual to the percentage of the population that speaks a language other than English at home in each state. Table 1.A2 in the appendix illustrates where bilingual nurses are relatively scarce by comparing Spanish-speaking nurses to the percent of the population that is Hispanic in each state. The states with the highest proportion of Hispanics have the largest disparity between the population and the proportion of Spanish-speaking nurses. This is true in many states for the home language classification. Since areas with relatively more Hispanics and larger proportions of individuals speaking a language other than English at home are often coupled

with small proportions of bilingual nurses, there is a demand based reason for bilingual nurses to receive a premium.

Second, the returns could be a manifestation of accounting for a portion of innate ability and skills that would otherwise have been unobserved by the firm. Those who are bilingual may have more innate ability and the bilingualism may be a signal of that innate ability.

Model

The common approach to human capital models and language models in particular is to utilize a standard wage equation (Schumacher, 2006; Lopez, 1992; Henley and Jones, 2005; Fry and Lowell, 2003; Grenier, 1984). The wage equation is assumed to be

$$w_i = \alpha + X_i\beta + \varepsilon_i \quad (1)$$

where w_i is the natural logarithm of the individual's earnings, X_i is a vector of human capital and other observable variables, and ε_i is a normally-distributed error term. To determine the factor driving the returns to bilingualism, assumptions about where the demand will arise must be made. It is assumed that the demand for bilingual workers will be higher in areas with a larger proportion of the population that speaks a language other than English at home. It is also assumed that the demand for Spanish-speaking bilinguals will be higher in areas

with a higher proportion of Hispanics. Two language region variables are defined: (1) a home language region denoted HLR, and (2) a Hispanic region.

The HLR is constructed from data on the percent of the population that speaks a language other than English at home. These data are available from the Census Bureau for both 2000 and 2004 for each state. The states are divided into four regions based on the percent of the population that speaks a language other than English at home. The first region, HLR1, consists of the 12 states with the lowest percent of the population that speaks a language other than English at home. The second region, HLR2, encompasses the next 13 states; the third region, HLR3, includes the following 13 states. Finally HLR4, the fourth region, consists of the 13 states with the highest percent of the population that speaks a language other than English at home. Table 1.A3 in the appendix presents the states by HLR.

The Hispanic regions are constructed in a similar manner using Census Bureau data by state on the percent of the population that is Hispanic. The states are divided into four regions. The first region, Hispanic Region 1, consists of the 12 states with the lowest percent of the population that is Hispanic. The remaining three regions have 13 states each, with those in Hispanic Region 4, having the highest percent of the population that is Hispanic. Table 1.A4 in the appendix presents the states by Hispanic region.

Several models are estimated including various combinations of fluency indicators, language regions, and interactions. As seen in Table 1.1, the average income for those who are fluent in a second language is substantially higher within MSAs than outside of MSAs.

Thus, in addition to estimating the models for the entire sample, the models are estimated by metropolitan residence as well. This will allow any suppressed effects from non-metropolitan areas to surface. The estimating equations are derived from the standard wage equation as seen above. The first specification examines the returns to knowledge of a foreign language in general:

$$w_i = \alpha + X_i\beta + \delta L_i + \varepsilon_i \quad (2)$$

In equation 2, X_i is a vector of individual human capital and demographic characteristics. Variables included in X_i are race, gender, marital status, nursing education, non-nursing education, experience and its square, a set of nursing specialty dummies, a set of Census region dummies, and indicators for MSA residence, foreign nursing education, and full time work. L_i is a bilingual fluency indicator. Three specifications of equation 2 are estimated – one for fluency in any language in addition to English and one each for Spanish fluency and Other Language fluency.

Equation 3 is similar to equation 2, however X_i now includes a set of language-region variables.

$$w_i = \alpha + X_i\beta + \delta R_i + \varepsilon_i \quad (3)$$

R_i is a vector of interactions between fluency indicators and language-region variables. Four specifications are estimated. The first three use the home language region dummies and

interactions with bilingual fluency indicators. The fourth specification uses the Hispanic region dummies and interactions with Spanish fluency. All the specifications for equations 2 and 3 are estimated separately by MSA residence as well. The specifications are the same as above excluding the MSA residence dummy variable.

Results

Table 1.2 shows the returns to bilingualism – with any second language in column one, Spanish in column 2, and Other Language in column 3. Being fluent in a second language to English shows a premium of 4.2%. Likewise there are positive returns to Spanish and other languages with premiums of 1.6% and 4.8% respectively. General and other language fluency are significantly different from zero at the 1% level.

Table 1.3a shows the results from interacting the fluency indicators with the percentage of the population that speaks a language other than English at home. There are positive returns to knowledge of a language other than English. However the returns are decreasing with the population composition variable except for general fluency where there is no effect. This decrease is offset by positive returns to working in a state with a higher percentage of the population that speaks a language other than English at home. Of further interest are the increased returns to individual language variables. The returns to Spanish and other language fluency rise to 5.5% and 6% respectively and are significantly different from zero: Spanish fluency is significantly different from zero at the 12% level and other fluency at the 5% level.

Table 1.3b shows the results from interacting the Spanish-fluency indicator with the percentage of the population that is Hispanic. Similar to the results for the home language region interactions, there are positive returns to knowledge of Spanish. The returns are decreasing with the percentage of the population that is Hispanic, and the decrease is offset by the positive returns to working in a state with a higher percentage of Hispanics. The return to speaking Spanish increased to 6% and is significantly different from zero at the 2% level.

The results from the interaction of the fluency variables with the home language regions are presented in Table 1.4. If the hypothesis that the positive returns to bilingualism are due to a response to demand for bilinguals, the premium will increase across regions. The premium should be the lowest in the home language region with the lowest proportion of individuals speaking a foreign language at home, HLR1, and highest in the home language region with the highest proportion of individuals speaking a foreign language at home, HLR4. Column 1 contains the general fluency results. In the lowest three regions there is no significant return to bilingualism and in HLR1 the returns are insignificant and negative. Only in HLR4 is there a significant return. Column 2 presents the results for Spanish fluency, in all four regions there are no significant returns. In the third column, the returns to speaking languages other than Spanish are presented. The returns are significant and positive in HLR3 and HLR4; however the returns are not significantly different across the two regions.

The results in Table 1.4 provided evidence both for and against the hypothesis that the positive returns to bilingualism are due to a response to demand. To further test this hypothesis, regions defined by Hispanic population are used. Table 1.5 presents the results from interacting Spanish fluency with the Hispanic region variables. Again, if the hypothesis holds that the positive returns to bilingualism are due to a response to demand for bilinguals, we would expect to see the premium increase across regions. The premium should be the lowest in the Hispanic region with the lowest proportion of Hispanic individuals, region 1, and highest in the Hispanic region with the highest proportion of Hispanic individuals, region 4. In all four regions, the returns are not significantly different from zero.[11] There is no evidence that the positive returns to bilingualism are in response to demand for bilingual workers.

The results in Tables 1.4 and 1.5 are robust to changes in the definitions of the Hispanic and home language regions. Alternative models (not shown) lead to the same results for bilingualism. Those models included dividing states into

- two regions (high and low);
- three regions (high, medium and low);
- three regions defined as below the mean, within one standard deviation above the mean and more than one standard deviation above the mean ; and
- four regions grouped by like proportions.[12]

[11] This result is not surprising given the research by Bloom and Grenier (1993) and Lopez (1999) where bilingual Spanish speakers earned less than monolingual English speakers.

[12] For the HLR regions, the four regions consist of states grouped by the following proportions: 0-5.9%,6-10.9%, 11-19.9% and 20+%. For the Hispanic regions, the four regions consist of states grouped by the following proportions: 0-4.9%, 5-9.9%, 10-19.9% and 20+%.

Further, the coefficients on the other independent variables do not vary significantly from specification to specification.

Table 1.6 shows the results for the specification seen in Table 1.2, stratified by MSA residence. In Table 1.6, the results indicate there are returns to bilingualism only for those residing in MSAs. Being fluent, in a second language to English, shows a premium of 4.6% to bilinguals within an MSA. Likewise there are positive returns to Spanish and other language fluency with premiums of 2.2% and 5% respectively for those within an MSA. This trend continues with the interaction of fluency indicators and home language regions. Table 1.7 presents results similar to those in Table 1.4, stratified by MSA residence. With the exception of HLR1, for general fluency there are no significant returns to bilingualism outside of an MSA. Within MSAs a pattern similar to Table 1.2 arises. Column 1 contains the general fluency results. In HLR1 and HLR3 there are no significant returns to bilingualism, and in HLR1 the returns are insignificant and negative. There are significant returns in HLR2 as well as HLR4. The significant returns in HLR2 are unexpected and likely driven by other language fluency. Columns 2 and 3 present the results for Spanish fluency and other language fluency respectively. In all four regions there are no significant returns to Spanish fluency. Other fluency is significant in HLR2, HLR3 and HLR4; however, the returns are not significantly different across regions. Table 1.8 presents the results from interacting Spanish fluency with the Hispanic region variables, stratified by MSA residence. Again there are no significant returns to bilingualism with this specification in or outside of MSAs.

Nurses working in different settings have different responsibilities and duties, including interactions with patients. A standard division of nurses is by hospital employment; nearly 60% of nurses work in hospitals. The model is estimated including interactions between the fluency indicators and hospital employment. Table 1.9 presents the results. The returns to bilingualism are lower for hospital employees than for non-hospital employees. This is expected as non-hospital nurses, such as those in nursing homes, doctor offices and clinics are more likely to have direct patient contact. To further investigate the relationship, the models estimated in Tables 1.4 and 1.5 were repeated, stratified by hospital employment status. The results were not significantly different from those presented above with the exception of Spanish fluency. The results for Spanish fluency are presented in Tables 1.10a and 1.10b. The results are similar to those presented in Tables 1.4 and 1.5 for the hospital nurses. However, for the non-hospital RNs there are positive and significant returns to Spanish fluency in Hispanic region 4. There are also positive and significant returns to Spanish fluency in HLR4. These results support the demand hypothesis.

Table 1.11 examines whether there are changes in the returns across time to bilingualism. Comparing 2000 to 2004 there is a notable difference. For general and Spanish fluency, the returns decreased from 2000 to 2004. This is a surprising result at first glance, however when population dynamics are examined the results are less surprising. From 2000 to 2004 there were not significant changes in the Hispanic proportion of the population, (an increase of approximately 1%), or the proportion that speaks a language other than English at home, (an increase of approximately 0.8%). Given this small change in the composition of

the population, the results across the two years provide evidence that the bilingual demand-driven component of the wage premium may have decreased between 2000 and 2004. The returns for other fluency increased and became significant in 2004.

Conclusion

Recent literature focuses primarily on immigrants and the returns received from learning English. This essay examines the wage premium received by bilinguals for whom English proficiency is given. A direct measure of fluency in a language other than English is used to examine the source of the bilingual wage premium.

Two avenues for the premium are examined, (1) a response to demand for bilingual workers and (2) a response to accounting for a portion of innate ability and skills that would otherwise have been unobserved by the firm. Regressing interactions of various language regions and fluency indicators provides limited evidence for the premium arising from an increase in demand for bilinguals. The interactions proved significant only for the most concentrated language regions. The results suggest that the majority of the premium is due to accounting for levels of skill and ability that would otherwise be unknown to the firms. Bilingual nurses, by learning a second language, signal to the market that they have higher ability and skills.

As more data become available on language use, including the 2008 NSSRN, the relationship between earnings and bilingualism should become clearer. As the composition of the population continues to change with respect to limited-English-proficiency

individuals, it is possible that the premium to bilinguals will also change as well as the avenue through which the premium arises. Likewise, data extending back into the 1990's or further would be of great use in discerning the language-wage relationship. Examination of the decision to learn a second language for native English speakers and the decision to immigrate for non-native speakers would likely greatly enhance this field of study as well. Unfortunately data of this sort is not readily available. This paper has shed some light on bilingualism in the U.S. labor market. Future research should focus on the choices involved in bilingualism in the U.S., as well as the labor market outcomes.

References

Alhburg, Dennis A. and Christine Brown Mahoney, (1996), "The Effect of Wages on the Retention of Nurses," *Canadian Journal of Economics*, 24 (Special Issue), pp. S126-S129.

Becker, Gary S., (1962),"Investment in Human Capital: A Theoretical Analysis," *The Journal of Political Economy*, 70(5) Part 2, pp. 9-49.

Becker, Gary S., (1964, 1993, 3rd ed.), Human Capital: A Theoretical and Empirical Analysis, With Special Reference to Education, Chicago, University of Chicago Press, ISBN 978-0-226-04120-9.

Behrman, Jere, Nancy Birdsall and Anil Deolalikar, (1995), "Marriage Markets, Labor Markets and Unobserved Human Capital: An Empirical Exploration for South-Central India," *Economic Development and Cultural Change*, 43(3), pp.585-601.

Blackburn, M., and D. Newmark, (1992), "Unobserved Ability, Efficiency Wages, and Interindustry Wage Differentials," *Quarterly Journal of Economics*, 107(4), pp.1421-1436.

Blackburn, M., and D. Newmark, (1993), "Omitted- Ability Bias and the Increase in Return to Schooling," *Journal of Labor Economics*, 11(3), pp. 521-544.

Bloom, David E. and Gilles Grenier, (1993), "Language, Employment and Earnings in the United States: Spanish-English Differential from 1970 to 1990," NBER Working Paper 4584.

Booton, LaVonne A. and Julia I. Lane, (1985), "Hospital Market Structure and the Return to Nursing Education," *The Journal of Human Resources*, 20(2), pp. 184-196.

Bruggink, Thomas H., Keith C. Finan, Eugene B. Gendel and Jeffrey S. Todd (1985),"Direct and Indirect Effects of Unionization on the Wage Levels of Nurses; A Case Study of New Jersey Hospitals," *Journal of Labor Research*, 6(4), pp. 405-416.

Buerhaus, Peter I. and Douglas O. Staiger, (1999),"Trouble in the Nurse Labor Market? Recent Trends and Future Outlook," *Health Affairs*, 18(1), pp. 214-222.

Buerhaus, Peter I., Douglas O. Staiger and David I. Auerbach, (2004), "New Signs of A Strengthening U.S. Nurse Labor Market," *Health Affairs*, Web Exclusive, pp. W4-526-W4-533.

Carliner, Geoffrey,(1981), "Wage Differences by Language Group and the Market for Language Skills in Canada," *Journal of Human Resources*, 16(3), pp.384-399.

Chiswick, Barry R. and Paul W. Miller, (1995), "The Endogeneity between Language and Earnings: International Analyses ," *Journal of Labor Economics*, 13(2), pp. 246-288.

Chiswick, Barry R. and Paul W. Miller,(1998), "Census Language Questions in North America," *Journal of Economic and Social Measurement*, 25, pp.73-95.

Chiswick, Barry R. and Paul W. Miller, (2002), "Immigrant Earnings: Language Skills, Linguistic Concentrations and The Business Cycle," *Journal of Population Economics*, 15(1), pp.31-57.

Dustmann, Christian and Arthur van Soest, (2001), "Language Fluency and Earnings: Estimation with Misclassified Language Indicators," *The Review of Economics and Statistics*, 83(4), pp. 663-674.

Feldman, Roger and Richard Scheffler (1982), "The Union Impact on Hospital Wages and Fringe Benefits," *Industrial and Labor Relations Review*, 35(2), pp.196-296.

Fradd, Sandra H. and Thomas D. Boswell, (1996), "Spanish as an Economic resource in Metropolitan Miami," *The Bilingual Research Journal*, 20(2), pp. 283-337.

Fritsch, Peter, (1996), "Tongue twister: Bilingual employees are seeking more pay, and many now get it," *Wall Street Journal*, New York, New York, November 13.

Fry, Richard and B. Lindsay Lowell, (2003), 'The Value of Bilingualism in the U.S. Labor Market," *Industrial and Labor Relations Review*, 57(1), pp.128-140.

Gould, Eric D., (2005),"Inequality and Ability," *Labour Economics*, 12(2),pp.169-189.

Green, David A. and W. Craig Riddell, (2002), "Literacy and Earnings: An Investigation of the Interaction of Cognitive and Unobserved Skills in Earnings Generation," *Labour Economics*, 10(2), pp.165-184.

Grenier, Gilles, (1984), "The Effects of Language Characteristics on the Wages of Hispanic-American Males," *The Journal of Human Resources*, 19(1), pp. 35-52.

Henley, Andrew and Rhian Eleri Jones,(2005), "Earnings and Linguistic Proficiency in a Bilingual Economy," *Manchester School*, 73(3), pp.300-320.

Holmås, Tor Helge, (2002), “Keeping Nurses at Work: A Duration Analysis,” Stein Rokkan Centre for Social Studies Bergen University Research Foundation, Working Paper 6-2002.

Kuo, Dennis Z., Karen G. O'Connor, Glenn Flores and Cynthia S. Minkovitz, (2007), “Pediatricians' Use of Language Services for Families With Limited English Proficiency,” *Pediatrics*, 119(4), pp. e920-e927.

Lehrer, Evelyn L., William D. White, and Wendy B. Young (1991), "The Three Avenues to a Registered Nurse License: A Comparative Analysis," *Journal of Human Resources*, 26(2), pp.262-79.

Link, Charles R., and Russell F. Settle, (1979), “Labor Supply Responses of Married Professional Nurses: New Evidence,” *Journal of Human Resources*, 4(2), pp.256-266.

Link, Charles R., and Russell F. Settle, (1981), “A Simultaneous-Equation Model of Labor Supply, Fertility and Earnings of Married Women: The Case of registered Nurses,” Southern Economic Journal, 47(4), pp.977-989.

Lopez, Mark,(2002), “Does Bilingual Education Affect Educational Attainment and Labor Market Outcomes? Evidence from the National Education Longitudinal Study of 1988 and High School and Beyond,” Working Paper School of Public Affairs, University of Maryland.

Lopez, Mark, “Does Speaking a Second Language Affect Labor Market Outcomes?,” unpublished paper, School of Public Affairs, University of Maryland, October 1999, http://pweb.jps.net/~lsbonnin/mark/wrkpapers.htm.

Nowak, Margaret J. and Alison C. Preston, (2001), “Can Human Capital Theory Explain Why Nurses are so Poorly Paid?,” *Australian Economic Papers*, 40(2), pp. 232-245.

O’leary, Nigel, PD Murphy, SJ Drinkwater and DH Blackaby, "English Language Fluency and the Ethnic Wage Gap for Men in England and Wales," *Economic Issues*, 6, 2001, pp. 21-32.

Schumacher, Edward J. , (1997),"Relative Wages and the Returns to Education in the Labor Market for Registered Nurses." In Solomon W. Polachek, ed. *Research in Labor Economics* 16 Greenwich, Conn.: JAI Press Inc., pp. 149-76,

Schumacher, Edward J. , (2006),"Foreign Nurses in the US Labor Market," Departments of Health Care Administration and Economics, Trinity University, Working Paper.

Schumacher, Edward J. and Barry T. Hirsch, (1997), "Compensating Differentials and Unmeasured Ability in the Labor Market for Nurses: Why Do Hospitals Pay More?," *Industrial and Labor Relations Review,* 50(4), pp. 557-579.

Shapiro, D.M. and M. Stelcner, (1981), "Male-Female Earnings Differentials and the Role of Language in Canada, Ontario and Quebec, 1970," *Canadian Journal of Economics*, 14(2), pp. 341-348

Shapiro, D.M. and M. Stelcner, (1982), "An Analysis of Earnings Disparities Among Linguistic Groups in Québec," *Industrial Relations,* 21(3), pp. 365-376.

Shields, Michael A. and Melanie Ward, (2001), "Improving nurse retention in the National Health Service in England: The Impact of Job Satisfaction on Intentions to Quit," *Journal of Health Economics*, 20, pp. 677–701.

Taber, Christopher R., (2001), "The Rising College Premium in the Eighties: Return to College or Return to Unobserved Ability?," *Review of Economic Studies*, 68(3), pp.665-691.

Weiss, Andrew, (1995), "Human Capital vs. Signaling Explanations of Wages," *Journal of Economic Perspectives*, 9(4), pp.133-154.

Table 1.1: Summary Statistics of the 2000 and 2004 NSSRN Sample

Female	93.95%	
White	85.70%	
Black	4.64%	
Age	44 years	
Single	10.50%	
Married	71.22%	
MSA Resident	83.91%	
Experience	24 years	
Staff Nurse	60.92%	
Hospital	58.66%	
Nursing Home	6.61%	
Income	$43,123	
Education		
Diploma	23.52%	
Associate Degree	44.65%	
Bachelor Degree	31.83%	
Non-Nursing Degree	15.82%	
Language		
Bi-lingual	8.95%	
Spanish	3.40%	
Other Language	5.58%	
	Bilingual	Monolingual
Income	$47,496	$42,715
MSA Resident	$48,541	$43,979
Non-MSA Resident	$40,627	$38,430
MSA Resident	91.54%	83.16%
Non-MSA Resident	8.46%	16.84%
n=49,958		

All statistics are calculated using sampling weights

Table 1.2: Returns to Bilingualism: No Interactions

	(1)	(2)	(3)
Fluent	0.042 *		
	(0.011)		
Spanish		0.016	
		(0.016)	
Other Language			0.048 *
			(0.014)
Experience	0.029 *	0.029 *	0.029 *
	(0.001)	(0.001)	(0.001)
Experience^2	-0.057 *	-0.057 *	-0.057 *
	(0.003)	(0.003)	(0.003)
MSA	0.119 *	0.120 *	0.120 *
	(0.006)	(0.006)	(0.006)
Female	-0.068 *	-0.068 *	-0.068 *
	(0.010)	(0.010)	(0.010)
Black	0.094 *	0.095 *	0.094 *
	(0.011)	(0.011)	(0.011)
Other Race	0.025 *	0.034 *	0.029 *
	(0.010)	(0.010)	(0.010)
Diploma-Nursing	0.010	0.010	0.010
	(0.008)	(0.008)	(0.008)
Bachelors-Nursing	0.042 *	0.043 *	0.043 *
	(0.006)	(0.006)	(0.006)
Full Time	0.585 *	0.586 *	0.585 *
	(0.007)	(0.007)	(0.007)
Hospital	0.213 *	0.213 *	0.213 *
	(0.007)	(0.007)	(0.007)
Nursing Home	0.022 *	0.023 *	0.022 *
	(0.011)	(0.011)	(0.011)
n	49,958	49,958	49,958
R^2	0.354	0.353	0.354

Standard errors in parentheses. Sampling weights used in estimation.

* Indicates significance at the 5% level or better

Other variables included in the regressions: dummy variables for marital status(2), non-nursing education(3), nursing position(15), region (8), and year, and indicators for foreign nursing training and prior LPN experience..

Table 1.3a:Returns to Bilingualism: Home Language Interactions

	(1)		(2)		(3)
Fluent*Percent Population That Speaks a Language Other Than English at Home	0.000 (0.001)	Spanish*Percent Population That Speaks a Language Other Than English at Home	-0.002 (0.002)	Other Language* Percent Population That Speaks a Language Other Than English	-0.001 (0.001)
Fluent	0.033 (0.020)	Spanish	0.055 (0.035)	Other Language	0.060 * (0.023)
Percent Population That Speaks a Language Other Than English at Home	0.004 * (0.000)	Percent Population That Speaks a Language Other Than English at Home	0.004 * (0.000)	Percent Population That Speaks a Language Other Than English at Home	0.004 * (0.000)
n	49,958		49,958		49,958
R^2	0.356		0.355		0.356

Standard errors in parentheses. Sampling weights used in estimation. * Indicates significance at the 5% level or better

Other variables included in the regressions: experience and its square indicators for MSA residence, gender, race, full time work, hospital work, nursing home work, marital status(2), nursing education (2), non-nursing education(3), nursing position(15), region (8), prior LPN experience and a year dummy.

Table 1.3b: Returns to Bilingualism: Hispanic Interactions

Spanish*Percent Population That is Hispanic	-0.003*	(0.001)
Spanish	0.060*	(0.026)
Percent Population That is Hispanic	0.003*	(0.000)
n	49,958	
R^2	0.355	

Standard errors in parentheses. Sampling weights used in estimation.

* Indicates significance at the 5% level or better

Other variables included in the regressions: experience and its square indicators for MSA residence, gender, race, full time work, hospital work, nursing home work, marital status(2), nursing education (2), non-nursing education(3), nursing position(15), region (8), prior LPN experience and a year dummy.

Table 1.4: Returns to Bilingualism: Home Language Region Interactions

	(1)		(2)		(3)
Fluent*HLR1 (b1)	-0.030	Spanish*HLR1 (b1)	-0.002	Other Lang*HLR1 (b1)	-0.042
	(0.030)		(0.046)		(0.039)
Fluent*HLR2 (b2)	0.023	Spanish*HLR2 (b2)	-0.009	Other Lang*HLR2 (b2)	0.049
	(0.026)		(0.048)		(0.028)
Fluent*HLR3 (b3)	0.007	Spanish*HLR3 (b3)	-0.001	Other Lang*HLR3 (b3)	0.044 *
	(0.021)		(0.034)		(0.023)
Fluent*HLR4 (b4)	0.052	Spanish*HLR4 (b4)	0.015	Other Lang*HLR4 (b4)	0.051 *
	(0.015)		(0.020)		(0.019)
HLR2	0.043 *		0.046 *		0.044 *
	(0.009)		(0.009)		(0.009)
HLR3	0.079 *		0.080 *		0.078 *
	(0.010)		(0.009)		(0.009)
HLR4	0.102 *		0.108 *		0.105 *
	(0.009)		(0.009)		(0.009)
(b4)-(b1)=0	p=0.036	(b4)-(b1)=0	p=0.640	(b4)-(b1)=0	p=0.029
n	49,958		49,958		49,958
R^2	0.356		0.355		0.356

Standard errors in parentheses. Sampling weights used in estimation.

* Indicates significance at the 5% level or better

Other variables included in the regressions: experience and its square indicators for MSA residence, gender, race, full time work, hospital work, nursing home work, marital status(2), nursing education (2), non-nursing education(3), nursing position(15), region (8), prior LPN experience and a year dummy.

Table 1.5: Returns to Bilingualism: Hispanic Region Interactions

Spanish*Hispanic Region 1 (b1)	-0.040	(0.049)
Spanish*Hispanic Region 2 (b2)	-0.120	(0.044)
Spanish*Hispanic Region 3 (b3)	0.039	(0.034)
Spanish*Hispanic Region 4 (b4)	0.011	(0.020)
Hispanic Region 2	0.054 *	(0.009)
Hispanic Region 3	0.054 *	(0.010)
Hispanic Region 4	0.099 *	(0.010)
(b4)-(b1)=0	p=.243	
n	49,958	
R^2	0.355	

Standard errors in parentheses. Sampling weights used in estimation.

* Indicates significance at the 5% level or better.

Other variables included in the regressions: experience and its square indicators for MSA residence, gender, race, full time work, hospital work, nursing home work, marital status(2), nursing education (2), non-nursing education(3), nursing position(15), region (8), prior LPN experience and a year dummy.

Table 1.6: Returns to Bilingualism: No Interactions by MSA Residence

	Resides in MSA				Resides Ouside MSA		
	(1)	(2)	(3)		(1)	(2)	(3)
Fluent	0.046 *				0.008		
	(0.012)				(0.034)		
Spanish		0.022				-0.025	
		(0.016)				(0.059)	
Other Language			0.050 *				0.022
			(0.015)				(0.032)
n	38,983	38,983	38,983		10,975	10,975	10,975
R^2	0.347	0.346	0.347		0.378	0.378	0.378

Standard errors in parentheses. Sampling weights used in estimation.

* Indicates significance at the 5% level or better.

Other variables included in the regressions: experience and its square indicators for MSA residence, gender, race, full time work, hospital work, nursing home work, marital status(2), nursing education (2), non-nursing education(3), nursing position(15), region (8), prior LPN experience and a year dummy.

Table 1.7: Returns to Bilingualism: Home Language Interactions by MSA Residence

Resides in MSA						
	(1)			(2)		(3)
Fluent*HLR1 (b1)	-0.072	Spanish*HLR1 (b1)		-0.047	Other Lang*HLR1 (b1)	-0.086
	(0.038)			(0.059)		(0.051)
Fluent*HLR2 (b2)	0.049 *	Spanish*HLR2 (b2)		0.022	Other Lang*HLR2 (b2)	0.069 *
	(0.022)			(0.030)		(0.029)
Fluent*HLR3 (b3)	0.015	Spanish*HLR3 (b3)		0.005	Other Lang*HLR3 (b3)	0.054 *
	(0.023)			(0.040)		(0.025)
Fluent*HLR4 (b4)	0.052 *	Spanish*HLR4 (b4)		0.019	Other Lang*HLR4 (b4)	0.050 *
	(0.015)			(0.021)		(0.020)
HLR2	0.032 *			0.036 *		0.033 *
	(0.011)			(0.010)		(0.011)
HLR3	0.079 *			0.080 *		0.078 *
	(0.011)			(0.011)		(0.011)
HLR4	0.101 *			0.107 *		0.104 *
	(0.011)			(0.011)		(0.011)
(b4)-(b1)=0	p=0.007	(b4)-(b1)=0		p=0.231	(b4)-(b1)=0	p=0.0122
n	38,983			38,983		38,983
R^2	0.349			0.349		0.349
Resides Outside MSA						
Fluent*HLR1 (b1)	0.093 *	Spanish*HLR1 (b1)		0.101	Other Lang*HLR1 (b1)	0.081
	(0.043)			(0.053)		(0.050)
Fluent*HLR2 (b2)	-0.099	Spanish*HLR2 (b2)		-0.199	Other Lang*HLR2 (b2)	-0.031
	(0.108)			(0.269)		(0.080)
Fluent*HLR3 (b3)	-0.030	Spanish*HLR3 (b3)		-0.012	Other Lang*HLR3 (b3)	-0.020
	(0.040)			(0.045)		(0.052)
Fluent*HLR4 (b4)	0.044	Spanish*HLR4 (b4)		-0.022	Other Lang*HLR4 (b4)	0.045
	(0.043)			(0.069)		(0.054)
HLR2	0.087 *			0.084 *		0.083 *
	(0.016)			(0.016)		(0.016)
HLR3	0.083 *			0.079 *		0.080 *
	(0.019)			(0.019)		(0.019)
HLR4	0.104 *			0.106 *		0.104 *
	(0.020)			(0.019)		(0.020)
(b4)-(b1)=0	p=0.528	(b4)-(b1)=0		p=0.155	(b4)-(b1)=0	p=0.6023
n	10,975			10,975		10,975
R^2	0.381			0.381		0.380

Standard errors in parentheses. Sampling weights used in estimation. * Indicates significance at the 5% level or better.

Other variables included in the regressions: experience and its square indicators for MSA residence, gender, race, full time work, hospital work, nursing home work, marital status(2), nursing education (2), non-nursing education(3), nursing position(15), region (8), prior LPN experience and a year dummy.

Table 1.8: Returns to Bilingualism: Hispanic Region Interactions by MSA Residence

Resides in MSA				Resides Ouside MSA		
Spanish*Hispanic Region 1 (b1)	-0.075	(0.063)		Spanish*Hispanic Region 1 (b1)	0.066	(0.055)
Spanish*Hispanic Region 2 (b2)	0.013	(0.033)		Spanish*Hispanic Region 2 (b2)	-0.177	(0.230)
Spanish*Hispanic Region 3 (b3)	0.048	(0.039)		Spanish*Hispanic Region 3 (b3)	-0.003	(0.057)
Spanish*Hispanic Region 4 (b4)	0.014	(0.021)		Spanish*Hispanic Region 4 (b4)	-0.006	(0.066)
Hispanic Region 2	0.058 *	(0.010)		Hispanic Region 2	0.069 *	(0.019)
Hispanic Region 3	0.058 *	(0.012)		Hispanic Region 3	0.048 *	(0.018)
Hispanic Region 4	0.107 *	(0.011)		Hispanic Region 4	0.074 *	(0.020)
(b4)-(b1)=0	p=0.118			(b4)-(b1)=0	p=0.393	
n	38,983			n	10,975	
R^2	0.348			R^2	0.380	

Standard errors in parentheses. Sampling weights used in estimation.

* Indicates significance at the 5% level or better.

Other variables included in the regressions: experience and its square indicators for MSA residence, gender, race, full time work, hospital work, nursing home work, marital status(2), nursing education (2), non-nursing education(3), nursing position(15), region (8), prior LPN experience and a year dummy.

Table 1.9: Returns to Bilingualism: Hospital Interactions

	(1)	(2)	(3)
Fluent	0.080*		
	(0.019)		
Fluent*Hospital	-0.063*		
	(0.020)		
Spanish		0.055*	
		(0.024)	
Spanish*Hospital		-0.069*	
		(0.031)	
Other Language			0.081*
			(0.023)
Other Language*Hospital			-0.052*
			(0.026)
n	49,958	49,958	49,958
R^2	0.354	0.353	0.353

Standard errors in parentheses. Sampling weights used in estimation.

* Indicates significance at the 5% level or better.

Other variables included in the regressions: experience and its square indicators for MSA residence, gender, race, full time work, hospital work, nursing home work, marital status(2), nursing education (2), non-nursing education(3), nursing position(15), region (8), prior LPN experience and a year dummy.

Table 1.10a: Returns to Bilingualism: Spanish Bilinguals by Hospital Employment: Hispanic Region Interactions

	Hospital RN		Non-Hospital RN		Hospital RN		Non-Hospital RN	
Spanish	-0.003	(0.020)	0.043	(0.026)	--	--	--	--
Spanish*Hispanic Region 1 (b1)	--	--	--	--	-0.060	(0.059)	-0.033	(0.078)
Spanish*Hispanic Region 2 (b2)	--	--	--	--	0.015	(0.031)	-0.031	(0.090)
Spanish*Hispanic Region 3 (b3)	--	--	--	--	0.060	(0.036)	0.024	(0.058)
Spanish*Hispanic Region 4 (b4)	--	--	--	--	-0.025	(0.027)	0.057 *	(0.029)
Hispanic Region 2	--	--	--	--	0.055 *	(0.009)	0.049 *	(0.016)
Hispanic Region 3	--	--	--	--	0.050 *	(0.011)	0.050 *	(0.017)
Hispanic Region 4	--	--	--	--	0.095 *	(0.011)	0.102 *	(0.017)
					(b4)-(b1)=0	p=0.589	(b4)-(b1)=0	p=0.279
	n	28,960	n	20,998	n	28,960	n	20,998
	R^2	0.349	R^2	0.351	R^2	0.351	R^2	0.352

Standard errors in parentheses. Sampling weights used in estimation. * Indicates significance at the 5% level or better.

Other variables included in the regressions: experience and its square indicators for MSA residence, gender, race, full time work, hospital work, nursing home work, marital status(2), nursing education (2), non-nursing education(3), nursing position(15), region (8), prior LPN experience and a year dummy.

Table 1.10b: Returns to Bilingualism: Spanish Bilinguals by Hospital Employment: Home Language Region Interactions

	Hospital RN			Non-Hospital RN	
Spanish*HLR1 (b1)	-0.054	(0.058)		0.043	(0.069)
Spanish*HLR2 (b2)	0.011	(0.034)		-0.018	(0.103)
Spanish*HLR3 (b3)	0.039	(0.031)		-0.047	(0.063)
Spanish*HLR4 (b4)	-0.020	(0.027)		0.060 *	(0.029)
HLR2	0.042 *	(0.010)		0.047 *	(0.015)
HLR3	0.079 *	(0.011)		0.082 *	(0.016)
HLR4	0.101 *	(0.011)		0.116 *	(0.016)
(b4)-(b1)=0	p=0.592			p=0.826	
n	28,960			20,998	
R^2	0.352			0.352	

Standard errors in parentheses. Sampling weights used in estimation.

* Indicates significance at the 5% level or better.

Other variables included in the regressions: experience and its square indicators for MSA residence, gender, race, full time work, hospital work, nursing home work, marital status(2), nursing education (2), non-nursing education(3), nursing position(15), region (8), prior LPN experience and a year dummy.

Table 1.11: Returns to Bilingualism by Year: No Interactions

	2000			2004		
	(1)	(2)	(3)	(1)	(2)	(3)
Fluent	0.043 *			0.039 *		
	(0.016)			(0.016)		
Spanish		0.031			0.002	
		(0.019)			(0.024)	
Other Language			0.035			0.052 *
			(0.019)			(0.021)
Experience	0.029 *	0.029 *	0.029 *	0.029 *	0.029 *	0.029 *
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Experience^2	-0.055 *	-0.055 *	-0.055 *	-0.058 *	-0.058 *	-0.058 *
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
MSA	0.105 *	0.105 *	0.105 *	0.132 *	0.132 *	0.132 *
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	-0.009
Female	-0.043 *	-0.043 *	-0.043 *	-0.089 *	-0.090 *	-0.089 *
	(0.016)	(0.016)	(0.016)	(0.012)	(0.012)	(0.012)
Black	0.083 *	0.085 *	0.085 *	0.105 *	0.106 *	0.104 *
	(0.016)	(0.016)	(0.016)	(0.014)	(0.014)	(0.014)
Other Race	0.024	0.035 *	0.032	0.025 *	0.034 *	0.028 *
	(0.018)	(0.018)	(0.018)	(0.013)	(0.013)	(0.012)
Diploma-Nursing	0.009	0.008	0.009	0.011	0.010	0.011
	(0.010)	(0.010)	(0.010)	(0.011)	(0.011)	(0.011)
Bachelors-Nursing	0.049 *	0.050 *	0.049 *	0.036 *	0.037 *	0.036 *
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Full Time	0.567 *	0.568 *	0.568 *	0.599 *	0.600 *	0.599 *
	(0.010)	(0.010)	(0.010)	(0.011)	(0.011)	(0.011)
Hospital	0.200 *	0.200 *	0.200 *	0.225 *	0.225 *	0.224 *
	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)
Nursing Home	0.006	0.007	0.006	0.037 *	0.038 *	0.036 *
	(0.015)	(0.015)	(0.015)	(0.016)	(0.016)	(0.016)
n	23,479	23,479	23,479	26,479	26,479	26,479
R^2	0.347	0.347	0.347	0.356	0.356	0.356

Standard errors in parentheses. Sampling weights used in estimation. * Indicates significance at the 5% level or better.
Other variables included in the regressions include: dummy variables for marital status(2), non-nursing education(3), nursing position(15), region (8), an indicator for foreign nursing training, and prior LPN experience.

Table 1.A1: Population Composition and Bilingual Nurses

	2000			2004		
	(1)	(2)		(1)	(2)	
	% of Nurses Who Are Bilingual	% of Population That Speaks a Language Other Than English at Home	(1)-(2)	% of Nurses Who Are Bilingual	% of Population That Speaks a Language Other Than English at Home	(1)-(2)
Alabama	3.0	3.9	-0.9	2.2	3.4	-1.2
Alaska	31.4	14.3	17.1	43.2	12.7	30.5
Arizona	11.4	25.9	-14.5	12.4	25.4	-13.0
Arkansas	7.5	5	2.5	5.6	5.6	0.0
California	19.4	39.5	-20.1	13.2	41.3	-28.1
Colorado	8.2	15.1	-6.9	8.9	16.1	-7.2
Connecticut	5.0	18.3	-13.3	10.8	18.9	-8.1
Delaware	10.0	9.5	0.5	21.9	11.1	10.8
DC	25.4	16.8	8.6	49.0	16.2	32.8
Florida	6.3	23.1	-16.8	8.2	24.3	-16.1
Georgia	4.9	9.9	-5.0	4.4	11	-6.6
Hawaii	55.8	26.6	29.2	68.4	24.4	44.0
Idaho	27.9	9.3	18.6	23.2	10.6	12.6
Illinois	6.7	19.2	-12.5	6.4	20.4	-14.0
Indiana	3.3	6.4	-3.1	2.5	8.9	-6.4
Iowa	4.5	5.8	-1.3	4.3	5.4	-1.1
Kansas	6.5	8.7	-2.2	6.6	8	-1.4
Kentucky	2.6	3.9	-1.3	2.4	4.2	-1.8
Louisiana	3.1	9.2	-6.1	4.6	7.7	-3.1
Maine	15.9	7.8	8.1	23.6	7.4	16.2
Maryland	6.6	12.6	-6.0	8.9	13.8	-4.9
Massachusetts	6.2	18.7	-12.5	5.0	19.5	-14.5
Michigan	3.3	8.4	-5.1	4.0	8.9	-4.9
Minnesota	3.4	8.5	-5.1	4.5	10.2	-5.7
Mississippi	7.2	3.6	3.6	6.2	2.5	3.7
Missouri	1.2	5.1	-3.9	2.1	5.2	-3.1
Montana	24.2	5.2	19.0	23.3	3.6	19.7

Table 1.A1 continued

	2000			2004		
	(1)	(2)		(1)	(2)	
	% of Nurses Who Are Bilingual	% of Population That Speaks a Language Other Than English at Home	(1)-(2)	% of Nurses Who Are Bilingual	% of Population That Speaks a Language Other Than English at Home	(1)-(2)
Nebraska	9.9	7.9	2.0	7.2	8.2	-1.0
Nevada	27.5	23.1	4.4	42.4	25.5	16.9
New Hampshire	16.5	8.3	8.2	17.4	7.7	9.7
New Jersey	11.6	25.5	-13.9	8.8	26.6	-17.8
New Mexico	51.0	36.5	14.5	42.5	36.4	6.1
New York	10.3	28	-17.7	6.3	27.3	-21.0
North Carolina	2.2	8	-5.8	2.2	8.7	-6.5
North Dakota	16.2	6.3	9.9	13.4	5.5	7.9
Ohio	2.4	6.1	-3.7	2.2	5.9	-3.7
Oklahoma	9.9	7.4	2.5	8.3	7.5	0.8
Oregon	8.0	12.1	-4.1	7.7	12.9	-5.2
Pennsylvania	2.7	8.4	-5.7	3.1	8.5	-5.4
Rhode	16.7	20	-3.3	21.6	19.8	1.8
South Carolina	5.4	5.2	0.2	5.3	5.3	0.0
South Dakota	15.3	6.5	8.8	7.5	4.2	3.3
Tennessee	3.1	4.8	-1.7	2.8	5.5	-2.7
Texas	14.8	31.2	-16.4	9.4	32	-22.6
Utah	30.9	12.5	18.4	28.1	12.1	16.0
Vermont	34.2	5.9	28.3	26.5	5.2	21.3
Virginia	4.0	11.1	-7.1	4.8	12.8	-8.0
Washington	9.6	14	-4.4	7.4	15.2	-7.8
West Virginia	2.3	2.7	-0.4	3.3	2.1	1.2
Wisconsin	3.1	7.3	-4.2	3.2	7.5	-4.3
Wyoming	20.3	6.4	13.9	27.1	5.9	21.2

Table 1.A2: Population Composition and Spanish Speaking Bilingual Nurses

	2000			2004		
	(1) % of Nurses Who Speak Spanish	(2) % of Population that is Hispanic	(1)-(2)	(1) % of Nurses Who Speak Spanish	(2) % of Population that is Hispanic	(1)-(2)
Alabama	2.19	1.71	0.48	0.25	1.95	-1.70
Alaska	15.70	4.12	11.58	19.87	4.76	15.11
Arizona	6.70	25.25	-18.55	7.04	28.12	-21.08
Arkansas	4.67	3.25	1.42	2.26	4.39	-2.13
California	7.46	32.38	-24.92	4.89	34.93	-30.04
Colorado	5.28	17.10	-11.82	3.56	19.18	-15.62
Connecticut	1.21	9.41	-8.20	2.63	10.59	-7.96
Delaware	6.24	4.76	1.48	9.52	5.90	3.62
DC	7.49	7.86	-0.37	21.02	8.86	12.16
Florida	2.64	16.79	-14.15	3.91	19.13	-15.22
Georgia	1.88	5.32	-3.44	1.03	6.71	-5.68
Hawaii	5.07	7.24	-2.17	13.13	7.89	5.24
Idaho	15.36	7.86	7.50	8.99	8.93	0.06
Illinois	1.38	12.32	-10.94	1.79	14.04	-12.25
Indiana	1.40	3.53	-2.13	1.80	4.37	-2.57
Iowa	2.08	2.82	-0.74	1.27	3.67	-2.40
Kansas	2.72	7.00	-4.28	3.72	6.06	-2.34
Kentucky	1.49	1.48	0.01	0.52	1.85	-1.33
Louisiana	0.78	2.41	-1.63	1.51	2.70	-1.19
Maine	3.14	0.73	2.41	2.98	0.89	2.09
Maryland	1.67	4.30	-2.63	2.63	5.42	-2.79
Massachusetts	2.28	6.75	-4.47	1.75	7.72	-5.97
Michigan	0.88	3.26	-2.38	1.11	3.64	-2.53
Minnesota	1.50	2.91	-1.41	1.61	3.49	-1.88
Mississippi	4.25	1.39	2.86	1.83	1.49	0.34
Missouri	0.56	2.12	-1.56	0.54	2.57	-2.03
Montana	16.08	2.00	14.08	9.96	2.24	7.72
Nebraska	3.86	5.52	-1.66	2.70	6.97	-4.27

Table 1.A2 continued

	2000			2004		
	(1) % of Nurses Who Speak Spanish	(2) % of Population that is Hispanic	(1)-(2)	(1) % of Nurses Who Speak Spanish	(2) % of Population that is Hispanic	(1)-(2)
Nevada	10.19	19.72	-9.53	10.18	22.93	-12.75
New Hampshire	5.15	1.66	3.49	4.38	2.07	2.31
New Jersey	2.65	13.28	-10.63	2.85	14.99	-12.14
New Mexico	36.15	42.08	-5.93	35.88	43.41	-7.53
New York	2.79	15.11	-12.32	1.79	16.12	-14.33
North Carolina	1.33	4.71	-3.38	1.06	6.12	-5.06
North Dakota	2.49	1.21	1.28	4.33	1.14	3.19
Ohio	0.80	1.91	-1.11	0.46	2.17	-1.71
Oklahoma	2.57	5.20	-2.63	2.77	6.41	-3.64
Oregon	3.82	8.05	-4.23	4.34	9.59	-5.25
Pennsylvania	0.98	3.21	-2.23	1.25	3.75	-2.50
Rhode	2.49	8.66	-6.17	7.19	10.53	-3.34
South Carolina	1.55	2.37	-0.82	2.63	2.97	-0.34
South Dakota	3.11	1.44	1.67	2.81	1.72	1.09
Tennessee	0.21	2.18	-1.97	1.39	2.87	-1.48
Texas	7.05	31.99	-24.94	5.63	34.94	-29.31
Utah	13.51	9.03	4.48	16.58	10.60	5.98
Vermont	5.99	0.90	5.09	5.57	0.85	4.72
Virginia	0.89	4.66	-3.77	1.53	5.79	-4.26
Washington	3.41	7.49	-4.08	2.55	8.53	-5.98
West Virginia	0.59	0.68	-0.09	1.77	0.62	1.15
Wisconsin	2.10	3.60	-1.50	1.24	4.38	-3.14
Wyoming	9.02	6.41	2.61	12.51	6.70	5.81

Table 1.A3: Percent of the Population That Speaks a Language Other Than English at Home

2000		2004	
HLR1			
West Virginia	2.7	West Virginia	2.1
Mississippi	3.6	Mississippi	2.5
Alabama	3.9	Alabama	3.4
Kentucky	3.9	Montana	3.6
Tennessee	4.8	Kentucky	4.2
Arkansas	5.0	South Dakota	4.2
Missouri	5.1	Missouri	5.2
Montana	5.2	Vermont	5.2
South Carolina	5.2	South Carolina	5.3
Iowa	5.8	Iowa	5.4
Vermont	5.9	North Dakota	5.5
Ohio	6.1	Tennessee	5.5
HLR2			
North Dakota	6.3	Arkansas	5.6
Indiana	6.4	Ohio	5.9
Wyoming	6.4	Wyoming	5.9
South Dakota	6.5	Maine	7.4
Wisconsin	7.3	Oklahoma	7.5
Oklahoma	7.4	Wisconsin	7.5
Maine	7.8	Louisiana	7.7
Nebraska	7.9	New Hampshire	7.7
North Carolina	8.0	Kansas	8.0
New Hampshire	8.3	Nebraska	8.2
Michigan	8.4	Pennsylvania	8.5
Pennsylvania	8.4	North Carolina	8.7
Minnesota	8.5	Indiana	8.9

2000		2004	
HLR3			
Kansas	8.7	Michigan	8.9
Louisiana	9.2	Minnesota	10.2
Idaho	9.3	Idaho	10.6
Delaware	9.5	Georgia	11.0
Georgia	9.9	Delaware	11.1
Virginia	11.1	Utah	12.1
Oregon	12.1	Alaska	12.7
Utah	12.5	Virginia	12.8
Maryland	12.6	Oregon	12.9
Washington	14.0	Maryland	13.8
Alaska	14.3	Washington	15.2
Colorado	15.1	Colorado	16.1
DC	16.8	DC	16.2
HLR4			
Connecticut	18.3	Connecticut	18.9
Massachusetts	18.7	Massachusetts	19.5
Illinois	19.2	Rhode	19.8
Rhode	20.0	Illinois	20.4
Florida	23.1	Florida	24.3
Nevada	23.1	Hawaii	24.4
New Jersey	25.5	Arizona	25.4
Arizona	25.9	Nevada	25.5
Hawaii	26.6	New Jersey	26.6
New York	28.0	New York	27.3
Texas	31.2	Texas	32.0
New Mexico	36.5	New Mexico	36.4
California	39.5	California	41.3

Table 1.A4: Percent of the Population That Is Hispanic

2000		2004		2000		2004	
Hispanic Region 1				**Hispanic Region 3**			
West Virginia	0.7	West Virginia	0.6	North Carolina	4.7	Delaware	5.9
Maine	0.7	Vermont	0.9	Delaware	4.8	Kansas	6.1
Vermont	0.9	Maine	0.9	Oklahoma	5.2	North Carolina	6.1
North Dakota	1.2	North Dakota	1.1	Georgia	5.3	Oklahoma	6.4
Mississippi	1.4	Mississippi	1.5	Nebraska	5.5	Wyoming	6.7
South Dakota	1.4	South Dakota	1.7	Wyoming	6.4	Georgia	6.7
Kentucky	1.5	Kentucky	1.9	Massachusetts	6.8	Nebraska	7.0
New Hampshire	1.7	Alabama	2.0	Kansas	7.0	Massachusetts	7.7
Alabama	1.7	New Hampshire	2.1	Hawaii	7.2	Hawaii	7.9
Ohio	1.9	Ohio	2.2	Washington	7.5	Washington	8.5
Montana	2.0	Montana	2.2	DC	7.9	DC	8.9
Missouri	2.1	Missouri	2.6	Idaho	7.9	Idaho	8.9
				Oregon	8.1	Oregon	9.6
Hispanic Region 2				**Hispanic Region 4**			
Tennessee	2.2	Louisiana	2.7	Rhode	8.7	Rhode	10.5
South Carolina	2.4	Tennessee	2.9	Utah	9.0	Connecticut	10.6
Louisiana	2.4	South Carolina	3.0	Connecticut	9.4	Utah	10.6
Iowa	2.8	Minnesota	3.5	Illinois	12.3	Illinois	14.0
Minnesota	2.9	Michigan	3.6	New Jersey	13.3	New Jersey	15.0
Pennsylvania	3.2	Iowa	3.7	New York	15.1	New York	16.1
Arkansas	3.3	Pennsylvania	3.8	Florida	16.8	Florida	19.1
Michigan	3.3	Indiana	4.4	Colorado	17.1	Colorado	19.2
Indiana	3.5	Wisconsin	4.4	Nevada	19.7	Nevada	22.9
Wisconsin	3.6	Arkansas	4.4	Arizona	25.3	Arizona	28.1
Alaska	4.1	Alaska	4.8	Texas	32.0	California	34.9
Maryland	4.3	Maryland	5.4	California	32.4	Texas	34.9
Virginia	4.7	Virginia	5.8	New Mexico	42.1	New Mexico	43.4

Chapter 2

Determining the Source of the Black-White Wage Differential in the Nursing Labor Market

Introduction

Standard models of wage differences among races find that blacks earn less than whites. Over the past several decades much work has been done to discover the factors accountable for the differential between black and white wages. Black wages rose relative to white wages from the 1940s through the 1980s (Vigdor, 2005; Smith and Welch, 1989; Blau and Beller, 1992; Browne and Askew, 2005) with particularly large gains in the late 1960s through the 1970s (Smith and Welch 1989). These gains were not permanent and blacks have lost ground compared to whites since the 1980s (Neal 2006).

The black-white wage differential is not consistent across genders. Since the 1980s the black-white wage ratio for men has typically been between 60% and 70%. Contrary to this, the black-white wage ratio for women has been found to be between 85% and 95% (Blau and Beller 1992). Among the highly educated, the wage differential is smaller for both genders.

While empirical studies often find that white women earn more than black women, it has been posited that in narrowly-defined education or skill groups working black women should earn more than their white counterparts (Neal 2004). Blau and Beller (1992) found the black-white ratio for women with 10-19 years of experience to be greater than 100%. Possible explanations proposed in the literature primarily include differences in education

and experience. Conditional on working, black women work more than white women, are more likely to participate in the labor market the higher their husbands' wages, and are less likely to work in the home (Potamites 2007). College-educated black women are also more likely to work than their white counterparts (Neal 2004). Thus, among women, actual experience per year of potential experience is likely higher for blacks than it is for whites, as they spend a greater portion of potential experience years in the workforce.

The average observed wage of black registered nurses (RNs) is higher than that of white RNs in the National sample Survey of Registered Nurses (NSSRN). This result is diametrically different from what is seen in most studies of the black-white wage differential among women. This paper analyzes the wage differential between black and white nurses in the NSSRN to determine the sources of the differential. Possible explanations explored include reverse discrimination, differing endowments, urban work, concentration effects, and differences in work effort, job setting and actual experience. It is shown that black nurses have better endowments than white nurses and support is found for self-selection and demand-side effects.

The rest of this essay is organized as follows. The second section contains a discussion of the nursing labor market. The following section discusses the data. The fourth section presents the main empirical findings. The fifth section presents several robustness checks. The differential is decomposed in the sixth section and a conclusion ends the essay.

The Nursing Labor Market

The labor market for nurses is unique in several ways. Nursing is a predominately female field. In 1977, 1.92% of nurses were male. This number rose to 5.4% by 2004.[1] There are also strict requirements to become a nurse. Unlike the labor market as a whole, the labor market for registered nurses is narrowly defined in terms of education. All RNs must complete one of three educational paths and obtain a license from a state agency in order to be employed. There exists variation in licensing schemes across states; but nurses nationwide face the same educational choices. They may (1) earn a nursing diploma, (2) obtain an associate degree, or (3) obtain a bachelor's degree. All three options require education beyond high school. The nursing diploma typically takes three years to earn and is completed in a hospital. Associate degree programs typically take two years to complete and require course and clinical work in practical patient care. The final option, the bachelor's degree, on average takes four years to complete. Similar to the associate degree, the bachelor's degree requires course and clinical work, but in both practical and theoretical patient care. There are also several advanced degrees that nurses may obtain including, master's degrees, nurse practitioner degrees, and doctorate degrees. These are not required to become a registered nurse, though they are required for many administrative, teaching and research positions. Schumacher (1997) finds that registered nurses with a bachelor's degree earn more than those with associate degrees or diplomas.

[1] From the 1977 and 2004 National Sample Survey of Registered Nurses (NSSRN)

In the nursing industry, RNs have several choices of work environments. The most common are hospitals, physician offices, and nursing homes. Each of these settings has different workloads and different job requirements. RNs working in hospitals typically face higher levels of responsibility, greater physical demands, and more shift work than nurses in other settings (Lehrer et al. 1991). There exists a premium to hospital work for RNs. Schumacher and Hirsch (1997) find premiums of 20% and 23% for hospital work compared to nursing homes and physicians offices. From 33% to 50% of the premium is due to hospitals attracting nurses with higher levels of unobserved ability, 10% is due to shift work, and the majority of the rest is due to other work conditions. Further, among nurses with five years or less experience, those with bachelor degrees have a higher probability of working in a hospital than those with an associate degree. The proportion of RNs working in hospitals lies between 40% and 50%. Comparatively, only 4% to 6% of RNs work in nursing homes.[2]

As in the economy as a whole, there is evidence of differentials between genders, races, and skill groups, both in wages and promotion time in the nursing field. However, these differentials are not well documented in the economics literature.[3] Pudney and Shields (1999) examine gender and racial promotion discrimination of nurses in Britain. Men are found to face shorter time to promotion than women, and whites a shorter time than non-whites. The differences in time to promotion become larger as the grade of nurses increases. Interestingly, career breaks are found to shorten the time to promotion for women while extending it for men. In another study of job grading in the British nursing profession,

[2] 1977-2004 NSSRN
[3] See Barbee (1993) for a summary of the sources and avenues of racism in U.S. nursing.

Pudney and Shields (2000) find that Asians and blacks suffer similar disadvantages compared to whites, but that gender differences are not significant.

Data

The primary data for this study come from the 1984 to 2004 National Sample Survey of Registered Nurses (NSSRN) General Public Use Files.[4] The NSSRN is collected by the Health Resources and Services Administration (HRSA) every four years, with exception of the second survey which occurred three years after the first. The data has been collected since 1977 and provides information on RNs throughout the country. This information includes but is not limited to standard demographics, education, labor force status, income[5] and specialty. The target population of the survey is all RNs with active licenses. The survey is administered via postal mail to a probability sample of the target population.

The six cross-sections of the NSSRN utilized here contain a total of 198,915 records. Only black and white nurses employed in a nursing position in the United States during the survey period without missing observations are included in this study, leaving a sample size of 112,956. The sample selected for this study contains observations on 4,206 black nurses and 108,750 white nurses.

Table 2.1 contains summary statistics for the sample. The majority of the nurses are female (95%), white (95%), and live in a metropolitan statistical area (82%). Roughly 73% of the nurses are married and 10% have never been married. The average age is 42 years and

[4] Following Schumacher (1997)
[5] The NSSRN reports annual earnings including overtime, shift pay and bonus pay. Hourly wages are calculated as annual income ÷ (hours*weeks). This number will overstate actual hourly pay.

the average number of years of experience is nearly 22 years. [6] About 22% of the sample has a non-nursing degree; the most common nursing degree is an associate degree (38%), followed by a diploma (36%), then a bachelor degree (26%). Approximately 63% of the RNs work in a hospital. The average annual income is $39,365.

The summary statistics are presented separately for blacks and whites in Table 2.1 as well. There are striking differences between the races. Over 70% of white nurses are married compared to just 58% of black nurses. The proportions of black nurses who are divorced or who have never been married both exceed the proportions for whites. On average, the experience level of blacks exceeds that of whites by more than one year. While both races are most likely to have an associate nursing degree, 28% of blacks have a bachelor nursing degree compared to 26% of whites. Blacks hold fewer diplomas than whites. Blacks are also more likely to have a non-nursing degree, live in an MSA, and work in a hospital. Blacks work more hours on average than whites, but a similar number of weeks. A larger proportion of blacks report full time work, 83% compared to 66% for whites. Both races are distributed similarly across nursing positions, though blacks are less likely to be general or staff nurses. White nurses are fairly well dispersed across the country, while nearly 75% of black nurses are confined to four regions with 30% in the South Atlantic region alone. Lastly, the average black nurse earns $46,230 compared to $39,037 earned by white nurses.

[6] Experience is constructed to be equal to the nurse's age minus schooling minus five (Schumacher 1997).

Empirical Model and Baseline Results

There are many approaches taken in estimating models that examine the differences in wages among groups of people. Common models include

- models of search behavior (Arcidiacono, 2001; Black, 1999; Flabbi, 2006),
- reduced form models including median regression (Johnson et al., 2000; Neal, 2004; Vigdor, 2005),
- pooled and group-specific regression (Black et al. 2004), and
- ordinary least squares (OLS) wage regressions (Smith, 1979; Blau and Beller, 1992; Browne and Askew, 2005 among others).

The latter three often incorporate a decomposition of the main effects in their analysis (Black et al. 2004, Card and Krueger 1992, Heckman et al. 2000, Bayard et al. 1999, Bound and Dresser 1999, Smith and Welch 1989, Black et al. 2006).

The most common model is a reduced form standard wage equation estimated by regressing the natural logarithm of wages on a set of explanatory variables. The explanatory variables typically include a measure of education, race, hours of work, and experience. Other variables that have been included are region (Browne and Askew, 2005; Smith and Welch, 1989; Blau and Beller, 1992; Smith, 1979), AFQT scores as a measure of productivity (Neal and Johnson, 1996), proportions of minorities within specific occupations, industries, establishments and job cells (Bayard et al., 1999), indicators for part-time work and urban residence (Blau and Beller, 1992; Smith, 1979), occupation, marital status, and for women the number of children (Blau and Beller, 1992).

The estimation technique used here will utilize a reduced form standard wage equation. The log-wage equation is assumed to be

$$w_i = \alpha + X_i\beta + \varepsilon_i \quad (1)$$

where w_i is the natural logarithm of the individual's earnings, X_i is a vector of human capital and other observable variables, and ε_i is a normally distributed error term.

Table 2.2 presents the results from the OLS estimation of equation (1). The signs and magnitudes of the coefficients on the standard explanatory variables are consistent with the nursing literature, with the exception of race. The results imply that black nurses earn wages that are on average 10.2% higher than white nurses. This result is diametrically different from most studies of wage differences. Further, blacks earn more than whites in all survey years and all Census regions.[7]

Robustness Checks

In this section, several explanations for the observed wage difference between black and white nurses are explored. First, blacks may have more actual experience per year of potential experience than whites. A second explanation is that blacks may have less distaste for less attractive positions than whites. Third, blacks may also be more willing to do shift work than whites. A fourth explanation is that black nurses may be more heavily concentrated in positions that pay higher wages. A fifth possibility involves black concentration effects. Black-white wage inequality is positively associated with the

[7] See Table 2.A1.

proportion of the labor market that is black. In other words, in areas where blacks make up a higher proportion of the population, the difference in wages between blacks and whites is greater.

Experience

The common measure of experience, Experience= Age –Years of School – 5, does not account for periods of time when an individual may be out of the labor force or unemployed. The standard measure calculates an upper bound on the potential experience a nurse could have. As a predominantly female occupation, nursing is likely to incur periods where nurses leave the labor force for work in the home. The likelihood of leaving the labor force differs between blacks and whites. Conditional on working, black women work more than white women, married blacks have higher labor force participation rates than married whites (Potamites, 2007) and college educated black women are more likely to work than their white counterparts (Neal, 2004). The underlying acceptance of working mothers in black culture is greater than in white culture. Married white mothers are more likely to work in the home (Neal, 2004). Thus it is likely that actual experience per year of potential experience is higher for blacks than it is for whites as they spend a greater portion of potential experience years in the workforce. If this is true, blacks would earn wages equal to whites at the beginning of their career, then black wages would rise above white wages as the level of potential experience increases (Blau and Beller 1992).

A simple method to examine this hypothesis is to look at the wage-experience profiles of black and white nurses. Nurses are often hourly employees; thus, annual wages may be higher for blacks simply because they work more hours on average. An hourly wage variable is constructed as Hourly Wage= Annual Income ÷ (Hours*Weeks). The wage-experience profiles are examined in order to determine if black hourly wages rise more with observed experience.

Figures 2.1 and 2.2 show the wage-experience profiles for the RNs. If the hypothesis is true, then blacks should earn wages equal to whites at the beginning of their career, with black wages rising above white wages as the level of potential experience increases. The profile for annual income is shown in Figure 2.1. Black wages are higher than white wages at all experience levels. The difference in the wages is practically constant from 6 years of experience to 50 years of experience. Figure 2.2 shows the income-experience profile using hourly wages. Black wages are higher than white wages up to 46 years of experience. Over the first 25, years black wages are only slightly higher than white wages. Between 26 years and 45 years, black wages increase slightly while white wages remain constant. While this is weakly supportive of the hypothesis, one must note that hourly wages are a noisy measure. Neither figure definitively demonstrates a pattern that would support the hypothesis. Actual experience per year is not higher for blacks.

Alternatively, given that black wages are consistently higher than white wages, the pattern is representative of a selection effect. This is reasonable if high-ability blacks have fewer options than high-ability whites and self-select into the nursing profession.

Distaste

Some nursing positions may be less attractive than others. If so, those positions would pay a premium to nurses who work in them. If blacks have less distaste for these positions than whites, they would be more likely to earn the compensating differential. A straightforward test of this hypothesis is to examine the coefficients for each nursing position from equation (1).[8] Positions that pay more should be associated with a larger proportion of black nurses.

Results are presented in Table 2.3. Under this hypothesis, it is assumed that the black-white wage differential reflects a compensating differential for unseen variables as some positions pay more holding all other variables constant. The unseen variables could include ability or additional training not accounted for alongside more traditional negative job qualities that make a position unattractive. It is expected that positions that pay relatively more would be associated with larger proportions of black nurses if the hypothesis were true. The results in Table 2.3 do not support this hypothesis. There is no distinct association between positions that pay relatively more and the proportion of the nurses that are black. This result also rejects any hypothesis stating that the higher wage received by black nurses is due to their predominance in higher-paying positions.

[8] Nursing position is statistically significant in determining RN wages. Of the 12 position dummies included in the original estimation of equation (1), 8 are significant at the 1% level.

Shift Work

Similarly blacks may be more willing than whites to do shift work, working nights and weekends. These shifts pay a premium. The NSSRN does not contain a shift work variable but it is possible to examine this hypothesis. A test of this hypothesis would be to observe the wage differential for nurses who work in hospitals and nursing homes, where shift work is likely, and for nurses who work in other settings. If a differential exists in settings where shift work is less likely, then the overall differential is not likely to be driven by blacks being more willing to perform shift work. Alternatively, positions such as instructor and research are not likely to require shift-work, whereas positions such as staff/general nursing are. If a differential exists in positions where shift work is uncommon, then the overall differential is not likely to be driven by blacks being more willing to perform shift work.[9]

The results for the hypothesis that blacks are more willing to perform shift work are presented in Tables 2.4 and 2.5. Table 2.4 presents the results by work setting. If the hypothesis is true, then a differential should not exist in *Other Settings* where shift work is not likely. The results show that the differential (coefficient on the variable black) is far larger for *Other Settings* than *Nursing Home,* and nearly equal for *Hospital* and *Other Settings*. Table 2.5 presents the results by nursing position. A differential should not exist in positions where shift work is not likely if the hypothesis is true. Table 2.5 shows that there

[9] One must note that nursing positions and work settings differ in ways other than shift work. Some may be more physically demanding, require more hazardous work, have greater responsibilities, etc. than others. Given the data available, it is not possible to control for these.

exists a differential even in positions that are not likely to involve shift work. The results in Table 2.4 and Table 2.5 do not show support for the hypothesis. A further implication of these results is that the differential exists even within areas of healthcare, specifically hospitals, that are commonly not for profit.

Distribution

It is possible that the overall differential is driven by the distribution of black nurses across nursing positions. Some positions pay more than others. If blacks are heavily concentrated in high-paying positions, then one would see the differential when examining the whole sample. However, if there is a differential in individual nursing positions, then something else has to be driving the differential (in sum) as it drives the differential in each position. If there is a differential within nursing positions, then a distribution effect is not supported.

Table 2.5 provides results for this hypothesis, presenting the coefficients for the black dummy variable across positions. Of the 13 nursing positions, the coefficient is significantly different from zero at the 5% level in five positions and significantly different from zero at the 10% level in three. The differential does not arise from a distribution effect. This rejection is also supported by the results in Table 2.3 as there is no distinct association between positions that pay relatively more and the proportion of the nurses that are black.[10]

[10]The rejection is further supported by the decomposition results presented below.

Concentration

Past research has shown that greater black population size relative to white population size is associated with higher white earnings and lower black earnings (Cohen 1998, Beggs et al. 1997, Burr et al. 1991). Black-white wage inequality is positively associated with the proportion of the labor market that is black. The effect is larger for women than men (Beggs et al 1997, Cassier 1996, Grant and Parcel 1990). In the context of the nursing labor market, the differential should be smaller or favor whites in areas where there is a larger proportion of blacks. Two methods are used to test this hypothesis. First, the percent of the population that is black by state[11] and its interaction with the black dummy variable are included in the estimation of equation (1). The coefficient on the interaction term should be negative if the hypothesis is supported, indicating that blacks in states with a higher proportion of blacks earn less than whites in those states. Second, equation (1) is estimated separately by region. If the hypothesis is supported, the coefficient on black will be smallest in regions with the largest proportion of black nurses.

Results for the hypothesis that black concentration effects may drive the observed wage differential are presented in Tables 2.6 and 2.7. Table 2.6 presents the results from the first test of the hypothesis, including the percent of the population that is black and its interaction with the black dummy in the estimation of equation (1). [12] The coefficient on the interaction term should be negative if the hypothesis is supported, indicating that blacks in

[11] For 1984-1996 the proportion of the population that is black by state is calculated using the monthly Curremt Population Survey. For 2000 and 2004 the data is obtained from the American Community Survey.
[12] The percentage of the population that is black is scaled so 35%=0.35.

states with a higher proportion of blacks earn less than whites in those states. The coefficients on the interaction are -0.154 and -0.147 for annual income and hourly income respectively. Both are significantly different from zero at the 5% level. While this result supports the hypothesis, the small magnitude of the coefficients indicates that concentration effects alone are not enough to account for the large differential.

The second test of the concentration hypothesis is presented in Table 2.7 where equation (1) is estimated separately by region. Moving top to bottom, the regions are presented in order from lowest black concentration to greatest. It is expected that the coefficient on black will be smallest in regions with the largest proportion of black nurses. The results show a mixed and possibly increasing trend in the coefficient on black moving from regions with a small proportion of blacks to regions with a large proportion of blacks for both hourly and annual wages. This is not the expected trend. The result indicates that the differential may be increasing as the black proportion of the population increases.

The result lends to an alternative explanation in demand theory. Figures 2.3 and 2.4 show the regions in order of the percent of the population that is black plotted against the coefficient on black in each region. There is an upward trend in the coefficient as the regions increase in black concentration. Patients may prefer to receive treatment from nurses with a similar ethnic background thereby increasing the demand for black nurses in these regions.[13] The increased demand increases the wages of blacks and thus the wage differential.

[13] Racial concordance leads to greater levels of satisfaction and utilization among patients (Gray and Stoddard, 1997; Laveist and Nuru-Jeter, 2002; Laveist et al, 2003; Saha et al, 1999).

Attraction

It is possible that nursing, as an occupation, has lower odds of discrimination than other occupations. In areas where discrimination is more frequent, nursing may attract blacks with relatively more ability. If relatively high ability blacks are attracted into nursing due to lower discrimination odds, the black-white wage differential would be larger in regions where there is greater discrimination in general. To test this, the differential is compared across regions. Regions with larger proportions of blacks are assumed to be regions with higher odds of discrimination. This assumption is based on the fact that greater black population size relative to white population size is associated with higher white earnings and lower black earnings (Cohen, 1998; Beggs et al., 1997; Burr et al., 1991). Black-white wage inequality is positively associated with the proportion of the population that is black.

Table 2.7 shows an increasing trend in the coefficient on black moving from regions with a small proportion of blacks to regions with a large proportion of blacks for both hourly and annual wages. The result indicates that the differential increases as the black proportion of the population increases. Attraction into nursing explains part of the differential.

Decomposition

The earnings differential is decomposed into five components following Blinder (1973). The five components provide information on the total differential, the portion due to differing endowments or means, the portion due to differing coefficients, an unexplained

portion, and a portion that is taken to be due to discrimination.[14] The decomposition is performed via a standard technique (Blinder 1973, Blau and Beller 1992). To generate the decomposition, equation (1) is estimated separately for high-wage earners and low-wage earners.[15]

$$w_i^H = \alpha^H + X_i^H \beta^H + \varepsilon_i^H \quad (2)$$

$$w_i^L = \alpha^L + X_i^L \beta^L + \varepsilon_i^L \quad (3)$$

The H superscript denotes high-wage earners and the L superscript low-wage earners. Using equations (2) and (3), computation of the portions of the differential explained by the shift component and the regression is straight forward as seen in equations (4) and (5) respectively.

$$\alpha_0^H - \alpha_0^L \quad (4)$$

$$\overline{X}_i^H \beta^H - \overline{X}_i^L \beta^L \quad (5)$$

The difference in the intercept terms, equation (4), is a reflection of the portion of the differential that is unexplained. The explained portion of the differential, equation (5), arises from both differences in coefficients and average characteristics. Thus following Blinder (1973), equation (5) can be further broken down.

$$\overline{X}_i^H \beta^H - \overline{X}_i^L \beta^L = \beta^H (\overline{X}_i^H - \overline{X}_i^L) + \overline{X}_i^L (\beta^H - \beta^L) \quad (6)$$

[14] Referring to a portion of the differential as being due to discrimination may be misleading as other unaccounted for factors may make up a part of this unexplained differential portion.
[15] Blacks are the high wage earners.

The first term on the right hand side is the advantage in average characteristics possessed by the high-wage earners evaluated by their wage equation.[16] Blinder refers to this as the "portion attributable to the endowments." The second term is the difference between how the high-wage equation would value the characteristics of the low-wage group and how the low wage equation actually values them. Blinder refers to the second term as the "portion attributable to the coefficients." The portion attributable to the coefficients would be zero if the market evaluated an identical bundle of traits equally for the two groups. If the term is non-zero, it is often interpreted as discrimination. In sum, there are five measures that are of importance:

R= Raw Differential= E+C+U = $\alpha_0^H + \overline{X}_i^H \beta^H - (\alpha_0^L + \overline{X}_i^L \beta^L)$

E=Portion Attributable to Differing Endowments = $\beta^H(\overline{X}_i^H - \overline{X}_i^L)$

C= Portion Attributable to Differing Coefficients = $\overline{X}_i^L(\beta^H - \beta^L)$

U= Unexplained Portion of the Differential = $\alpha_0^H - \alpha_0^L$

D=Portion of the Differential Attributable to Discrimination = C+U

Equations (2) and (3) are estimated via OLS and the results from these equations are used to calculate the five components of the differential discussed above. The explanatory variables included in the regressions are experience and its square; dummy variables for gender, marital status (2), nursing education (3), non-nursing education (3), full time work,

[16] Blinder shows that one can equivalently evaluate the difference by using the low-wage earner equation. The choice to use the high-wage equation allows each term to have an economic explanation.

more than one position in nursing, MSA residence, hospital work, other household income (7), nursing position (12), and region (8); and a constant term. Estimates are calculated by decade for all nurses, full time nurses, part time nurses, nurses employed in hospitals, and nurses employed outside of a hospital. In total, 30 regressions are estimated using equations (2) and (3). [17] For black nurses, three decade regressions are performed for the five nurse groupings (all nurses, full time, part time, hospital and non-hospital) and the process is the same for white nurses.

The decomposition results are presented in Tables 2.8 through 2.10. Blacks are the high-wage earners; thus, positive values in the decomposition results favor blacks and negative values favor whites. Table 2.8 presents the results for the full sample of nurses. For annual income, the portion of the differential that is unexplained along with the differing coefficients (D) favors blacks, as does the portion due to differing endowments (E). [18] The amount of the differential due to differing coefficients alone (C) favors whites. While blacks have better endowments, whites receive better returns to the endowments. If whites were given the same endowments as blacks, then they would be expected to earn more than blacks. However, for hourly income, the portion due to differing endowments (E) favors whites.

[17] These results are available from the author upon request.
[18] This is the proportion that Blinder refers to as "the proportion due to discrimination". This may be misleading as many factors other than discrimination may make up part of this unexplained differential portion.

Conclusion

The average observed wage of black RNs is higher than that of white RNs in the NSSRN. This essay analyzed the wage differential, between black and white nurses, in the NSSRN to determine the sources of the differential. Several possible explanations were examined in this essay, including differing endowments, differing returns to endowments, concentration effects, distribution effects, differences in distaste for positions, shift work, and actual experience.

While the source of the differential could not be completely fleshed out, several interesting findings were made. Black nurses with equal endowments to whites are discriminated against. A decomposition of the differential showed that black nurses have on average better endowments than white nurses which leads to higher wages. Why this is so is the subject of future research.

There was a substantial portion of the differential that could not be explained by the decomposition. This is typically attributed to discrimination; in this case reverse discrimination favoring black RNs. Examination of the income-experience profile provided support for black nurses having more actual experience per year of potential experience. These profiles also show a selection bias; black RNs earn more than white RNs at all levels of experience. There was no support for blacks having less distaste for unattractive positions than whites, or being more willing to take on shift work. Distribution effects were not supported by the results.

Black concentration effects were found to support prior literature on the general population. However, the small magnitude of the concentration effect was not substantial enough to account for the large black-white differential. Support for a demand side explanation and an attraction explanation were shown; a potentially upward trend in the differential was seen across regions as they increased in black concentration. Further, investigation of the demand side hypothesis, attraction and possible self-selection utilizing information on tastes and preferences would be beneficial.

References

Adamache, Killard W. and Frank A. Sloan (1982), "Unions and Hospitals, Some Unresolved Issues," *Journal of Health Economics* , 1, pp. 81–108.

Aigner, Dennis J. and Glen G. Cain, (1977), "Statistical Theories of Discrimination in Labor Markets," *Industrial and Labor Relations Review*, 30(2), pp. 175-187.

Altonji, Joseph G. and Rebecca Blank, (1999), "Race and Gender in the Labor Market," *The Handbook of Labor Economics,* Volume 3C, Chapter 48, pp.3144-3259.

Alhburg, Dennis A. and Christine Brown Mahoney, (1996), "The Effect of Wages on the Retention of Nurses," *Canadian Journal of Economics*, 24 (Special Issue), pp. S126-S129.

Altonji, Joseph G. and Charles R. Pierret,(2001), "Employer Learning and Statistical Discrimination," *Quarterly Journal of Economics*, 116(1), 2001, pp. 313-350.

Arcidiacono, Peter, (2003), "The Dynamic Implications of Search Discrimination" *Journal of Public Economics*, 87(7-8), pp. 1681-1707.

Barbee, Evelyn L. (1993), "Racism in U.S. Nursing," *Medical Anthropology Quarterly*, 7(4), pp. 346-362.

Bayard, Kimberly, Judith Hellerstein, David Neumark, and Kenneth Troske, (1999), "Why Are Racial and Ethnic Wage Gaps Larger for Men than for Women? Exploring the Role of Segregation Using the New Worker-Establishment Characteristics Database." In *The Creation and Analysis of Employer-Employee Matched Data*, edited by John C. Haltiwanger et al. Amsterdam: Elsevier Sci.

Beggs, John J., Wayne J. Villemez and Ruth Arnold, (1997), "Black Population Concentration and Black-White Inequality: Expanding the Consideration of Place and Space Effects," *Social Forces*, 76(1), pp. 65-91.

Black, Dan A., (1995), "Discrimination in an Equilibrium Search Model," *Journal of Labor Economics*, 13(2), pp.309-334.

Black, Dan, Amelia Haviland, Seth Sanders, and Lowell Taylor, (2006), "Why do Minority Men Earn Less? A Study of the Wage Differentials Among the Highly Educated," *The Review of Economics and Statistics*, 88(1), pp. 300–313.

Dan, Amelia Haviland, Seth Sanders, and Lowell Taylor, (2007), "Gender Wage Differences Among the Highly Educated," *Journal of Human Resources*, Forthcoming

Blau, Francine D., and Andrea H. Beller, (1992), "Black-White Earnings over the 1970s and 1980s: Gender Differences in Trends." *Review of Economics and Statistics,* 74(2), pp. 276–86.

Bollinger, Christopher R., (1998), "Measurement Error in the Current Population Survey: A Nonparametric Look," *Journal of Labor Economics*, 16(3), pp. 576-594.

Bound, John and Laura Dresser, (1999), "Losing Ground: The Erosion of the Relative Earnings of African American Women During the 1980s," In *Latinas and African American Women at Work: Race, Gender, and Economic Equality*, ed. Irene Browne, Russell Sage Foundation, pp. 61-104.

Bound, John, Alan B. Krueger, (1991),"The Extent of Measurement Error in Longitudinal Earnings Data: Do Two Wrongs Make a Right," *Journal of Labor Economics,* 9(1), pp. 1-24.

Browne, Irene and Rachel Askew, (2005)"Race, Ethnicity, and Wage Inequality Among Women," *American Behavioral Scientist*, 48(9), pp. 1275-1292.

Browne, Irene, and Joya Misra,(2003), " The intersection of gender and race in the labor market," *Annual Review of Sociology*, 29, pp. 487–513.

Bruggink, Thomas H., Keith C. Finan, Eugene B. Gendel and Jeffrey S. Todd (1985),"Direct and Indirect Effects of Unionization on the Wage Levels of Nurses; A Case Study of New Jersey Hospitals," *Journal of Labor Research*, 6(4), pp. 405-416.

Buerhaus, Peter I. and Douglas O. Staiger, (1999),"Trouble in the Nurse Labor Market? Recent Trends and Future Outlook," *Health Affairs*, 18(1), pp. 214-222.

Buerhaus, Peter I., Douglas O. Staiger and David I. Auerbach, (2004), "New Signs of A Strengthening U.S. Nurse Labor Market," *Health Affairs*, Web Exclusive, pp. W4-526-W4- 533.

Butler, Richard, and James J. Heckman, (1977), "The Government's Impact on the Labor Market Status of Black Americans: A Critical Review." In *Equal Rightsand Industrial Relations*, edited by Leonard J. Hausman et al. Madison, Wisc.: Indus. Relations Res. Assoc.

Card, David, and Alan B. Krueger (1992), “School Quality and Black-White Relative Earnings: A Direct Assessment.” *Quarterly Journal of Economics,* 107(1), pp. 151–200.

Cassirer, Naomi, (1996), “Race Composition and Earnings: Effects by Race, Region, and Gender,” *Social Science Research*, 25(4) pp. 375-399.

Chandra, Amitabh, (2000), “Labor-Market Dropouts and the Racial Wage Gap: 1940–1990.” *American Economic Review Papers and Proceedings,* 90(2), pp. 333–38.

Cohen, Philip N. (1998), “Black Concentration Effects on Black-White and Gender Inequality: Multilevel Analysis for U.S. Metropolitan Areas,” *Social Forces*, 77(1), pp. 207-229.

Feldman, Roger and Richard Scheffler (1982), “The Union Impact on Hospital Wages and Fringe Benefits,” *Industrial and Labor Relations Review*, 35(2), pp.196-296.

Flabbi, Luca, (2006), “Gender Discrimination Estimation in a SearchModel with Matching and Bargaining,” Working Paper, Georgetown University. Grant, Don Sherman and Toby L. Parcel, (1990), “Revisiting Metropolitan Racial Inequality: The Case for a Resource Approach,” *Social Forces,* 68(4), pp. 1121-1142.

Gray, Bradley, and Jeffery J. Stoddard, (1997), "Patient-Physician Pairing: Does Racial and Ethnic Congruity Influence Selection of A Regular Physician?" *Journalof Community Health*, 22(4), pp. 247-259.

Health Resources and Services Administration, (2004), “National Center for Health Workforce Analysis: Supply, Demand, and Use of Licensed Practical Nurses,” http://bhpr.hrsa.gov/healthworkforce/reports/lpn/LPN1_5.htm

Heckman, James J., Thomas M. Lyons, and Petra E. Todd (2000), “Understanding Black-White Wage Differentials, 1960–1990.” *Economic Review Papers and Proceedings,* 90(2), pp. 344–49.

Hirsch, Barry T., and Edward J. Schumacher, (1992), "Labor Earnings, Discrimination and the Racial Composition of Jobs," *Journal of Human Resources,* 27(4), pp. 602-628.

Hirsch, Barry T., and Edward J. Schumacher(1995), "Monopsony Power and Relative Wages in the Labor Market for Nurses," *Journal of Health Economics*, 14(4), pp. 443-76.

Hirsch, Barry T., and Edward J. Schumacher, (1998), "Union Wages, Rents, and Skills in Health Care Labor Markets," *Journal of Labor Research*, 19(1), pp. 1-23.

Hirsch, Barry T., and Edward J. Schumacher (2005), "Classic Monopsony or New Monopsony? Searching for Evidence in Nursing Labor Markets," *Journal of Health Economics*, 24(5), pp. 969-989.

Holmås, Tor Helge, (2002), "Keeping Nurses at Work: A Duration Analysis," Stein Rokkan Centre for Social Studies Bergen University Research Foundation, Working Paper 6-2002.

Jacobson, Jonathan, Cara Olsen, Jennifer King Rice, Stephen Sweetland, and John Ralph, (2001), *Educational Achievement and Black-White Inequality*. Statistical Analysis Report no. 2001-061 (July). Washington, D.C.: National Center for Education Statistics.

Johnson, William, Derek Neal and Yuichi Kitamura, (2000), "Evaluating a Simple Method for Estimating Black-White Gaps in Median Wages," *American Economic Review*, 90(2), pp. 339-343.

LaVeist, Thomas A. and Amani Nuru-Jeter, (2002), "Is Doctor-Patient Race Concordance Associated With Greater Satisfaction With Care?," *Journal of Health and Social Behavior*, 43(3), pp. 296-306.

LaVeist, Thomas A., Amani Nuru-Jeter and Kiesha E. Jones, (2003), "The Association of Doctor-Patient Race Concordance With Health Services Utilization," *Journal of Public Health Policy*, 24(3/4), pp. 312-323.

Link, Charles R., and Russell F. Settle, (1979), "Labor Supply Responses of Married Professional Nurses: New Evidence," *Journal of Human Resources*, 4(2), pp.256-266.

Link, Charles R., and Russell F. Settle, (1981), "A Simultaneous-Equation Model of Labor Supply, Fertility and Earnings of Married Women: The Case of registered Nurses," Southern Economic Journal, 47(4), pp.977-989.

Murnane, Richard J., John B. Willett and Frank Levy, (1995), "The Growing Importance of

Cognitive Skills in Wage Determination," *The Review of Economics and Statistics*, 77(2), pp. 251- 266.

Neal, Derek, (2004), "The Measured Black-White Wage Gap Among Women Is Too Small," Journal *of Political Economy*, 112(1), pp. S1-S28.

Neal, Derek, (2006) "Black-White Labour Market Inequality in the United States," Forthcoming in the *New Palgrave Dictionary of Economics*.

Neal, Derek, and William R. Johnson, (1996), "The Role of Premarket Factors in Black-White Wage Differences." *Journal of Political Economy*, 104 (5): 869–95.

Potamites, Elizabeth,(2007), "Why Do Black Women Work More? A Comparison of White and Black Married Women's Labor Supply," Working Paper New York University.

Pudney, Stephen and Michael A. Shields, (2000),"Gender and Racial Discrimination in Pay and Promotion for NHS Nurses," *Oxford Bulletin of Economics & Statistics*, 62(5) Special Issue, pp.801-835.

Roemer, Mark I., (2000), "Assessing the Quality of the March Current Population Survey and the Survey of Income and Program Participation Income Estimates: 1990-1996," Internal Report, Washington, D.C.: U.S. Census Bureau. June 16, 2000.

Saha, Somnath, LMiriam M. Komaromy, R. D. Koepsell and Andrew B.Bindman,(1999), "Patient-physician Racial Concordance and the Perceived Quality and Use of Health Care," *Archives of Internal Medicine*, 19(4), pp.76-83

Schumacher, Edward J. ,(2002), "Technology, Skills, and Health Care Labor Markets," *Journal of Labor Research*, 23(3), pp. 397-415.

Schumacher, Edward J. "Relative Wages and the Returns to Education in the Labor Market for Registered Nurses," *Research in Labor Economics*, 16, 1997, pp. 149-176.

Schumacher, Edward J. "Relative Wages and Exit Behavior among Registered Nurses," *Journal of Labor Research*, 18(4), 1997, pp. 581-92.

Schumacher, Edward J., and Barry T. Hirsch. "Compensating Differentials and Unmeasured Ability in the Labor Market for Nurses: Why Do Hospitals Pay More?" *Industrial and Labor Relations Review* 50(4), 1997, pp. 557-579.

Sorensen, Elaine, (1989), “Measuring the Effect of Occupational Sex and Race Composition on Earnings,” In *Pay Equity:Empirical Inquiries*, ed. Robert Michael and Heidi Hartmann, Washington D.C.: National Academy Press, pp. 101-124.

Smith, James P., (1979),“The Convergence to Racial Equality in Women’s Wages.” In *Women in the Labor Market*, edited by Cynthia B. Lloyd, Emily S. Andrews, and Curtis L. Gilroy. New York: Columbia Univ. Press.

Smith, James P., and Finis R. Welch. 1989. “Black Economic Progress after Myrdal.” Journal of Economic *Literature* 27 (2): 519–64.

U.S. Commission on Civil Rights, (1990), *The Economic Status of Black Women*, Washington D.C.: U.S.

Vigdor, Jacob L., (2005), “The New Promised Land: Black-White Convergence in the American South, 1940-2000,” Working Paper Duke University and NBER.

APPENDIX

Nurses in the NSSRN provide support for black women earning more than their white counterparts. This finding, though not entirely unexpected, is contrary to results from the Current Population Survey (CPS). Table 2.A2 presents a comparison of NSSRN and CPS summary statistics. This discrepancy has not been resolved in the literature, thus justification for use of the NSSRN instead of the CPS is discussed. Schumacher and Hirsch (1997) note that in the CPS black nurses earn 10% less than white nurses; Schumacher (1997) finds blacks to earn 12.5% less than whites in the CPS but 6.5% more in the NSSRN. Nonetheless, it is noted that regression coefficients are similar for the two surveys when weighted least squares is used in conjunction with the provided sample weights in the NSSRN.[19] The difference between the two surveys was attributed to potential response bias in the NSSRN from (low-wage) blacks not responding to the survey. It is equally likely that the CPS oversamples low-wage blacks or classifies nurses incorrectly.

The NSSRN provides sample weights to correct for over-sampling and under-sampling of different demographic groups within the RN population. Other factors not considered in past research may be of importance in explaining the difference between the wage differentials from each survey. First, the CPS over-samples both blacks and low-wage individuals by design. Second, the CPS excludes members of the Armed Forces while the NSSRN does not. RNs in the Armed Forces are paid based on their rank and years of service according to regulations. It is not uncommon for military nurses to earn more than

[19] Table 2.A3 demonstrates this finding.

their civilian counterparts.[20] Inclusion of these RNs in the sample should lead to lower differentials between blacks and whites under the assumption that discrimination on the basis of race in the military is low and the fact that blacks are over represented in the military. Third, blacks in the NSSRN on average have higher levels of nursing education than whites. Further, the NSSRN differentiates between nursing and non-nursing education. The CPS cannot differentiate between nursing and non-nursing degrees. Indeed, in the CPS, diploma nurses can only be identified as individuals who report being an RN with no post secondary education. Fourth, the Outgoing Rotation Files (ORG) of the CPS include a measure of hourly wages excluding overtime and other non-hourly compensation. The NSSRN includes a measure of gross annual income that would include overtime, bonuses and other monetary compensation. In the NSSRN, an hourly wage must be derived from this measure of annual income. The CPS and NSSRN hourly wage measures include different income components. Hourly income in the NSSRN is 13% higher than in the CPS for all nurses and 26% higher for blacks. Interestingly, when annual income is calculated from the CPS data black nurses on average earn 4% more than white nurses despite the exclusion of overtime pay and other non-hourly compensation.

The NSSRN only samples RNs who have an active license. The CPS samples the general population; RNs are determined by an individual's response to occupation questions. There is a large literature on reporting error in the CPS (see for example Bound and Krueger 1991, Bollinger 1998 and Roemer 2000). It is probable that many licensed practical nurses

[20] From discussion with retired Lieutenant Colonel Catherine Grumbeck of the U.S. Army Nurse Corps a prior RN and current nurse practitioner with the Department of Veteran's Affairs.

are incorrectly classified as registered nurses since the two occupations are closely related. In the CPS the estimated number of licensed practical nurses is consistently smaller than the number of active licenses (HRSA Report 2004). Further, the CPS nurses do not necessarily have a current license and the CPS will, in most situations, classify administrative, consulting, supervisory and research nurses and well as nursing instructors in occupations other than nursing even though they are licensed registered nurses.

The NSSRN and CPS samples are intrinsically different. Using the CPS as a standard for the NSSRN is not reliable. The two samples should not be expected to provide identical results. It is the belief of this author that the NSSRN is a more accurate representation of the registered nurse population in the United States, hence its use in this study.

Table 2.1: Summary Statistics of the 1984-2004 NSSRN Sample

	All RNs	White	Black
Race		95.44%	4.56%
Annual Income	$39,365	$39,037	$46,230
Hourly Income*	$23.38	$23.27	$25.59
Female	95.41%	95.37%	96.13%
Married	72.96%	73.68%	57.86%
Divorced	17.24%	16.83%	25.85%
Single	9.80%	9.49%	16.29%
Age	42	41	43
Experience	21.60	21.53	23.07
Hospital	63.50%	63.37%	66.38%
Hours	35.78	35.60	39.53
Weeks	49.61	49.62	49.38
Full Time	66.74%	65.99%	82.58%
MSA	82.12%	81.67%	91.55%
Education			
Diploma	35.83%	36.34%	25.08%
Associate	37.90%	37.47%	46.91%
Bachelor	26.05%	25.96%	27.77%
Graduate	0.22%	0.22%	0.24%
Non-Nursing Degree	21.53%	21.19%	28.73%

	All RNs	White	Black
Nursing Position			
Administrative	5.80%	5.78%	6.29%
Consultant	1.11%	1.13%	0.70%
Supervisor	4.76%	4.71%	5.79%
Instructor	3.59%	3.57%	4.10%
Head Nurse	5.86%	5.76%	7.92%
Staff/General	63.36%	63.52%	60.16%
Practioner/Midwife	2.24%	2.26%	1.76%
Clinical Specialist	1.67%	1.69%	1.36%
Clinician	1.29%	1.29%	1.42%
Nurse Anesthesiologist	1.08%	1.09%	0.88%
Research	0.51%	0.52%	0.22%
Private Duty	0.81%	0.80%	1.06%
Other	7.92%	7.90%	8.34%
Region			
New England	7.44%	7.68%	2.37%
Middle Atlantic	17.02%	16.80%	21.76%
South Atlantic	17.34%	16.76%	29.50%
East So Central	5.89%	5.74%	8.95%
West So Central	8.14%	7.97%	11.65%
East No Central	18.27%	18.56%	12.26%
West No Central	8.73%	9.00%	3.10%
Mountain	5.32%	5.50%	1.41%
Pacific	11.86%	11.99%	8.99%

n=112,956

n White=108,750

n Black=4,206

Sampling weights used in all calculations.

Table 2.2: Baseline Wage Regression Coefficients

Variable	Coefficient		Standard Error
Intercept	10.226	*	(0.020)
Black	0.102	*	(0.006)
Experience	0.014	*	(0.001)
Experience^2	-0.028	*	(0.002)
Female	-0.079	*	(0.006)
Married	-0.213	*	(0.006)
Divorced	-0.010		(0.006)
Full Time	0.580	*	(0.004)
MSA	0.084	*	(0.004)
Hospital	0.199	*	(0.004)
Nursing Education		*	
Diploma	-0.004		(0.004)
Bachelor	0.010	*	(0.004)
Graduate	0.088	*	(0.029)
Non-Nursing Education		*	
Associate	-0.013		(0.008)
Bachelor	-0.033	*	(0.008)
Graduate	-0.044		(0.025)
n	112,956		
R-Squared	0.464		

*Indicates significance at the 5% level or better.
Other variables included in the equation: dummies for region (8), other household income (6), nursing position (12), more than one nursing job and, year (5).
Sampling weights used in all calculations.

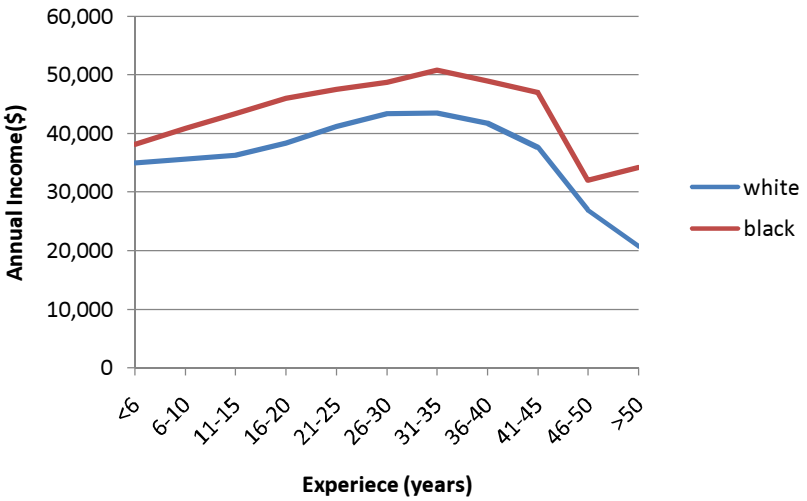


Figure 2.1: NSSRN Annual Income-Experience Profile

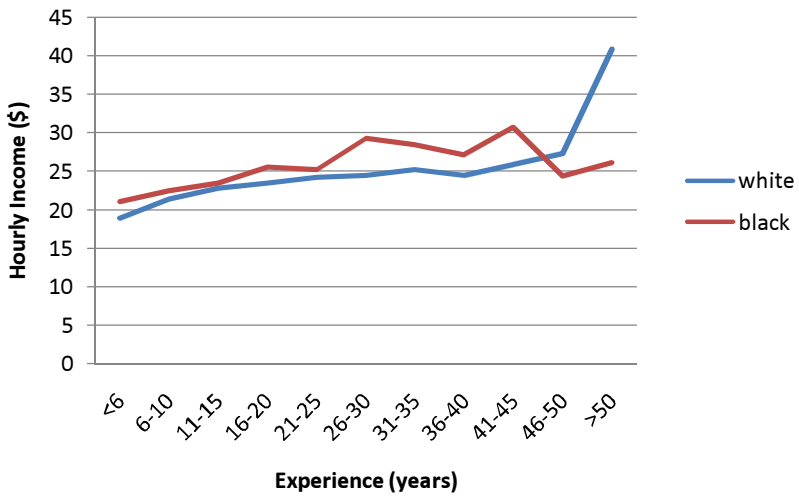


Figure 2.2: NSSRN Hourly Income-Experience Profile

Table 2.3: Examination of a Distaste Effect

Nursing Position	Annual Income	Hourly Wage	Annual Coefficient	Hourly Coefficient	% Black
Head Nurse	$47,983	$23.74	0.056 *	0.038 *	6.16%
Private Duty	$26,155	$21.55	-0.220 *	0.004	5.96%
Supervisor	$41,904	$23.20	0.061 *	0.053 *	5.55%
Instructor	$39,115	$25.76	-0.006	0.130 *	5.20%
Nurse Clinician	$40,527	$23.22	0.000	-0.003	5.02%
Administrative	$55,944	$26.98	0.211 *	0.151 *	4.94%
Staff/General	$35,617	$22.43	-0.082 *	-0.041 *	4.79%
Clinical Specialist	$45,012	$25.19	0.060 *	0.045 *	4.32%
Nurse Anesthesiologist	$85,322	$44.20	0.525 *	0.488 *	3.70%
Nurse Practioner/Midwife	$51,435	$29.31	0.204 *	0.179 *	3.70%
Consultant	$42,221	$32.13	-0.005	0.122 *	3.58%
Research	$42,834	$24.48	-0.025	0.009	2.89%
Other	$42,178	$24.58	--	--	8.34%
n			112,956	112,956	
R-Squared			0.429	0.346	

Sampling weights used in estimation.

*Indicates significance at the 5% level or better.

Other variables included in the estimation: experience, experience^2, dummies for marital status (2), nursing education (3), non-nursing education (3), other household income (7), region (8),and year (5); and indicators for black, female, fulltime work, MSA residence, hospital employment, and holding more than one nursing position; and a constant.

Table 2.4: Examination of a Shift-Work Effect by Work Setting

	Annual Income								
	Hospital			Nursing Home			Other Settings		
Intercept	10.391	(0.022)	*	10.184	(0.076)	*	10.309	(0.047)	*
Black	0.082	(0.006)	*	0.142	(0.025)	*	0.134	(0.015)	*
Experience	0.011	(0.001)	*	0.014	(0.002)	*	0.016	(0.002)	*
Experience^2	-0.020	(0.002)	*	-0.030	(0.004)	*	-0.034	(0.005)	*
Female	-0.074	(0.006)	*	-0.013	(0.034)		-0.131	(0.016)	*
Married	-0.197	(0.005)	*	-0.188	(0.023)	*	-0.261	(0.018)	*
Divorced	-0.024	(0.005)	*	0.004	(0.024)		-0.002	(0.020)	
Diploma	0.005	(0.004)		-0.012	(0.013)		-0.012	(0.010)	
Bachelor	0.013	(0.005)	*	-0.017	(0.018)		0.015	(0.009)	
Graduate	0.093	(0.032)	*	-0.061	(0.087)		0.080	(0.050)	
Full Time	0.529	(0.005)	*	0.584	(0.014)	*	0.686	(0.010)	*
MSA	0.089	(0.004)	*	0.087	(0.013)	*	0.070	(0.009)	*
n	72263			8141			32552		
R-Squared	0.485			0.535			0.4263		
	Hourly Wages								
	Hospital			Nursing Home			Other Settings		
Intercept	3.362	(0.020)	*	3.195	(0.068)	*	3.347	(0.040)	*
Black	0.071	(0.006)	*	0.124	(0.023)	*	0.127	(0.015)	*
Experience	0.005	(0.001)	*	-0.001	(0.002)		0.004	(0.002)	*
Experience^2	-0.005	(0.002)	*	0.004	(0.004)		-0.003	(0.004)	
Female	-0.055	(0.006)	*	-0.038	(0.028)		-0.094	(0.014)	*
Married	-0.148	(0.005)	*	-0.117	(0.022)	*	-0.175	(0.017)	*
Divorced	-0.015	(0.005)	*	0.029	(0.024)		-0.002	(0.020)	
Diploma	0.022	(0.003)	*	0.012	(0.011)		-0.005	(0.008)	
Bachelor	0.037	(0.004)	*	0.017	(0.014)		0.052	(0.008)	*
Graduate	0.071	(0.038)	*	-0.006	(0.096)		0.083	(0.042)	*
Full Time	-0.129	(0.004)	*	-0.098	(0.011)	*	-0.053	(0.007)	*
MSA	0.094	(0.004)	*	0.080	(0.011)	*	0.066	(0.007)	*
n	72263			8141			32552		
R-Squared	0.282			0.212			0.212		

Sampling weights used in estimation.

*Indicates significance at the 5% level or better.

Other variables included in the estimation: experience, experience^2, dummies for marital status (2), nursing education (3), non-nursing education (3), other household income (7), region (8),and year (5); and indicators for black, female, fulltime work, MSA residence, hospital employment, and holding more than one nursing position; and a constant.

Table 2.5: Examination of a Shift-Work Effect and Distribution Effect by Nursing Position

	Annual Income			*Hourly Wage*			
Nursing Position	Coefficient on Black	n	R-squared	Coefficient on Black	n	R-squared	Shift-Work Likely?
Research	0.207 +	517	0.501	0.098	517	0.278	No
Consultant	0.038	1,208	0.462	-0.011	1,208	0.161	No
Nurse Anesthesiologist	0.071 +	1,435	0.514	0.133 *	1,435	0.431	No
Instructor	0.120 *	4,216	0.429	0.079 *	4,216	0.174	No
Nurse Clinician	-0.007	1,308	0.545	0.062	1,308	0.264	No
Administrative	0.090 *	6,735	0.438	0.064	6,735	0.337	No
Clinical Specialist	0.066 +	1,871	0.507	0.076 *	1,871	0.2653	No
Head Nurse	0.046 *	6,385	0.530	0.046 *	6,385	0.309	No
Other	0.100 *	8,056	0.431	0.104 *	8,056	0.178	No
Supervisor	0.040	5,435	0.525	0.050 +	5,435	0.297	Yes
Private Duty	0.017	785	0.407	0.048	785	0.098	Yes
Staff/General Nurse	0.122 *	72,526	0.413	0.103 *	72,526	0.2167	Yes
Nurse Practitioner/Midwife	0.024	2,479	0.399	0.021	2,479	0.2061	Yes

Sampling weights used in estimation.

*Indicates significance at the 5% level or better. + Indicates significance at the 10% level or better.

Other variables included in the estimation: experience, experience^2, dummies for marital status (2), nursing education (3), non-nursing education (3), other household income (7), region (8),and year (5); and indicators for black, female, fulltime work, MSA residence, hospital employment, and holding more than one nursing position; and a constant.

Table 2.6: Black Concentration Effects

	Annual				Hourly		
Intercept	10.210	(0.020)	*		0.323	(0.017)	*
Black	0.123	(0.010)	*		0.109	(0.011)	*
Percent Black	0.247	(0.022)	*		0.283	(0.000)	*
Black*Percent Black	-0.154	(0.040)	*		-0.147	(0.040)	*
Experience	0.014	(0.001)	*		0.005	(0.069)	*
Experience^2	-0.028	(0.002)	*		-0.005	(0.002)	*
Female	-0.080	(0.006)	*		-0.061	(0.006)	*
Married	-0.212	(0.006)	*		-0.153	(0.005)	*
Divorced	-0.010	(0.006)			-0.006	(0.006)	
Diploma	-0.004	(0.004)			0.012	(0.003)	*
Bachelor	0.010	(0.004)	*		0.041	(0.003)	*
Graduate	0.089	(0.029)	*		0.081	(0.027)	*
Full Time	0.580	(0.004)	*		-0.105	(0.003)	*
MSA	0.083	(0.004)	*		0.083	(0.003)	*
Hospital	0.199	(0.004)	*		0.156	(0.003)	*
n	112956				112956		
R-Squared	0.464				0.252		

Sampling Weights used in estimation
Standard errors are in parentheses.
Other variables included the equations were dummies for region (8), nursing position (12) and year (5).

Table 2.7: Wage Regression--By Region

	Annual Income				Hourly Wage			
	Coefficient on Black	Standard Error	R-Squared		Coefficient on Black	Standard Error	R-Squared	n
Mountain	0.022	(0.030)	0.505		0.002	(0.032)	0.234	14,455
New England	0.140*	(0.035)	0.437		0.082*	(0.028)	0.242	11,234
West North Central	0.053*	(0.025)	0.444		0.048*	(0.027)	0.231	15,912
Pacific	0.089*	(0.021)	0.449		0.074*	(0.029)	0.235	11,396
East South Central	0.086*	(0.014)	0.413		0.074*	(0.018)	0.209	8,244
East North Central	0.076*	(0.019)	0.466		0.080*	(0.019)	0.208	13,149
West South Central	0.087*	(0.019)	0.471		0.084*	(0.015)	0.271	8,690
Middle Atlantic	0.183*	(0.015)	0.474		0.145*	(0.015)	0.248	10,515
South Atlantic	0.070*	(0.010)	0.487		0.081*	(0.010)	0.252	19,361

Standard errors in parentheses. *Indicates significance at the 5% level or better.
Other variables included in the estimation: experience, experience^2, dummies for marital status (2), nursing education (3), non-nursing education (3), other household income (7), region (8),and year (5); and indicators for black, female, fulltime work, MSA residence, hospital employment, and holding more than one nursing position; and a constant.

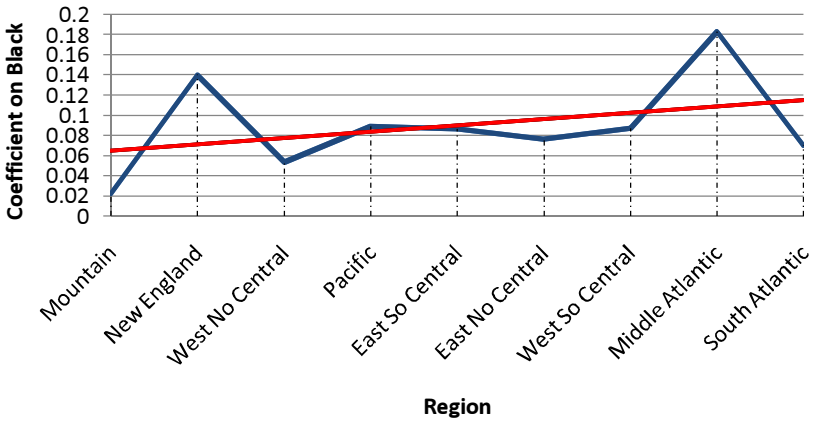


Figure 2.3:Regional Demand For Black Nurses - Annual Income

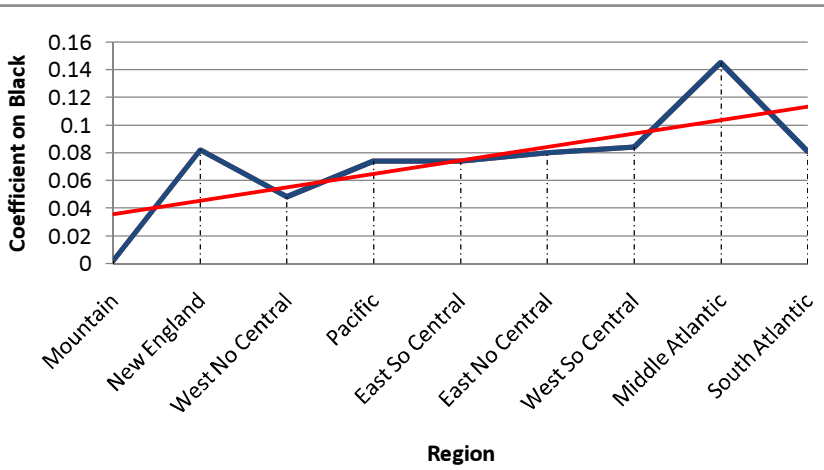


Figure 2.4:Regional Demand For Black Nurses - Hourly Income

Table 2.8: Decomposition Results

Annual Income				
		1980s	1990s	2000s
Raw Differential	R	0.246	0.229	0.190
Amount Due to Differing Endowments	E	0.093	0.070	0.053
Amount Due to Differing Coefficients	C	-0.363	-0.238	-0.304
Unexplained Portion of Differential	U	0.516	0.397	0.441
Portion Due to Discrimination	D	0.153	0.159	0.138
Hourly Wage				
		1980s	1990s	2000s
Raw Differential	R	0.096	0.113	0.066
Amount Due to Differing Endowments	E	-0.018	-0.005	-0.036
Amount Due to Differing Coefficients	C	-0.083	0.080	-0.061
Unexplained Portion of Differential	U	0.198	0.038	0.163
Portion Due to Discrimination	D	0.114	0.118	0.102

Note: a positive value indicates an advantage for blacks and a negative value an advantage for whites. Values may not sum exactly due to rounding.

D=C+U, R=E+C+U

Table 2.A1: Income By Region And Year

	Annual Income				*Hourly Income*		
	All RNs	**White**	**Black**		**All RNs**	**White**	**Black**
Region				**Region**			
New England	$39,987	$39,864	$48,235	New England	$25.03	$25.00	$26.87
Middle Atlantic	$39,926	$39,247	$50,657	Middle Atlantic	$24.74	$24.52	$28.35
South Atlantic	$40,304	$39,889	$44,976	South Atlantic	$23.15	$22.91	$25.85
East So Central	$38,692	$38,489	$41,415	East So Central	$21.64	$21.52	$23.19
West So Central	$41,479	$41,198	$45,100	West So Central	$22.88	$22.79	$24.03
East No Central	$37,195	$36,971	$44,547	East No Central	$22.40	$22.34	$24.28
West No Central	$35,938	$35,856	$40,673	West No Central	$21.70	$21.68	$22.33
Mountain	$38,090	$38,043	$41,821	Mountain	$22.54	$22.56	$21.59
Pacific	$44,804	$44,518	$52,554	Pacific	$27.74	$27.61	$31.29
Year				**Year**			
1984	$32,861	$32,560	$39,098	1984	$19.59	$19.50	$21.47
1988	$35,113	$34,823	$41,839	1988	$20.38	$20.29	$22.41
1992	$39,808	$39,449	$47,432	1992	$23.30	$23.18	$25.88
1996	$40,510	$40,205	$47,065	1996	$24.89	$24.74	$28.05
2000	$41,109	$40,768	$47,014	2000	$25.09	$24.93	$27.90
2004	$45,446	$45,115	$51,672	2004	$26.79	$26.74	$27.78

n=112,956
n White=108,750
n Black=4,206
Sampling weights used in all calculations.

Table 2.A2: Comparison of Summary Statistics for the NSSRN and CPS

	NSSRN				CPS		
	All RNs	**White**	**Black**		**All RNs**	**White**	**Black**
Race		95.44%	4.56%	Race		92.06%	7.94%
Annual Income	$39,365	$39,037	$46,230	Annual Income**	$33,159	$33,074	$34,386
Hourly Income*	$23.38	$23.27	$25.59	Hourly Income	$19.75	$19.85	$18.49
Female	95.41%	95.37%	96.13%	Female	94.39%	94.41%	94.25%
Married	72.96%	73.68%	57.86%	Married	67.49%	69.13%	48.53%
Divorced	17.24%	16.83%	25.85%	Divorced	18.09%	17.06%	30.10%
Single	9.80%	9.49%	16.29%	Single	14.41%	13.81%	21.38%
Diploma	35.83%	36.34%	25.08%	H.S. Graduate	4.81%	4.43%	9.20%
Associate	37.90%	37.47%	46.91%	Some College	49.26%	49.72%	43.88%
Bachelor	26.05%	25.96%	27.77%	Bachelor	38.45%	38.23%	41.07%
Graduate	0.22%	0.22%	0.24%	Graduate	7.48%	7.62%	5.85%
Non-Nursing Degree	21.53%	21.19%	28.73%				
Age	42	41	43	Age	40	40	41
Experience	21.60	21.53	23.07	Experience	20.02	20.00	20.36
MSA	82.12%	81.67%	91.55%	MSA	80.99%	80.08%	91.57%
Hospital	63.50%	63.37%	66.38%	Hospital	71.97%	72.12%	70.25%
Hours	49.61	49.62	49.38	Hours	34.54	34.22	38.29
Weeks	0.67	0.66	0.83				
Full Time				Full Time	66.65%	65.21%	83.39%
Region				**Region**			
New England	7.44%	7.68%	2.37%	New England	7.17%	7.61%	2.06%
Middle Atlantic	17.02%	16.80%	21.76%	Middle Atlantic	14.88%	14.80%	15.88%
South Atlantic	17.34%	16.76%	29.50%	South Atlantic	17.80%	16.54%	32.46%
East So Central	5.89%	5.74%	8.95%	East So Central	6.09%	5.84%	8.90%
West So Central	8.14%	7.97%	11.65%	West So Central	8.38%	8.19%	10.57%
East No Central	18.27%	18.56%	12.26%	East No Central	19.98%	20.16%	17.85%
West No Central	8.73%	9.00%	3.10%	West No Central	9.53%	10.04%	3.72%
Mountain	5.32%	5.50%	1.41%	Mountain	5.06%	5.39%	1.12%
Pacific	11.86%	11.99%	8.99%	Pacific	11.11%	11.43%	7.44%
Nursing Position							
Administration	5.80%	5.78%	6.29%	Union	15.27%	14.73%	22.50%
Consultant	1.11%	1.13%	0.70%				
Supervisor	4.76%	4.71%	5.79%				
Instructor	3.59%	3.57%	4.10%				
Head Nurse	5.86%	5.76%	7.92%				
Staff/General	63.36%	63.52%	60.16%				
Practioner/Midwife	2.24%	2.26%	1.76%				
Clinical Specialist	1.67%	1.69%	1.36%				
Clinician	1.29%	1.29%	1.42%				
Nurse Anesthet	1.08%	1.09%	0.88%				
Research	0.51%	0.52%	0.22%				
Private Duty	0.81%	0.80%	1.06%				
Other	7.92%	7.90%	8.34%				
n	112,956	108,750	4,206	n	11,764	11,004	760

Sampling weights used in all calculations.

* Hourly income calculated as annual income/ weeks*hours. All variable come from the NSSRN.

** Annual income calculate as hourly income*weeks*hours where the average weeks reported in the NSSRN is used for each race.

Table 2.A3: Comparison of NSSRN and CPS Wage Regression Coefficients

Hourly					
	NSSRN			CPS	
Variable	Coefficient	Standard Error	Variable	Coefficient	Standard Error
Intercept	2.678	0.014	Intercept	2.532	0.023
Black	0.081	0.007	Black	-0.103	0.011
Experience	0.016	0.001	Experience	0.019	0.001
Experience^2	-0.027	0.002	Experience^2	-0.036	0.002
Female	-0.096	0.007	Female	-0.003	0.013
Married	-0.037	0.006	Married	0.023	0.009
Divorced	-0.012	0.006	Divorced	0.004	0.011
Diploma	0.034	0.003	H.S. Graduate	-0.089	0.015
Bachelor	0.097	0.004	Bachelor	0.112	0.007
Graduate	0.243	0.031	Graduate	0.158	0.012
Full Time	-0.055	0.004	Full Time	-0.012	0.007
MSA	0.116	0.004	MSA	0.092	0.008
Hospital	0.135	0.003	Hospital	0.139	0.007
			Union	0.048	0.009
Annual					
	NSSRN			CPS	
Variable	Coefficient	Standard Error	Variable	Coefficient	Standard Error
Intercept	9.552	0.017	Intercept	9.557	0.030
Black	0.092	0.007	Black	-0.077	0.015
Experience	0.028	0.001	Experience	0.026	0.001
Experience^2	-0.055	0.002	Experience^2	-0.052	0.003
Female	-0.119	0.007	Female	-0.038	0.017
Married	-0.074	0.006	Married	-0.054	0.012
Divorced	-0.016	0.007	Divorced	-0.010	0.015
Diploma	0.023	0.004	H.S. Graduate	-0.089	0.019
Bachelor	0.071	0.004	Bachelor	0.104	0.009
Graduate	0.280	0.032	Graduate	0.157	0.015
Full Time	0.655	0.005	Full Time	0.507	0.009
MSA	0.118	0.004	MSA	0.080	0.010
Hospital	0.181	0.004	Hospital	0.147	0.009
			Union	0.076	0.011

Other variables included the equations were dummies for region (8), and year (5).

Sampling weights used in all calculations.

* Hourly income calculated as annual income/ weeks*hours. All variables come from the NSSRN.

** Annual income calculate as hourly income*weeks*hours where the average weeks reported in the NSSRN is used for each race.

Chapter 3

The Effect of the Minimum Wage on Covered Teenage Employment

Introduction

Current literature on the effect of the minimum wage examines the change in total employment, including jobs both covered and uncovered by the minimum wage.[1] Covered workers are those paid a wage at or above the minimum wage. Uncovered workers are paid a wage below the minimum wage. It is possible that workers are displaced from the covered sector to the uncovered sector in response to changes in the minimum wage. If so, examining changes in total employment will result in an inaccurate measure of the effect of the minimum wage grossly understating its effect on job losses.

Using data on teenagers from the Current Population Survey (CPS), this essay examines the loss of covered jobs in response to changes in the minimum wage. A significant proportion of teenagers are affected by the minimum wage, allowing for empirical discernment of minimum wage effects. Reported wages are used to classify workers as covered or uncovered. Utilizing reported wages to determine into which sector workers are classified is subject to systematic error. Classification may be particularly affected when the minimum wage is increased, as wages do not necessarily respond immediately to changes in the minimum wage. There could be a lag in reporting the new wage or employers may not immediately adjust wages.

[1]The term minimum wage refers to the binding minimum wage defined as the higher of the state or federal minimum wage.

This paper builds upon the previous literature, which has focused on a time series approach to analyzing the effect of the minimum wage. In the literature, several aspects of the empirical modeling have not been sufficiently addressed, including multiple period autoregressive structure, measurement error, fixed effects, and observation weighting. This study incorporates an autoregressive component into the estimation. Measurement error from reporting lags and reporting bias is tested and addressed. In addition to fixed effects estimation, state, year and quarter dummies are included in the analysis. Finally, the data is used to generate weights for the state level observations.

In this study, it is shown that systematic error does exist in the classification of workers and corrections are undertaken. After the corrections, the decrease in covered employment is at least three times as large as the decrease in total employment.

The remainder of the essay is organized as follows. The second section introduces the motivation for the analysis to be performed. The third section discusses the minimum wage and measurement error. The fourth section describes the data and classification of workers. The fifth section presents baseline results for the effect of changes in the minimum wage on teenage employment. The sixth section is comprised of tests for systematic error and a conclusion ends the essay.

Analysis – The Two-Sector Model

This analysis uses a two-sector model. The two sectors are defined as covered and uncovered. Firms in the covered sector are constrained, either legally or by choice, to pay

wages equal to or greater than the minimum wage. The uncovered sector is comprised of firms who pay wages below the minimum wage. Analysis of the effect of the minimum wage on teenage employment shows a small loss in jobs when gross employment is examined. This occurs as teenagers losing covered jobs take uncovered jobs rather than leaving the labor force. This reallocation is not accounted for in a single sector market. In a two-sector model, covered jobs are separated from uncovered jobs to examine the effect of the minimum wage on covered employment. Utilizing a two sector model allows the researcher to discern distortions from the minimum wage by examining the effect of the minimum wage on covered workers.

If the two sector model is accurate, the impact of minimum wages on workers earning the minimum wage or higher will be greater than the impact on all workers. A testable implication that arises from this hypothesis is that the minimum wage elasticity of employment for all workers will be less elastic than the elasticity for covered workers.

Background

The Minimum Wage

In 1938, a national minimum wage was instituted at $0.25 per hour. As of July 2008, the federal minimum wage is $6.55 per hour. Table 3.A1 presents the history of the federal minimum wage. States may impose their own minimum wage and the higher of the state or federal minimum wage is binding. The federal minimum wage for tipped employees is

lower than the standard minimum wage. Currently, (July 2008), the tipped minimum wage is $2.13 per hour. States may also set their own tipped minimum wage.

There is a long standing debate over whether or not the minimum wage affects employment levels. Works, such as that by Card and Krueger (1994), show that the minimum wage does not decrease employment. In a study of the 1988 increase in the California minimum wage, Card (1992-2) finds that the change in the minimum wage increased the earnings of low wage workers and did not affect teenage employment. Similar results are found for teenagers with respect to the 1990 increase in the federal minimum wage (Card 1992-1). Controlling for the business cycle, Burnette et al. (2007) shows no minimum wage effect on teenage employment when compared to older cohorts.

Still, the empirical case against the minimum wage has been made by many. Deere, Murphy and Welch (1995) show that the minimum wage does have an effect on low-wage employees. Examining 16-19 year olds, Neumark (2001) presents results that are most consistent with the minimum wage having disemployment effects. Using the fraction of teenagers earning at or below the minimum wage, Wessels (2001) finds, even with controls for the business cycle, that minimum wage hikes decrease the labor force participation of teens. Changes in the minimum wage account for 7 to 10% of the variation in teen employment rates (Williams and Mills 2001). The minimum wage has been shown to have small negative effects on teenage employment with an elasticity ranging from -0.09 (Currie and Fallick 1996) to -0.2 (Neumark and Wascher 1992). Burkhauser et al. (2000) found larger effects, a 0% to 4% decrease in employment for a 10% increase in the minimum

wage. Neumark and Washer (2002) found still larger effects using a different estimation strategy.[2] This study finds for every 10% increase in the federal minimum wage overall employment decreases by 0% to 2%, matching the changes found in most studies. It finds a stronger effect for covered employment. A 10% increase in the minimum wage decreases covered employment by 6% to 14% dependent on the specification.

Models that analyze the minimum wage most often use typical estimation techniques, including logit, ordinary least squares, feasible generalized least squares, instrumental variables, vector autoregression, autoregression, normit and difference-in-difference techniques.[3] A simple time series estimation model is a standard seen in the minimum wage literature:

$$E_t = \alpha_0 + \alpha_1 MW_t + X_t\beta + \varepsilon_t \quad (1)$$

where E_t is the employment to population ratio, MW_t is a minimum wage variable, X_t is a vector of state characteristics and in some cases economic indicators, and ε_t is a normally-distributed error term (Wessels, 2001; Neumark and Wascher, 1992; Williams and Mills, 2001). Teenagers are often examined as they are most likely to earn the minimum wage, given they are at the bottom of the wage distribution and make up a large portion of low-wage workers (Card 1992-1).

[2] Their estimation accounts for the likelihood that the minimum wage is binding in a state. The ratio of the minimum wage to adult wages is regressed on the fraction of teenagers that are employed. A -0.41 effect is found.

[3] See Burnette et al. (2007), Currie and Fallick (1996), Wessels (2001), Card (1992-1), Card and Krueger(1995) and Williams and Mills (2001) for examples.

Studies that use the CPS typically include prime-age male unemployment and the proportion of the group being analyzed that is in the working-age population. The purpose is to control for aggregate economic activity and supply variation respectively (Neumark 2001). Other control variables include year and state dummies (Neumark, 2001; Neumark and Wascher 1992), year effects (Deere et al.1995), school enrollment (Neumark and Wascher, 1992; Williams and Mills, 2001), a dummy for whether the state minimum wage is higher than the federal minimum wage (Wessels 2001), lags of the dependent variable (Wessels 2001), the Kaitz index, average manufacturing wage, share of teenagers in the armed forces, and the share of teenagers aged 16-17 (Williams and Mills 2001).

Measurement Error

Measurement error in data has many consequences that researchers are often concerned about. In general, measurement error leads to false results and makes the underlying economic relationships difficult to discern. The estimates may be biased or inconsistent if the dependent variable is limited in some way, say to be greater than zero (Hausman 2001). Correcting for systematic error in the dependent variable is difficult. Consistent estimators have been suggested in the literature (Cavanagh and Sherman, 1998; Abrevaya and Hausman, 1999) but these estimators are not proven to be efficient. Many studies in the literature use validation or re-interview data to determine the true response of

individuals in the primary survey of interest.[4] Other studies do not rely on auxiliary or re-interview data. These studies utilize misclassification probabilities, semi-parametric estimation, instrumental variables estimation, and imputation to correct for reporting error.[5]

The occurrence of measurement error in the CPS is documented in the literature with a large focus on income reporting. Using the 1978 CPS-SSE (Social Security Earnings Record) Exact Match File, Bound and Krueger (1991) find that 14% of women and 12% of men report wages to the dollar in the CPS. Greater than 40% of the sample report wages within 2.5% of their Social Security wages. Under the assumption of classical measurement error, the reliability of CPS wages is found to be approximately 0.80 and 0.90 for men and women respectively. Using only male heads of household from the 1978 CPS-SSE, Bollinger (1998) finds that 11.7% of the men report their wages exactly. Using the 1978 CPS-SSE and 1977 March Annual Demographic File (ADF), 12.7% of women are shown to report exactly. Using matched CPS-IRS data from 1990-1996, Roemer (2000) shows that the reporting error varies by income level. Approximately 15%-33% of those who earn below $20,000 per year report their wages in the CPS within 5% of their IRS wages. The proportion that report within 25% of their IRS wages is 31%-75%. For all income levels the proportion that report within 5% of their IRS wages is 15%-42% and within 25% of their

[4] Chen, Hong and Tamer (2005), Roemer (2000), Magnac and Visser (1999), Bollinger (1998), Porterba and Summers (1995), Bound and Krueger (1991), Chua and Fuller (1987), Duncan and Hill (1985), Abowd and Zellner (1985) and Mellow and Sider (1983).

[5] Sullivan (2006), Abrevaya and Hausman (1999, 2004), Li et al. (2003), Dustmann and van Soest (2001), Lewbel (2000), Hausman et al. (1998) , and Lewbel (1997) , Brownstone and Valletta (1996) and Poterba and Summers (1986).

IRS wages is 31%-90% respectively. The highest correspondence occurs for those earning greater than or equal to $10,000 and less than $150,000. The worst correspondence is among those earning less than $10,000 and those earning $150,000 or more. Teenage workers in this study are likely to be in the low-wage, high-incidence of reporting error group.

Data

The primary data in this study are from the monthly Current Population Survey (CPS) and the Merged Outgoing Rotation Group (MORG) of the CPS. The CPS is a monthly survey of approximately 60,000 households performed by the Bureau of the Census for the Bureau of Labor Statistics. The CPS interviews an adult member of each household for four months, ignores them for eight months, and then interviews them for four more months. If the occupants of the household move, they are not followed; rather, the new occupants of the dwelling unit are interviewed. The CPS collects data on demographics, education, employment status, occupation, and several other topics. The MORG is a subset of the monthly CPS interviews. In interview months four and eight, households are asked about their usual weekly earnings and hours as well as their hourly income if they are an hourly employee. These interviews are collectively known as the MORG.

CPS data is taken from 1987-2001. These years were chosen to encompass the changes in the minimum wage in 1990, 1991, 1996, and 1997. Quarterly data was constructed from the monthly CPS for the teenage proportion of the population, the teenage

employment ratio, the adult unemployment rate, the average adult hourly wage, and per capita income. Summary statistics are presented in Table 3.A2.

It is possible to use monthly or annual data in place of quarterly data. The choice of quarterly data was made for several reasons. The monthly sample size for each state can be quite small.[6] Aggregating to the quarter increases the sample size for each state. Larger sample size should result in more accurate estimation. Annual data would only allow 13 observations per state; thus quarterly data again allows greater precision in estimation. Further, the effect of the change in the minimum wage may dissipate over the course of a year leading to false conclusions. The use of quarterly values will minimize this dissipation.

Classifying Workers

In this study, workers are classified by sector as covered or uncovered. Firms in the covered sector are constrained, either legally or by choice, to pay wages equal to or greater than the minimum wage. The uncovered sector is comprised of firms who pay wages below the minimum wage. Thus covered workers earn the minimum wage or higher and uncovered workers earn below the minimum wage. As these are legal terms they do not necessarily capture the dynamics of the two-sector model. Covered workers who lose their jobs do not necessarily find uncovered work and teenagers frequently enter and leave the labor market so the dynamics may be more indirect. With the high attrition rate among teenage workers,

[6] The smallest sample is for February 1993 in with 38 observations. The largest sample is for March 1990 in California with 716 observations. 50% of the state/month cells have fewer than 104 observations, 75% have fewer than 136 observations and 90% have less than 336 observations.

firms in the covered sector may reduce their hiring rate and without firing anyone decrease the size of their workforce. Concurrently, uncovered firms may hire new entrants to the labor market. The end result is that the individuals losing jobs and those gaining jobs need not be the same, implying that panel data on individuals is not necessarily appropriate.

Determining the two classifications of workers is straightforward in most cases using the reported hourly wage. However, special attention needs to be paid to restaurant wait staff and retail workers. Nearly all states allow tip-offsetting for restaurant employees.[7] This allows the restaurant to pay employees, typically bartenders, waiters and their assistants, less than the standard minimum wage.[8] However, the wage paid by the employer plus the tips earned by the worker must be equal to or greater than the minimum wage. The standard minimum wage, not the tipped minimum wage, is used to classify tipped restaurant workers in all states. The reasoning is that restaurants in states with tip-offsetting act in a manner similar to firms in the uncovered sector. Consider an example. Suppose a restaurant is paying $4 per hour to tipped employees and the minimum wage is raised from $5.85 to $6.55 without changing the tipped minimum wage. Workers unable to get covered jobs may now seek restaurant employment. This would allow the restaurant to lower its hourly wage to say $3.50 per hour and still increase employment. Even though the restaurant is legally covered, it is acting as an uncovered firm.

[7] The states without tip-offsetting are Alaska, California, Minnesota, Montana, Nevada, Oregon and Washington.

[8] Federal laws impose a tipped minimum wage of $2.13 for restaurant employees. States may impose their own tipped minimum wage. The higher of the two is binding. The federal minimum wage has remained relatively unchanged through time. In the 1980's the tipped minimum wage was $2.01 and currently the tipped minimum wage is $2.13.

Retail workers may receive a sales commission that counts towards the minimum wage. The reported hourly wage in the CPS does not include overtime, tips or commissions. Thus for retail workers, an estimated hourly wage is derived by dividing usual weekly earnings by usual weekly hours. The higher of the reported hourly wage and estimated hourly wage is used to classify retail workers.

Baseline Effect of the Minimum Wage

The employment regression, equation 1, is estimated following Card and Krueger (1995):

$$E_t = \alpha_0 + \alpha_1 MW_t + X_t\beta + \varepsilon_t \quad (1)$$

The dependent variable, E_t, is the log of the ratio of quarterly teenage covered employment to the teenage population. Teenage covered employment is calculated as described above. The independent variables, in X_t, include a set of year dummies, a set of state dummies, the log of the higher of the state or federal minimum wage, the log of adult wages (30-39 year olds), the log of per capita income, the log of the real gross domestic product (GDP), the log of the GDP deflator, the fraction of teenagers in the population, and the unemployment rate of white males, ages 35 to 55.[9] All variables are state level with the exception of the GDP deflator and the real GDP.

[9] Adults ages 30 to 39 were selected as a group that is close to teenagers but whose wages are only slightly affected by the minimum wage.

If the two-sector model is accurate, the impact of the increase in the minimum wage on covered workers will be greater than the impact on all workers. A testable implication that arises from this hypothesis is that the minimum wage elasticity for covered employment should be more elastic than that for total employment.

Table 3.1 presents the results for regressions using both the log of the ratio of all teenage employment to teenage population and the log of the ratio of covered teenage employment to teenage population as the dependant variable. Results are presented for both level and first-difference regressions. The first-difference analysis is employed to remove state-level fixed differences in employment. The addition of state dummies further removes fixed differences in employment growth among states. In the top half of the table the dependent variable is the log of the ratio of total teenage employment to teenage population. In the bottom half of the table the dependent variable is the log of the ratio of covered teenage employment to teenage population. In both, columns 1 through 3 show the results from level regressions while columns 4 through 7 show the results from first-difference regressions. The results are corrected for autocorrelation using lags of the independent variable.[10] An increase in the minimum wage significantly decreases covered employment and decreases it more than it decreases total employment.

The decrease in covered employment is roughly four times as great as the decrease in total employment. For the level regression, the minimum wage elasticity for total teenage employment ranges from -0.228 to -0.168 and for covered teenage employment from -

[10] Two criteria for selecting lags were employed – the first based on the Akaike Information Criterion (AIC), the second based on the significance of lags. As each additional lag is added, it must be significant.

1.111 to -0.854. For the first-difference regression, the elasticity ranges from -0.187 to -0.169 for total employment and from -1.048 to -1.01 for covered employment.

Of interest is the similarity between the level and first-difference results. The similar negative effect between the two suggests that the negative effect is not influenced by confounding factors specific to either method of estimation. Given this and that in principle both estimators are consistent in a correctly-specified model, the choice between level and first-difference estimation is not of great consequence.

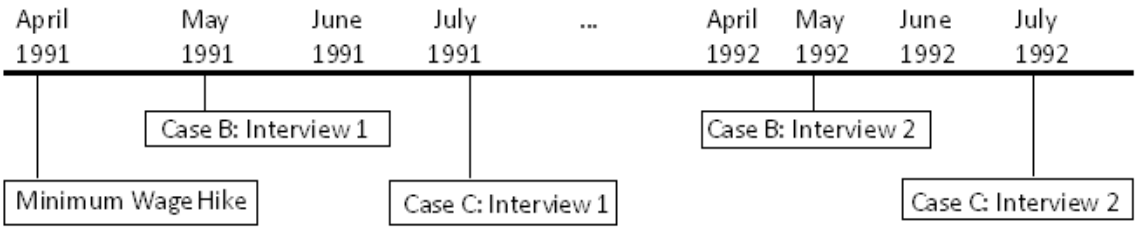
Testing for Systematic Error in Reported Wages

When the minimum wage is increased, systematic error may exist in the reported wages. The reported wages need not necessarily respond immediately to changes in the minimum wage. There may be a lag in reporting the new wage or employers may not immediately adjust wages. Thus, during periods when the minimum wage is changed, potential systematic error in reported wages must be addressed.

Lag in Reported Wages

The growth rate of wages is examined to determine whether there is evidence of reported wages lagging actual wages following a minimum wage hike. The CPS MORG data is matched across interviews allowing two observations per teenager. The first observation is from the fourth interview of the household and the second observation is from the eighth interview. The observations are one year apart.

Consider the following time line based on the 1991 minimum wage hike:



Three cases are possible. In case A, there is no lag in reporting wages. In cases B and C, there is a two month lag in reporting wages. Assume that the only error is from there being a lag in reporting wages following a minimum wage hike and that wages grow at an annual rate g. Let w_1 represent the wage reported at the first interview and let w_1^* be the true wage at the first interview. Further let w_2 be both the reported and the true wage at the second interview. In case A, $w_2= w_1(1+g)= w_1^*(1+g)$ as there is no reporting error. In case B where there is a two month lag in reporting wages, the minimum hike has not yet been realized. Thus $w_1 +\Delta mw= w_1^*$ and $w_2= (w_1+\Delta mw)\ (1+g) = w_1^*(1+g)$. Case C is similar to case A. In case C $w_1= w_1^*$ since July is the third month following the hike and the two month lag has passed. Thus $w_2= w_1(1+g)= w_1^*(1+g)$ as in case A.

If a lag does exist in reporting wages following a minimum wage hike, then the closer the first interview to the minimum wage hike the higher the growth in wages from interview 1 to interview 2 (case B compared to case C). To implement this empirically an OLS regression, with the log of growth rate in wages as the independent variable, is

performed for the time periods following the 1991 and 1997 minimum wage hikes.[11] For comparison, 1994 and 1999, years when there is no minimum wage hike, are examined as well. The estimating is equation is:

$$\text{Log}(w_{2i}/w_{1i})=Z_i\beta+\varepsilon_i \quad (2)$$

Where Z_i is a vector including an indicator for having a reported wage greater than, equal to or less than the minimum wage, as well as an interaction of the minimum wage dummies with time; ε_i is a normally distributed error term. Time is measured in months after the minimum wage hike. For 1991, time=0 for April 1991, time=1 for May 1991 and so forth. For 1997, time=0 for September 1997, time=1 for October 1997 and so forth.

If there is a lag in reporting wages, then the interaction of the *below the minimum wage* dummy and time will be negative and significant. That is, over time the growth rate of wages for those earning below the minimum wage slows. This indicates that individuals interviewed close to the minimum wage hike report wages less accurately than those interviewed later. Table 3.2 presents the results from the estimation. The coefficient on the interaction term is not significantly different from zero. This implies that after one year there is no lag in reporting wages.

Any lags that occur must do so within the year following the second hike of each minimum wage increase. A simple way to eliminate this bias, while retaining the long-run

[11] Only the second hike of each minimum wage increase is a valid test of this hypothesis since an observation starting within a year of the first hike will almost always include the second hike. Results for 1990 and 1996 are presented in Table A3.

effect of the minimum wage, is to eliminate the observations that may be problematic. The observations from 1990Q2 to 1992Q2 inclusive and from 1996Q4 to 1998Q3 inclusive are eliminated. Let these time periods collectively be the adjustment period and all other time periods be the non-adjustment period. Equation (1) is estimated using the new sample. The results are presented in Table 3.3. The elasticity is more elastic than for the entire sample, implying that there are reporting lags.[12] The bias indicates that the results in Table 3.1 understate the effect the minimum wage has on covered employment.

The above results assume that all individuals are likely to misreport their wages in a manner that will affect their classification. In actuality, it is likely that only those individuals reporting wages near the minimum wage are likely to misreport their wages affecting classification. To control for this form of potential non-random error, information from the non-adjustment period to can be utilized to determine the probability of an individual being a covered worker. First, a logit model is estimated using individuals from the non-adjustment period with wages that lie in a preset range of the minimum wage.

$$p(\text{covered}=1|X) = \frac{e^{X\beta+\varepsilon}}{1+e^{X\beta+\varepsilon}} \tag{3}$$

The logit regression is appropriate; there is a heavy concentration of individuals in the tails of the income distribution. However, the logit does not fit well for very small probabilities. Thus the wage restriction is employed to increase the proportion of uncovered workers thereby increasing the fit of the model. The dependent variable is a binary indicator

[12] See Table 3.1

for covered employment. The independent variables are age, education, experience, average hours, seven industry dummies, eight occupation dummies, and indicators for race, sex, reference person, marital status, full time or part time employment, union membership, month of interview, urban residence, and state. Data from the MORG of the CPS are used to estimate the logit coefficients. The logit results are presented in Table 3.A4.

Second, the logit coefficients from the non-adjustment period are used to calculate the probability that each individual within the preset wage range is covered in the adjustment period. The coverage probabilities for individuals outside the wage range or in the non-adjustment period are taken directly from the data. The probabilities from both periods are then merged and summed quarterly, by state, resulting in the proportion of employees that are covered, $P_{s,t}$:

$$P_{s,t} = \sum_{i} p_i \ \forall i \in s, \ t=1987{:}1\text{-}2001{:}4 \tag{4}$$

Teenage covered employment is calculated by multiplying the level of total teenage employment by $P_{s,t}$. Equation (1) is estimated using the new measure of covered employment. The results are presented in Table 3.4 for five brackets around the minimum wage: 10 cents, 25 cents, 50 cents, 75 cents, and one dollar. The minimum wage elasticity ranges from -0.628 to -1.127 for the level results and from -0.702 to -1.368 for the first-difference results. While this implies that a portion of the unadjusted minimum wage effect on covered employment is due to reporting lags, the effect on covered employment is still significantly more negative than the effect on total employment.

Self vs. Other Reported Wages

Over 94% of teenagers in the CPS do not self-report their wages. This may lead to a bias. The reporting member of the household may not know the exact wage of the teenager. Table 3.5 compares the proportion of wages reported to be equal to, above, and below the minimum wage by self-reported and other-reported teenagers. Teenagers between the ages of 16 and 17 are more likely to have other-reported wages. Looking at Table 3.5 it is easily ascertained that when wages are not reported by the teenager they are more likely to be reported as equal to or less than the minimum wage. This is also true when wages are examined by age group. Teenagers 16 to 17 years old are more likely to have reported wages that are equal to or less than the minimum wage.

Equation (1) is estimated separately for the two groups, self-reported and other-reported. The results are presented in Table 3.6. For the level regressions the elasticity is more elastic for self-reported wages than other-reported wages. Any bias that results from other reported wages dampens the effect of the minimum wage on covered teenage employment. The first-difference results are surprising; there are no significant effects for the self-reported wages. This is likely due to the small sample size of individuals who self-report.[13]

[13] 5.36% of the sample self reports.

Conclusion

Current literature on the effect of the minimum wage examines the change in total employment. This however, is not an accurate measure of the effect of the minimum wage as workers move from the covered sector to the uncovered sector. This study examines the loss of covered jobs in response to changes in the minimum wage. Concurrently, systematic error in the dependent variable is addressed. The minimum wage elasticity for covered employment is significantly more elastic than that for total employment, even after correcting for systematic error. The effect of the minimum wage on covered employment is, at a minimum, three times as large as the effect on total employment. The minimum wage elasticity is more elastic than previous literature suggests. Without utilizing the two-sector model, false conclusions will be drawn about the effect of minimum wages.

References

Abrevaya, Jason and Jerry Hausman,(1999), "Semiparametric Estimation with Mismeasured Dependent Variables: An Application to Duration Models for Unemployment Spells," *Annales DEconomie et de Statistique*, 55-56, pp. 243-75.

Abrevaya, Jason and Jerry Hausman,(2004), "Response Error in a Transformation Model With an Application to Earnings-Equation Estimation," *The Econometrics Journal*, 7(2), pp. 366-388.

Bollinger, Christopher R., (1998), "Measurement Error in the Current Population Survey: A Nonparametric Look," *Journal of Labor Economics*, 16(3), pp. 576-594.

Bound, John, Alan B. Krueger, (1991),"The Extent of Measurement Error in Longitudinal Earnings Data: Do Two Wrongs Make a Right," *Journal of Labor Economics*, 9(1), pp. 1-24.

Box, G.E.P. and D.R. Cox, (1964), "An Analysis of Transformations," *Journal of the Royal Statistical Society Series B(Methodological)*, 26(2), pp. 211-252.

Brown, Charles,(1999), "Minimum Wages, Employment, and the Distribution of Income," *Handbook of Labor Economics*, 3B, by Orley Ashenfelter and David Card, pp.2101-2163.

Brownstone, David and Robert G. Valletta, (1996), "Modeling Earnings Measurement Error: A Multiple Imputation Approach," *Review of Economics & Statistics*, 78(4), pp. 705-717.

Buonaccorsi , John P.,(1996), "Measurement Error in the Response in the General Linear Model," *Journal of the American Statistical Association*, 91(434), pp. 633-642.

Burkhauser, Richard V., Kenneth C. Couch, and David C. Wittenburg, (2000) "A Reassessment of the New Economics of the Minimum Wage Literature with Monthly Data from the Current Population Survey," *Journal of Labor Economics*, 18(4), pp.653-80.

Burnette, Jeffrey, James M. Holmes and Patricia A. Hutton,(2007), "The Effect of Minimum Wage Increases on 16 - 19 Year Olds: A Difference-in-Differences Analysis," Working Paper.

Card, David, (1992-1), "Using Regional Variation in Wages to Measure the Effects of the Federal Minimum Wage," *Industrial and Labor Relations Review*, 46(1) pp. 22-37.

Card, David, (1992-2), "Do Minimum Wages Reduce Employment? A Case Study of California, 1987-89," *Industrial and Labor Relations Review*, 46(1) pp. 38-54.

Card, David, Alan B. Krueger, (1995),"Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania", *The American Economic Review*, 84(4), pp. 772-793.

Coder, John and Lydia Scoon-Rogers, "Evaluating the Quality of Income Data Collected in the Annual Supplement to the March Current Population Survey and the Survey of Income and Program Participation," Working Paper, U.S. Bureau of the Census, July, 1996.

Cole, Nancy and Janet Currie,(1994), "Reported Income in the NLSY: Consistency Checks and Methods for Cleaning the Data," NBER Technical Paper 160.

Currie, Janet and Bruce C. Fallick, (1996), "The Minimum Wage and the Employment of Youth: Evidence From the NLSY," *Journal of Human Resources*, 31(2), pp. 404-428.

Deere, Donald, Kevin M. Murphy and Finis Welch,(1995), "Employment and the 1990-1991 Minimum-Wage Hike," *The American Economic Review*, 85(2), pp. 232-237.

Duncan, Greg J., Daniel H. Hill, (1985), "An Investigation of the Extent and Consequences of Measurement Error in Labor-economic Survey Data," *Journal of Labor Economics*, 3(4), pp. 508-532.

Glewwe, Paul, (2005), "How Much of Observed Economic Mobility Is Measurement Error? A Method to Remove Measurement Error Bias, with an Application to Vietnam," Working Paper.

Hausman, Jerry,(2001), "Mismeasured Variables in Econometric Analysis: Problems from the Right and Problems from the Left," *The Journal of Economic Perspectives*, 15(4), pp. 57-67.

Hausman, Jeny, Jason Abrevaya and F. M. Scott-Morton, (1998), "Misclassification of the Dependent Variable in a Discrete-Response Setting," *Journal of Econometrics*, 87(2), pp.239-69.

Kapteyn, Arie and Jelmer Yeb Ypma, (2006), "Measurement Error and Misclassification A Comparison of Survey and Register Data," RAND working paper, WR-283-1.

Lewbel, Arthur, (2000), "Identification of the Binary Choice Model With Misclassification," *Econometric Theory*, 16(4), pp. 603-609.

Mellow, Wesley and Hal Sider, (1983), "Accuracy of Response in Labor Market Surveys: Evidence and Implications," *Journal of Labor Economics*, 1(4), pp. 331-344.

Meyer, Bruce D., (1988), "Classification-Error Models and Labor-Market Dynamics," *Journal of Business & Economic Statistics*, 6(3), pp. 385-390.

Meyer, Robert H. and David A. Wise, (1983), "Discontinuous Distributions and Missing Persons: The Minimum Wage and Unemployed Youth," *Econometrica*, 51(6), pp.1677-1698.

Neumark, David,(2001), "The Employment Effects of Minimum Wages: Evidence from a Pre-Specified Research Design The Employment Effects of Minimum Wages," *Industrial Relations*, 40(1), pp. 121–144.

Neumark, David and William Washer, (1992), "Employment Effects of Minimum and Submimimum Wages: Panel Data on State Minimum Wage Laws," *Industrial and Labor Relations Review*, 46(1), pp. 55-81.

Poterba, James M. and Lawrence H. Summers, (1986), "Reporting Errors and Labor Market Dynamics," *Econometrica*, 54(6), pp. 1319-1338.

Poterba, James M. and Lawrence H. Summers, (1995), "Unemployment Benefits and Labor Market Transitions: A Multinomial Logit Model with Errors in Classification," *The Review of Economics and Statistics*, 77(2), pp. 207-216

Ramalho, E.A., (2002), "Regression Models for Choice-Based Samples With Misclassification in the Response Variable," *Journal of Econometrics*, 106(1), pp. 171-201.

Roemer, Mark I., (2000), "Assessing the Quality of the March Current Population Survey and the Survey of Income and Program Participation Income Estimates: 1990-1996," Internal Report, Washington, D.C.: U.S. Census Bureau. June 16, 2000.

Schiller, Bradley R., (1994), "Below-Minimum-Wage Workers: Implications for Minimum-Wage Models," *The Quarterly Review of Economics and Finance*, 34(2), pp.131-143.

Schmitt, John, (2003), "Creating a consistent hourly wage series from the Current Population Survey's Outgoing Rotation Group, 1979-2002," Washington, DC: Center for Economic and Policy Research.

Schneeweiss, Hans and Thomas Augustin, (2006),"Some Recent Advances in Measurement Error Models and Methods," *Allgemeines Statistisches Archiv*, 90(1), pp. 183-197.

Sullivan, Paul, (2006),"Estimation of an Occupational Choice Model when Occupations are Misclassified," Bureau of Labor Statistics, MPRA Paper No. 862

Thies, Clifford F., (1991), "The First Minimum Wage Laws," *Cato Journal*, 10(3).

Wessels, Walter,(2001), "The Effect of Minimum Wages on the Labor Force Participation Rates of Teenagers," Employment Policies Institute paper.

Williams, Nicolas and Jeffrey A. Mills,(2001), "The Minimum Wage and Teenage Employment: Evidence From Time Series," *Applied Economics*, 33(3), pp. 285-300.

Table 3.1: The Effect of an Increase in the Minimum Wage on Teenage Employment

	Dependent Variable: Log of Total Teenage Employment						
	Level Results				First-Difference Results		
Log Minimum Wage Coefficient	-0.228*	-0.176*	-0.168*	-0.187*	-0.169*	-0.180*	-0.184*
Standard Error	0.051	0.049	0.049	0.083	0.080	0.069	0.073
n	3000	2950	2850	2950	2900	2800	2600
R-Squared	0.81	0.82	0.82	0.53	0.57	0.68	0.68
AR	No	1~^	3	No	1	3~^	7
	Dependent Variable: Log of Covered Teenage Employment						
	Level Results				First-Difference Results		
Log Minimum Wage Coefficient	-1.111*	-0.910*	-0.854*	-1.031*	-1.042*	-1.010*	-1.048*
Standard Error	0.080	0.078	0.079	0.129	0.120	0.107	0.113
n	3000	2950	2850	2950	2900	2800	2600
R-Squared	0.70	0.71	0.71	0.35	0.45	0.55	0.56
AR	No	1~^	3	No	1	3^	7~

Other variables included in the regressions: the log of adult wages, the log of per-capita income, the adult unemployment rate, the fraction of teenagers in the population, the log of the GDP deflator, the log of real GDP, quarterly dummy variables and year dummy variables. The teenage employment population is calculated with CPS weights.
All variables are state specific except for the GDP deflator and real GDP.
White standard errors are reported.
*Indicates significance at the 5% level or better.
^Indicates the number of lags selected using the Akaike Information Criterion (AIC).
~Indicates the number of lags selected by lag significance.

Table 3.2: Test for Lag in Wage Reporting

	1991	
	Coeffiecient	Standard Error
Intercept	0.288	0.255
Above minimum wage	-0.366	0.284
Below minimum wage	0.667	0.375
Time*Above minimum wage	0.003	0.008
Time*Equal to minimum wage	-0.014	0.016
Time*Below minimum wage	-0.023	0.018
	1997	
	Coeffiecient	Standard Error
Intercept	0.120	0.094
Above minimum wage	-0.028	0.095
Below minimum wage	0.348*	0.110
Time*Above minimum wage	-.002	0.002
Time*Equal to minimum wage	0.003	0.011
Time*Below minimum wage	-0.001	0.006
	1994	
	Coeffiecient	Standard Error
Intercept	0.110*	0.041
Above minimum wage	-0.084	0.046
Below minimum wage	0.369*	0.068
Time*Above minimum wage	0.001	0.003
Time*Equal to minimum wage	0.005	0.006
Time*Below minimum wage	-0.003	0.008
	1999	
	Coeffiecient	Standard Error
Intercept	0.157	0.100
Above minimum wage	-0.064	0.101
Below minimum wage	0.317*	0.128
Time*Above minimum wage	-0.001	0.003
Time*Equal to minimum wage	0.002	0.015
Time*Below minimum wage	-0.0004	0.011

*Indicates significance at the 5% level or better

Table 3.3: The Effect of the Minimum Wage--Correction for Lag in Reported Wages

Potentially Problematic Observations Deleted, 1990Q2 to 1992Q2 & 1996Q4 to 1998Q3						
	Dependent Variable: Log of Covered Teenage Employment					
	Level Results			First Difference Results		
Log Minimum Wage Coefficient	-1.212*	-0.945*		-1.612*	-1.442*	-1.416*
Standard Error	0.099	0.098		0.427	0.384	0.545
n	2150	2000		2000	1700	950
R-Squared	0.71	0.72		0.37	0.53	0.57
AR	No~	1^		No	2~	7^

Other variables included in the regressions: the log of adult wages, the log of per-capita income, the adult unemployment rate, the fraction of teenagers in the population, the log of the GDP deflator, the log of real GDP, quarterly dummy variables and year dummy variables. The teenage employment population is calculated with CPS weights.

All variables are state specific except for the GDP deflator and real GDP.

White standard errors are reported.

*Indicates significance at the 5% level or better.

^Indicates the number of lags selected using the Akaike Information Criterion (AIC).

~Indicates the number of lags selected by lag significance.

Table 3.4: The Effect of the Minimum Wage--Logit Coverage Results

Coverage Probabilities Utilized to Classify Workers Within Each Preset Bracket									
	10¢ Bracket								
	Level Results			First Difference Results					
Log Minimum Wage Coefficient	-1.127*	-0.935*	-0.800*	-1.368*	-1.328	-1.234*	-1.271*	-1.272*	-1.279*
Standard Error	0.093	0.092	0.088	0.148	0.141	0.126	0.127	0.131	0.133
n	3000	2950	2800	2950	2900	2800	2750	2650	2600
R-Squared	0.68	0.69	0.70	0.38	0.48	0.57	0.58	0.58	0.58
AR	No	1^	4~	No	1	3^	4~	6	7
	25¢ Bracket								
	Level Results			First Difference Results					
Log Minimum Wage Coefficient	-1.059*	-0.868*	-0.716*	-1.267*	-1.193*	-1.071*	-1.111*	-1.123*	-1.145*
Standard Error	0.099	0.096	0.094	0.163	0.153	0.142	0.144	0.146	0.147
n	3000	2950	2800	2950	2900	2800	2750	2650	2600
R-Squared	0.61	0.680	0.69	0.32	0.44	0.55	0.56	0.56	0.56
AR	No	1^	4~	No	1	3	4^~	6	7
	50¢ Bracket								
	Level Results			First Difference Results					
Log Minimum Wage Coefficient	-0.920*	-0.755*	-0.628*	-0.811*	-0.748*	-0.702*	-0.732*	-0.730*	-0.747*
Standard Error	0.096	0.091	0.087	0.138	0.127	0.114	0.114	0.117	0.118
n	3000	2950	2800	2950	2900	2800	2750	2650	2600
R-Squared	0.61	0.670	0.69	0.31	0.43	0.55	0.56	0.56	0.56
AR	No	1^~	3	No	1	3	4^~	6	7

Table 3.4 continued

	75¢ Bracket								
	Level Results			First Difference Results					
Log Minimum Wage Coefficient	-0.840*	-0.749*	-0.681*	-0.864*	-0.811*	-0.784*	-0.833*	-0.808*	-0.788*
Standard Error	0.098	0.094	0.096	0.163	0.155	0.141	0.143	0.146	0.149
n	3000	2950	2800	2950	2900	2800	2750	2650	2600
R-Squared	0.48	0.50	0.51	0.17	0.34	0.47	0.51	0.49	0.50
AR	No	1^~	3	No	1	3	4	6^~	7
	$1 Bracket								
	Level Results			First Difference Results					
Log Minimum Wage Coefficient	-0.834*	-0.767*	-0.725*	-0.868*	-0.779*	-0.756*	0.812*	-0.787*	-0.764*
Standard Error	0.099	0.094	0.097	0.183	0.168	0.159	0.160	0.163	0.166
n	3000	2950	2800	2950	2900	2800	2750	2650	2600
R-Squared	0.46	0.470	0.47	0.15	0.34	0.45	0.49	0.48	0.48
AR	No	1^~	3	No	1~	3	4	6	7^

Other variables included in the regressions: the log of adult wages, the log of per-capita income, the adult unemployment rate, the fraction of teenagers in the population, the log of the GDP deflator, the log of real GDP, quarterly dummy variables and year dummy variables. The teenage employment population is calculated with CPS weights. White standard errors are reported. *Indicates significance at the 5% level or better. ^Indicates the number of lags selected using the Akaike Information Criterion (AIC). ~Indicates the number of lags selected by lag significance.

Table 3.5: Test for Other-Reported Wage Bias

	Other-Reported Wages	Self- Reported Wages
Full Sample n=94,237		
Below the Minimum Wage	15.05%	9.22%
Equal to the Minimum Wage	7.53%	4.12%
Above the Minimum Wage	77.42%	86.66%
16 year olds n=16,159		
Below the Minimum Wage	23.80%	16.74%
Equal to the Minimum Wage	11.05%	13.24%
Above the Minimum Wage	65.14%	70.01%
17 year olds n=23,409		
Below the Minimum Wage	18.30%	14.24%
Equal to the Minimum Wage	8.76%	6.33%
Above the Minimum Wage	72.94%	79.43%
18 year olds n=26,253		
Below the Minimum Wage	12.89%	9.87%
Equal to the Minimum Wage	6.85%	3.82%
Above the Minimum Wage	80.26%	86.30%
19 year olds n=28,416		
Below the Minimum Wage	9.78%	8.36%
Equal to the Minimum Wage	5.29%	3.85%
Above the Minimum Wage	84.93%	87.79%
*Sampling weights used in all calculations.		

Table 3.6: The Effect of the Minimum Wage--Self vs. Other Reported Wages

	Self-Reported Wages					
	Level Results		First Difference Results			
Log Minimum Wage Coefficient	-1.439*	-1.490*	-0.465	-0.611	0.131	0.039
Standard Error	0.451	0.450	0.719	0.650	0.646	0.895
n	3000	2950	2950	2900	2800	2150
R-Squared	0.10	0.10	0.01	0.24	0.32	0.470
AR	No~	1	No	1	3^	16~
	Other-Reported Wages					
	Level Results		First Difference Results			
Log Minimum Wage Coefficient	-1.133*	-0.929*	-1.098*	-1.102*	-1.078*	-1.018*
Standard Error	0.080	0.079	0.131	0.122	0.108	0.133
n	3000	2950	2950	2900	2800	2150
R-Squared	0.69	0.70	0.35	0.45	0.55	0.58
AR	No	1^~	No	1	3^	16~

Other variables included in the regressions: the log of adult wages, the log of per-capita income, the adult unemployment rate, the fraction of teenagers in the population, the log of the GDP deflator, the log of real GDP, quarterly dummy variables and year dummy variables. The teenage employment population is calculated with CPS weights.

All variables are state specific except for the GDP deflator and real GDP.

White standard errors are reported.

*Indicates significance at the 5% level or better.

^Indicates the number of lags selected using the Akaike Information Criterion (AIC).

~Indicates the number of lags selected by lag significance.

Table 3.A1: Minimum Hourly Wage of Workers in Jobs First Covered by[1]

Effective Date	1938 Act [2]	1961 Amendments [3]	1966 and Subsequent Amendments [4]	
			Nonfarm	*Farm*
October 24, 1938	$0.25			
October 24, 1939	$0.30			
October 24, 1945	$0.40			
January 25, 1950	$0.75			
March 1, 1956	$1.00			
September 3, 1961	$1.15	$1.00		
September 3, 1963	$1.25			
September 3, 1964		$1.15		
September 3, 1965		$1.25		
February 1, 1967	$1.40	$1.40	$1.00	$1.00
February 1, 1968	$1.60	$1.60	$1.15	$1.15
February 1, 1969			$1.30	$1.30
February 1, 1970			$1.45	
February 1, 1971			$1.60	
May 1, 1974	$2.00	$2.00	$1.90	$1.60
January 1, 1975	$2.10	$2.10	$2.00	$1.80
January 1, 1976	$2.30	$2.30	$2.20	$2.00
January 1, 1977			$2.30	$2.20
January 1, 1978	$2.65 for all covered, nonexempt workers			
January 1, 1979	$2.90 for all covered, nonexempt workers			
January 1, 1980	$3.10 for all covered, nonexempt workers			
January 1, 1981	$3.35 for all covered, nonexempt workers			
April 1, 1990	$3.80 for all covered, nonexempt workers			
April 1, 1991	$4.25 for all covered, nonexempt workers			
October 1, 1996	$4.75 for all covered, nonexempt workers			
September 1, 1997	$5.15 for all covered, nonexempt workers			
July 24, 2007	$5.85 for all covered, nonexempt workers			
July 24, 2008	$6.55 for all covered, nonexempt workers			
July 24, 2009	$7.25 for all covered, nonexempt workers			

[1] Table adapted from the U.S. Department of Labor Employment Standards Administration Wage and Hour Division

[2] The 1938 Act was applicable generally to employees engaged in interstate commerce or in the production of goods for interstate commerce.

[3] The 1961 Amendments extended coverage primarily to employees in large retail and service enterprises as well as to local transit, construction, and gasoline service station employees.

[4] The 1966 Amendments extended coverage to State and local government employees of hospitals, nursing homes, and schools, and to laundries, drycleaners, and large hotels, motels, restaurants, and farms. Subsequent amendments extended overage to the remaining Federal, State and local government employees who were not protected in 1966, to certain workers in retail and service trades previously exempted, and to certain domestic workers in private household employment.

Table 3.A2: Summary Statistics

CPS MORG	
Age	17.72
Hours	24.85
Hourly Wage	$5.31
Married	2.86%
Never Married	96.57%
Divorced	0.58%
Female	50.58%
Metro Residence	76.97%
Full Time	31.02%
Less than High Scool	55.24%
High School Grad	28.99%
More than HS	15.77%
Head of Household	5.36%
White	87.45%
Black	9.22%
Other	3.33%
Union Member	3.64%
CPS	
Adult Unemployment	0.0340
Adult Wage 30-39 years	$10.46
Teenage Employment Rate	0.4720
Per Capita Income	$ 21,552.72
Teens in Population (16-19/16-64)	0.7650
Sapmling weights used in all calculations.	

Table 3.A3: Test for Lag in Wage Reporting

1990		
	Coeffiecient	Standard Error
Intercept	0.026	0.130
Above minimum wage	-0.073	0.142
Below minimum wage	0.304	0.161
Time*Above minimum wage	-0.010	0.015
Time*Equal to minimum wage	-0.047	0.036
Time*Below minimum wage	0.105*	0.028
1996		
	Coeffiecient	Standard Error
Intercept	0.222*	0.080
Above minimum wage	-0.012	0.083
Below minimum wage	0.410*	0.133
Time*Above minimum wage	-0.004	0.003
Time*Equal to minimum wage	-0.008	0.012
Time*Below minimum wage	-0.009	0.015
*Indicates significance at the 5% level or better.		

Table 3.A4: Logit Coefficients for Non-Adjustment Periods

	10¢ Bracket		25¢ Bracket		50¢ Bracket		75¢ Bracket		$1.00 Bracket		Total Sample	
Intercept	-0.673	(0.193)**	-0.181	(0.156)	-0.044	(0.144)	0.488	(0.134)**	0.540	(0.131)**	0.78	(0.121)**
Age 16	-0.025	(0.078)	-0.049	(0.063)	-0.102	(0.058)	-0.209	(0.054)**	-0.272	(0.052)**	-0.544	(0.048)**
Age 17	-0.040	(0.074)	-0.028	(0.060)	-0.033	(0.055)	-0.114	(0.051)*	-0.154	(0.050)**	-0.334	(0.045)**
Age 18	0.024	(0.064)	0.057	(0.052)	0.043	(0.048)	0.029	(0.044)	0.010	(0.042)	-0.089	(0.037)*
In School	-0.017	(0.048)	-0.001	(0.039)	0.064	(0.036)	0.043	(0.034)	0.073	(0.032)*	0.119	(0.029)**
Full Time	-0.252	(0.072)**	-0.191	(0.058)**	-0.087	(0.053)	-0.020	(0.049)	0.006	(0.048)	0.164	(0.043)**
Head of Household	0.002	(0.125)	-0.021	(0.097)	0.013	(0.088)	0.007	(0.081)	0.022	(0.077)	0.051	(0.061)
Usual Hours	0.015	(0.003)**	0.016	(0.002)**	0.018	(0.002)**	0.018	(0.002)**	0.020	(0.002)**	0.028	(0.002)**
MSA	-0.081	(0.044)	0.007	(0.036)	0.109	(0.033)**	0.174	(0.030)**	0.224	(0.029)**	0.319	(0.027)**
Female	-0.062	(0.043)	-0.055	(0.035)	-0.054	(0.031)	-0.077	(0.029)**	-0.085	(0.028)**	-0.26	(0.026)**
Black	-0.150	(0.066)*	-0.237	(0.053)**	-0.244	(0.049)**	-0.310	(0.046)**	-0.313	(0.045)**	-0.273	(0.042)**
Other Race	0.154	(0.124)	-0.028	(0.095)	-0.052	(0.087)	-0.052	(0.081)	-0.017	(0.079)	0.047	(0.072)
Married	0.096	(0.141)	0.084	(0.116)	0.075	(0.108)	0.025	(0.101)	-0.001	(0.098)	0.02	(0.083)
Divorced	0.071	(0.280)	-0.061	(0.244)	-0.124	(0.221)	-0.295	(0.207)	-0.356	(0.195)	-0.081	(0.189)
Union Employee	0.338	(0.157)*	0.463	(0.122)**	0.572	(0.109)**	0.574	(0.103)**	0.563	(0.100)**	0.684	(0.089)**
Less than HS Diploma	0.211	(0.062)**	0.054	(0.050)	0.002	(0.046)	-0.079	(0.042)	-0.069	(0.041)	-0.15	(0.037)**
More than HS Diploma	0.647	(0.082)**	0.384	(0.067)**	0.314	(0.061)**	0.294	(0.056)**	0.296	(0.053)**	0.21	(0.044)**
State												
Alaska	-0.245	(0.330)	0.395	(0.245)	-0.075	(0.189)	-0.169	(0.167)	-0.134	(0.164)	0.716	(0.148)**
Arizona	0.008	(0.194)	-0.032	(0.163)	-0.037	(0.151)	0.111	(0.143)	0.113	(0.140)	0.279	(0.130)*
Arkansas	-0.143	(0.166)	-0.124	(0.141)	-0.137	(0.133)	-0.076	(0.126)	-0.049	(0.124)	0.021	(0.121)
Colorado	0.037	(0.205)	0.048	(0.168)	0.147	(0.157)	0.258	(0.147)	0.294	(0.143)*	0.466	(0.129)**
California	1.740	(0.156)**	0.925	(0.126)**	0.590	(0.117)**	0.520	(0.109)**	0.399	(0.107)**	0.552	(0.103)**
Connecticut	0.292	(0.312)	-0.098	(0.219)	-0.364	(0.182)*	0.068	(0.157)	-0.023	(0.151)	0.379	(0.139)**
Delaware	-0.774	(0.263)**	-0.509	(0.198)*	-0.253	(0.176)	0.054	(0.158)	0.046	(0.152)	0.286	(0.136)*
Florida	0.336	(0.161)*	0.220	(0.135)	0.299	(0.127)*	0.473	(0.119)**	0.557	(0.117)**	0.518	(0.107)**
Georgia	0.285	(0.194)	0.050	(0.161)	0.110	(0.152)	0.209	(0.142)	0.233	(0.137)	0.395	(0.128)**
Hawaii	0.170	(0.246)	0.284	(0.196)	0.166	(0.183)	0.174	(0.171)	0.068	(0.168)	0.293	(0.159)
Idaho	0.244	(0.176)	0.074	(0.148)	0.141	(0.137)	0.262	(0.128)*	0.271	(0.124)*	0.371	(0.117)**

Table 3.A4 continued

	10¢ Bracket		25¢ Bracket		50¢ Bracket		75¢ Bracket		$1.00 Bracket		Total Sample	
Illinois	0.127	(0.150)	0.028	(0.125)	0.101	(0.117)	0.274	(0.110)*	0.311	(0.108)**	0.472	(0.102)**
Indiana	0.141	(0.182)	0.076	(0.153)	0.062	(0.143)	0.266	(0.134)*	0.309	(0.131)*	0.451	(0.123)**
Iowa	-1.347	(0.178)**	-0.856	(0.143)**	-0.448	(0.128)**	-0.482	(0.119)**	-0.440	(0.115)**	-0.239	(0.109)*
Kansas	0.144	(0.177)	0.205	(0.148)	0.254	(0.137)	0.341	(0.129)**	0.364	(0.126)**	0.456	(0.119)**
Kentucky	0.110	(0.180)	-0.001	(0.155)	0.000	(0.145)	0.095	(0.137)	0.132	(0.134)	0.259	(0.130)*
Louisiana	-0.182	(0.176)	-0.177	(0.149)	-0.228	(0.141)	-0.250	(0.133)	-0.282	(0.131)*	-0.348	(0.129)**
Maine	0.697	(0.245)**	0.431	(0.183)*	0.470	(0.166)**	0.487	(0.156)**	0.549	(0.152)**	0.756	(0.135)**
Maryland	0.124	(0.282)	-0.074	(0.217)	0.129	(0.198)	0.305	(0.177)	0.322	(0.171)	0.566	(0.146)**
Massachusetts	1.656	(0.239)**	0.618	(0.153)**	0.363	(0.137)**	0.343	(0.126)**	0.287	(0.122)*	0.598	(0.111)**
Michigan	0.076	(0.145)	0.116	(0.122)	0.115	(0.115)	0.204	(0.108)	0.178	(0.105)	0.311	(0.099)**
Minnesota	0.351	(0.196)	0.058	(0.153)	-0.019	(0.139)	0.090	(0.130)	0.194	(0.127)	0.682	(0.120)**
Mississippi	0.026	(0.176)	-0.241	(0.152)	-0.271	(0.143)	-0.172	(0.136)	-0.145	(0.134)	-0.152	(0.131)
Missouri	0.183	(0.183)	0.152	(0.153)	0.141	(0.142)	0.212	(0.134)	0.226	(0.131)	0.35	(0.123)**
Montana	-0.021	(0.166)	-0.006	(0.142)	0.117	(0.133)	0.223	(0.126)	0.234	(0.124)	0.331	(0.120)**
Nebraska	0.150	(0.169)	0.090	(0.143)	0.176	(0.133)	0.293	(0.126)*	0.294	(0.123)*	0.448	(0.114)**
Nevada	0.032	(0.287)	-0.080	(0.219)	0.161	(0.206)	0.372	(0.197)	0.562	(0.193)**	0.938	(0.183)**
NewHampshire	0.957	(0.337)**	0.209	(0.229)	0.447	(0.207)*	0.821	(0.195)**	0.969	(0.189)**	1.3	(0.152)**
NewJersey	-1.888	(0.179)**	-1.237	(0.138)**	-0.859	(0.124)**	-0.775	(0.115)**	-0.603	(0.111)**	-0.2	(0.104)
NewMexico	-0.194	(0.177)	-0.224	(0.152)	-0.204	(0.142)	-0.141	(0.133)	-0.149	(0.129)	-0.149	(0.120)
NewYork	-0.093	(0.149)	-0.091	(0.124)	-0.082	(0.117)	0.127	(0.110)	0.173	(0.108)	0.382	(0.102)**
NorthCarolina	0.201	(0.154)	0.191	(0.132)	0.250	(0.124)*	0.432	(0.117)**	0.459	(0.114)**	0.614	(0.108)**
NorthDakota	-0.001	(0.162)	-0.027	(0.137)	0.030	(0.129)	0.096	(0.122)	0.121	(0.119)	0.242	(0.115)*
Ohio	-0.030	(0.144)	-0.020	(0.122)	-0.006	(0.114)	0.114	(0.108)	0.120	(0.106)	0.165	(0.100)
Oklahoma	0.206	(0.181)	0.117	(0.151)	0.192	(0.142)	0.296	(0.135)*	0.287	(0.132)*	0.207	(0.124)
Oregon	0.794	(0.193)**	0.752	(0.166)**	0.513	(0.149)**	0.371	(0.141)**	0.306	(0.138)*	0.234	(0.130)
Pennsylvania	0.148	(0.147)	-0.073	(0.125)	-0.077	(0.116)	0.000	(0.110)	0.014	(0.108)	0.156	(0.102)
RhodeIsland	0.540	(0.269)*	-0.352	(0.201)	-0.181	(0.169)	-0.126	(0.154)	-0.009	(0.150)	0.188	(0.140)
SouthCarolina	-0.174	(0.181)	-0.130	(0.151)	-0.043	(0.142)	0.031	(0.134)	0.035	(0.132)	0.139	(0.123)
SouthDakota	-0.193	(0.167)	0.010	(0.139)	0.069	(0.128)	0.105	(0.120)	0.181	(0.117)	0.304	(0.110)**
Tennessee	0.155	(0.188)	0.034	(0.156)	0.039	(0.145)	0.103	(0.136)	0.104	(0.134)	0.127	(0.126)
Texas	0.065	(0.142)	-0.068	(0.121)	-0.070	(0.114)	0.026	(0.108)	0.011	(0.106)	-0.02	(0.100)

Table 3.A4 continued

	10¢ Bracket		25¢ Bracket		50¢ Bracket		75¢ Bracket		$1.00 Bracket		Total Sample	
Utah	0.429	(0.188)*	0.187	(0.151)	0.154	(0.142)	0.255	(0.132)	0.276	(0.128)*	0.501	(0.119)**
Vermont	0.895	(0.275)**	-0.001	(0.178)	0.203	(0.158)	0.301	(0.147)*	0.341	(0.145)*	0.569	(0.133)**
Virginia	0.127	(0.185)	0.064	(0.157)	0.149	(0.146)	0.285	(0.138)*	0.257	(0.135)	0.326	(0.122)**
Washington	0.512	(0.178)**	0.008	(0.142)	-0.370	(0.126)**	-0.625	(0.114)**	-0.731	(0.112)**	-0.711	(0.104)**
WestVirginia	-0.220	(0.173)	-0.358	(0.149)*	-0.495	(0.142)**	-0.536	(0.135)**	-0.570	(0.133)**	-0.636	(0.127)**
Wisconsin	-0.267	(0.239)	-0.114	(0.187)	0.115	(0.168)	0.646	(0.156)**	0.699	(0.153)**	1.122	(0.145)**
Wyoming	-0.216	(0.178)	-0.056	(0.150)	0.099	(0.139)	0.237	(0.131)	0.217	(0.128)	0.262	(0.119)*
Occupation												
Tipped Restruant	0.170	(0.154)	-0.144	(0.120)	-0.310	(0.108)**	-0.536	(0.098)**	-0.689	(0.094)**	-1.584	(0.082)**
Non-Tipped Restruant	0.420	(0.129)**	0.230	(0.099)*	0.246	(0.090)**	0.067	(0.082)	0.073	(0.080)	0.017	(0.072)
Sales	1.395	(0.134)**	0.949	(0.104)**	0.940	(0.094)**	0.822	(0.086)**	0.845	(0.083)**	1.053	(0.076)**
Admin/Mangement	0.267	(0.131)*	0.239	(0.101)*	0.295	(0.092)**	0.257	(0.084)**	0.310	(0.081)**	0.658	(0.073)**
Health	0.332	(0.238)	0.346	(0.190)	0.358	(0.172)*	0.308	(0.155)*	0.335	(0.149)*	0.617	(0.129)**
Professional/Specialty	0.579	(0.176)**	0.307	(0.137)*	0.348	(0.124)**	0.284	(0.113)*	0.344	(0.111)**	0.607	(0.101)**
Other Service	0.279	(0.130)*	0.083	(0.100)	0.087	(0.090)	-0.028	(0.083)	-0.034	(0.080)	-0.413	(0.071)**
Industry												
Trade	0.244	(0.124)	0.175	(0.096)	0.230	(0.086)**	0.136	(0.079)	0.168	(0.076)*	0.357	(0.069)**
Retail	0.167	(0.071)*	0.244	(0.056)**	0.236	(0.051)**	0.071	(0.046)	0.036	(0.044)	-0.207	(0.037)**
Construction	-0.451	(0.190)*	-0.392	(0.148)**	-0.333	(0.133)*	-0.017	(0.114)	0.069	(0.110)	0.567	(0.097)**
Business Services	-0.148	(0.139)	0.096	(0.108)	0.161	(0.098)	0.150	(0.090)	0.132	(0.087)	0.333	(0.081)**
Entertain/Recreation	0.145	(0.100)	0.137	(0.080)	0.159	(0.073)*	-0.007	(0.068)	0.025	(0.065)	0.175	(0.062)**
Personal Services	0.072	(0.130)	0.161	(0.101)	0.118	(0.092)	-0.040	(0.084)	-0.054	(0.081)	-0.021	(0.074)
Health Services	0.400	(0.165)*	0.123	(0.135)	0.101	(0.124)	0.050	(0.112)	0.159	(0.108)	0.302	(0.098)**
Education Services	-0.040	(0.095)	-0.086	(0.078)	-0.159	(0.071)*	-0.413	(0.064)**	-0.448	(0.062)**	-0.59	(0.056)**
n	16788		26802		35216		47253		54027		90466	
Psuedo R-Squared	0.095		0.053		0.045		0.051		0.056		0.1408	
Wald chi2(80)	1363.89		1186.16		1278.62		1830.26		2225.42		7309.14	
Log pseudolikelihood	-9997.165		-15928.492		-19736.921		-23536.474		-25497.745		-32736.876	

Robust standard errors in parentheses. Sampling weights used in estimation.
* Indicates significance at the 5% level. ** Indicates significance at the 1% level.