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**Unhealthy Assimilation:
Do Immigrants Converge to American Weights?**

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Unhealthy Assimilation: Do Immigrants Converge to American Weights?

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Abstract

It is well documented that immigrants are in better health upon arrival in the United States than their American counterparts, but that this health advantage erodes over time. We study the potential determinants of this “healthy immigrant effect”, with a particular focus on the tendency of immigrants to converge to unhealthy American weight levels. Using data from the National Health Interview Survey, we find that the average female and male immigrants enter the U.S. approximately two and five percentage points lighter than native-born white men and women, respectively. And, consistent with the declining health status of immigrants the longer they remain in the United States, we also find that female immigrants completely converge to American weights within ten years of arrival and men close a third of the gap within fifteen years.

1. Introduction

According to the U.S. Census, the foreign born population reached an all-time high of 32 million persons in 2000, an increase of 12 million people since 1990. This means that immigrants constituted 10 percent of the U.S. population in 2000 compared to only 8 percent in 1990. The large and increasing presence of immigrants highlights the importance of monitoring immigrant health, since immigrant health (and the health of their descendants) has a larger impact on the overall health outcomes of the American population the bigger the immigrant population becomes. Further, larger immigrant populations may increase pressure on the U.S. health care system, as there is empirical evidence showing that immigrants place a burden on Medicaid (Borjas and Hilton 1996).¹

Researchers from a wide array of disciplines have studied health differences between immigrants and native-born Americans. A key stylized fact that is generally supported in the literature is that upon arrival in the United States immigrants are healthier than their native counterparts, but that over time this health advantage dissipates (see for example, House et. al. 1990; Stephen et. al. 1994). A similar pattern has also been documented in other major immigrant receiving countries. For Canadian evidence, see Chen et. al.(1996), Perez (2002), Deri (2003), and McDonald (2003) and for Australian evidence see Donovan et. al. (1992). This phenomenon is often called the “Healthy Immigrant Effect”, henceforth referred to as the HIE.

The existence of the HIE has spawned a growing literature that seeks to explain this effect. The main hypothesized contributing factors are: (1) immigrants are positively selected and are hence in better health either by choice or due to the U.S. immigration screening process (Marmot et. al.

¹ Borjas and Trejo (1991) similarly find that recent immigrant cohorts are more welfare dependent than earlier cohorts and that immigrant households are more likely to receive welfare the longer they reside in the United States. They further show that the changing national origin mix explains the increase take-up in welfare among recent immigrant cohorts.

1984; MacDonald 2004; and Jasso et. al. 2004);² (2) the acculturation process, or exposure to the U.S. environment, causes immigrants to adopt native-born behaviors (such as, diet and exercise) that have important health implications (Marmot and Syme 1976; Kasl and Berkman 1983; Stephen et. al. 1994; and McDonald 2004);³ (3) improved access to health care for immigrants with time in residence might reduce reported health by increasing the diagnosis of pre-existing conditions (McDonald And Kennedy 2004 and Jasso et. al. 2004), however, it has also been suggested that increased access to health care may improve reported health by reducing immigrant/native gaps in preventative health care screening, diagnosis and treatment of health care problems (Leclere et. al., 1994, Laroche 2000, and McDonald and Kennedy 2004) which works against the HIE. Also working against the HIE, is the fact that immigrant income and employment (relative to natives) rises with time in residence (examples include: Chiswick 1986; LaLonde and Topel 1992; Duleep and Regets 1994, 1999, 2002; Funkhouser and Trejo 1995; Borjas 1985, 1995; Schoeni 1997, 1998; Hu 2000; Antecol, Kuhn and Trejo 2003) which should lead to relatively better immigrant health levels compared to natives over time (Jasso et. al. 2004).

An issue that is largely overlooked in this literature is the role obesity (an outcome of dietary acculturation) plays in explaining the HIE. While the growing incidence of obesity is well documented for the American population (Costa and Steckel 1995; Philipson and Posner 1999; Himes 2000; Philipson 2001; Lakdawalla and Philipson 2002; Chou, Grossman, and Saffer 2002; and Cutler, Glaeser and Shapiro 2003), it has been essentially overlooked for the foreign born

² An alternative explanation is that healthy immigrants are subsequently more likely to return to their home country (Jasso et. al. 2004).

³ Alternatively, the act of migration may lead to worse health outcomes either due to the stress associated with the immigration process (Kasl and Berkman 1983) or exposure to discrimination in the host country (Vega and Amaro 1994).

population.⁴ The rising obesity rate is of great concern to policymakers due to the associated health risks, and hence costs. To put it in context, only tobacco use leads to higher rates of premature death than obesity (Chou, Grossman, and Saffer 2002). In particular, obesity increases the risk of heart disease, stroke, some types of cancer and diabetes, and hence the financial burden due to greater health care consumption and/or productivity loss (Wolf and Colditz 1998 and Sturm 2002).⁵ And, of course, these elevated costs are not borne entirely by the obese since half of all health care is paid for by federal, state or local governments (Chou, Grossman, and Saffer 2002).

The objective of this paper is two-fold. We first document the HIE using the National Health Interview Surveys (NHIS). However, unlike much of the previous literature we control for differences in cohort quality.⁶ Secondly, we examine the HIE related hypotheses that are testable using NHIS data. More specifically, we present evidence on hypotheses 2 and 3, as well as the potentially countervailing impact of falling relative poverty rates. We particularly focus on the weight assimilation aspect of acculturation, which has received limited attention in the literature. The absence of research in this area is in part due to data limitations as few data sources provide information on weight and height as well as immigrant status. We are able to circumvent this problem using data from the 1989-96 NHIS, which include detailed information on immigrants (e.g., year of arrival) and weight and height, as well as detailed demographic information (age, education, and so on).

We find support for the HIE in the NHIS using three measures of health (self-reported health status, health conditions, and activity limitations). Moreover, while we find little evidence that

⁴ One exception is McDonald (2004), who examines the role obesity plays in explaining the HIE in Canada. And, there is a growing literature documenting obesity rates among foreign-born adolescents (see for example, Popkin and Udry 1998 and Gordon-Larsen et. al. 2003).

⁵ A related literature also finds that there is a wage penalty associated with obesity (Register and Williams 1990; Hamermesh and Biddle 1994; Averett and Korenman 1996; Pagan and Davila 1997; and Cawley 2000).

greater medical access or reduced poverty rates improve immigrant health over time, we do find substantial evidence that the weight assimilation patterns of immigrant closely mirror self-reported health assimilation. Overall, we find that immigrant women enter the country approximately 2 percentage points lighter (lower BMIs) than native-born non-Hispanic white women, but entirely converge to American weights within the first decade of residence in the United States. In contrast, immigrant men enter approximately 5 percentage points lighter than native-born non-Hispanic white men and close only one-third of the gap even after 15 years of U.S. residence. While convergence in average weight is interesting, it masks an even greater difference in the percentage of natives and immigrants who are overweight ($BMI \geq 25$) and obese ($BMI \geq 30$). Immigrant women (men) are about 5 (15) percentage points less likely to be overweight than native-born non-Hispanic whites at entry and they close 100 (50) percent of the gap within 10 (15+) years of U.S. residence. In fact, 15 years after arrival immigrant women are actually 3 percentage points more likely to be overweight than native women. A similar pattern is found for obesity rates, except that immigrant women converge to but do not overtake their native counterparts in this regard.

The remainder of the paper is as follows. Sections 2 and 3 describe the data and the estimation strategy, respectively. Section 4 documents the HIE. The results are presented in Section 5. Section 6 concludes.

⁶ This technique is commonly used in the labor economics literature to examine wage and employment assimilation (see Borjas 1985 for the classic study).

2. Data

All data are drawn from the National Health Interview Surveys (NHIS) from 1989-96. The NHIS is an annual cross-sectional survey intended to obtain information about the distribution of illness and the health services that people receive. Approximately 120,000 individuals in 45,000 households are surveyed each year. Information regarding basic socioeconomic characteristics as well as summary health measures such as self-reported health status and activity limitations are collected for all individuals, and measures of weight and height are collected for individuals aged eighteen and older. Our analysis is restricted to 1989-96 because years of U.S. residence are only reported in these years. To ensure a representative sample, we also restrict the sample to men and women aged 20-64; since overweight individuals may be less healthy and hence have higher pre-mature mortality rates.

We define race as non-Hispanic white, non-Hispanic black, Hispanic, and non-Hispanic other (Asians, Indians, etc.) – henceforth referred to as white, black, Hispanic, and other – and immigrants by year since arrival to the United States (0-4, 5-9, 10-14, and 15+). The sample includes 342,899, 60,179, 20,510, and 5,894 native and 17,793, 4,439, 26,496, and 12,596 immigrant whites, blacks, Hispanics and others, respectively. Not surprisingly, given the open-ended nature of the 15+ years since arrival category, it is by far the largest group of immigrants with 29,099 immigrants, while 0-4 years since arrival includes 11,047 immigrants, 5-9 years since arrival includes 11,033 immigrants and 10-14 years since arrival includes 10,145 immigrants. However, due to a small amount of non-reporting for some health measures, the exact sample sizes vary slightly across outcomes.

Table 1 reports summary statistics for the variables used throughout the analysis.⁷ As the majority of the analysis compares immigrants to native-born whites, the reported summary statistics

⁷ All variables are defined in Appendix Table 1.

are restricted to these two groups. For both natives and immigrants we have measures for age, an indicator for currently married, years of education, an indicator for currently employed and indicators for urban residence and region of residence.⁸ For all immigrants, Table 1 also reports immigrant arrival cohorts (1980 or before, 1981-85, 1986-90, and 1991-96)⁹ and the years since arrival (0-4, 5-9, 10-14, and 15+).

Throughout the analysis, we use three self-reported health indicators: poor health, the presence of at least one health condition, and the existence of at least one activity limitation. Poor health is defined as one if the individual reports their health status as fair or poor and zero if they report their health status as excellent, very good, or good. An individual is defined as having at least one health condition if they report one or more health conditions. Finally, the activity limitation indicator is set equal to one if the respondent is unable to perform their major activity (i.e., work), is limited in the kind or amount of their major activity, or is limited in any activity. For the sample as a whole, approximately 10 percent of people report poor health, 41 percent report at least one health condition, and 14 percent report an activity limitation.

In order to investigate the HIE hypotheses discussed in Section 1 we also include indicator variables for physician access and poverty. An individual is defined as having access to a physician if they report having seen a doctor in the past twelve months. While this is an imperfect measure, since it may confound access and utilization, it is the only access measure available in all waves of the NHIS. The indicator variable for poverty is set equal to one if family income is below the NHIS poverty threshold (where the threshold depends on family size and the number of children under the

⁸ To conserve space, the regional indicators are not reported in Table 1, but are included in all models.

⁹ The NHIS reports years since U.S. arrival rather than immigrant arrival cohorts. As such, we assign individuals to five-year cohorts to maximize the number of immigrants placed in the correct arrival cohort. Immigrants reporting 15+ years of U.S. residence in all NHIS years and those reporting 10-14 years in 1989-92 are designated as arriving in 1980 or earlier. Immigrants reporting 10-14 years in 1993-96 and 5-9 years in 1989-92 are designated as arriving in 1981-85.

age of eighteen) in that year, and zero otherwise. See section 5.2 for a more detailed discussion of the poverty measure.

While reported height and weight can be used to construct the BMI (kgs/meters²), which adjusts weight for height differences, self-reported height and weight are subject to reporting errors that may bias coefficient estimates. Unfortunately, the NHIS does not include measured height and weight. As such, we are forced to use self-reported measures. For our purposes we are particularly concerned that different racial and/or immigrant groups may differentially misreport. For example, in a similarly aged sample in the Third National Health and Nutrition Examination Survey (NHANES III) conducted in 1988-94, the average immigrant woman under-reports her weight by 1.3 percent while the average native woman under-reports her weight by 2.4 percent. On the other hand, the average native and immigrant man both under report their actual weight by 0.8 percent.

Following Cawley (2000) we address this misreporting problem using the strategy described in Lee and Sepanski (1995) and Bound, Brown and Mathiowetz (1999). More specifically, we correct self-reported weight and height using data from NHANES III, which is a nationally representative sample containing information on immigrant status as well as self-reported weight and height and professionally measured weight and height. As such, we regress measured (true) weight (height) on reported weight (height) and reported weight (height) squared separately for men and women by race/immigrant group (white, black, Hispanic and other immigrants and natives – 16 groups in total).¹⁰ We then use the coefficient estimates to predict measured weight and height in the NHIS data.¹¹ All summary BMI statistics and estimates reported in this paper are based on predicted weight and height. That being said, all results are similar if reported weight and height are

Immigrants reporting 5-9 years in 1993-96 and 0-4 years in 1989-92 are designated as arriving in 1986-90. Finally, immigrants reporting 0-4 years in 1993-96 are designated as arriving in 1991-96.

¹⁰ All models are appropriately weighted.

used instead.¹²

Rows 6-8 in Table 1 report the average BMI, the percentage defined as overweight (BMI \geq 25) and the percentage defined as obese (BMI \geq 30).¹³ 40 percent of native white women are overweight compared to 44 percent of immigrant women. In contrast, 59 percent of native white men are overweight compared to only 49 percent of immigrant men. As we will see in Section 5.3, these averages hide interesting racial/ethnic origin differences.

3. Empirical Framework

Our goal is to document that immigrants in the NHIS are healthier upon arrival to the United States, relative to their native counterparts, but that relative immigrant health declines with years in the United States. Moreover, we seek to understand the determinants of the entry and assimilation patterns. In particular, we focus on three potentially important factors: access to health care, poverty, and weight/obesity. For all outcome measures, we examine immigrant assimilation using the regression framework developed by Borjas (1985, 1995). To begin we focus on the assimilation of immigrants to native whites. In particular, we estimate equations of the following form:

$$Y_i = X_i\beta + A_i\delta + C_i\lambda + T_i\pi + \varepsilon_i \quad (1)$$

where i denotes individuals, Y represents the outcome measure of interest, X is a vector of control variables, A is vector of dummy variables indicating how long an immigrant has lived in the United States (set equal to zero for natives), C is a vector of dummy variables identifying immigrant arrival cohorts, T is a vector of dummy variables indicating the survey year, and ε is a random error term.

¹¹ See Appendix A in Cawley (2000) for a more detailed discussion of these issues. This, of course, assumes that the relationship between reported and measured height are the same in the NHANES III and NHIS.

¹² These results are available from the authors upon request.

¹³ We exclude 52 respondents who reported extreme heights (under 48 inches or over 84 inches) from the weight analysis. However, all results are similar if these individuals are included.

This specification gives each immigrant arrival cohort its own intercept, and differences in these intercepts represent permanent outcome differentials between cohorts. The coefficients for the duration of U.S. residence dummies (A) measure the effects of immigrant assimilation with respect to the outcome measure in question.

In order to identify cohort and age we restrict the period effect π to be the same for immigrants and natives. In essence, this means that the period effects are estimated from natives, and this information is used to identify cohort and assimilation effects for immigrants. Although not necessary for identification, equation (1) also restricts the effects of the variables in the control vector (X) to be the same for immigrants and natives and across survey years. We also estimated less constrained models that did not impose these latter restrictions and obtained very similar results. As such, these results not reported in the paper, but are available upon request.

4. The Healthy Immigrant Effect

Do immigrants arrive in the U.S. healthier than their native counterparts? And, do immigrants converge to American health levels? In order to answer these questions we estimate equation (1) for three indicator variables for health: poor health (=1 if self-reported health is either fair or poor), health conditions (=1 if one or more health conditions are reported), and activity limitations (=1 if activity or work is limited).

Table 2 presents the immigrant cohort and assimilation effects for our three health measures by gender. All the health equations are estimated as probit models. In order to more easily describe the quantitative importance of the explanatory variables in the probit specifications, Table 2 (and all remaining tables) report the marginal effects ($\partial \text{prob}(Y_i=1)/\partial X_i$) for continuous variables and average treatment effects for the discrete variables, in both cases evaluated at means, as well as standard

errors calculated using the “delta” method. In addition to the variables listed in Table 2, all regressions include controls for age, age squared, years of education, and indicator variables for married, employed, residence in an urban area, region of residence, and survey year.

The period effects indicate that Americans are getting less healthy over time irrespective of the health measure analyzed. Between 1989 and 1996, holding all else constant, the average female probability of being in poor health increased by 1.3 percentage points and the average male probability of being in poor health increased by 0.9 percentage points. In order to avoid overly cluttered tables, and because the results mirror those in the established literature, we do not report these coefficient estimates in Table 2.

The immigrant arrival cohort coefficients reported in Table 2 represent immigrant-native health differentials evaluated at 0-4 years of U.S. residence. For example, the estimated coefficient for 1986-90 female immigrants in the health conditions specification indicates that, in their first four years after arriving, this cohort was 2 percentage points less likely to be in poor health relative to otherwise similar white natives.

That the cohort coefficients are uniformly negative implies that both male and female immigrants from every arrival cohort entered the United States with a lower proportion of individuals in poor health, with health conditions, and activity limitations than natives. In general, the coefficients tend to be similar in magnitude for the various arrival cohorts suggesting that, after controlling for years of U.S. residence, health is similar across cohorts.

We now turn to the assimilation effects. In Table 2, the coefficients for the duration of U.S. residence indicate how health changes the longer an immigrant cohort remains in the United States. The assimilation patterns are similar for male and female immigrants, thus we focus on the female assimilation patterns here. While the bulk of assimilation for the probability of being in poor health

takes place within the first decade after arrival, immigrant assimilation in terms of health conditions and activity limitations occurs more slowly. For example, the probability of being in poor health increases by 2.4 percentage points as female immigrants pass from 0-4 to 5-9 years in the United States, but thereafter increases only a modest 2.3 percentage points. In contrast, the percentage of female immigrants with health conditions, relative to their level during the initial four years of U.S. residence, rises by 3.8 percentage points after 5-9 years, by 5.3 percentage points after 10-14 years, and 14.6 percentage points after more than 15 years.

Finally, recall the negative cohort coefficients discussed earlier. These coefficients indicate that, all immigrant cohorts were less likely to be in poor health, by all measures, at the time of arrival compared to white natives. However, assimilation towards U.S. levels eventually erases all or most of the initial health advantage. As an illustration, consider the 1981-85 arrival cohort. During their first four years in the United States this female (male) cohort had an incidence of being limited in activities that was 8.3 (7.8) percentage points below that of white natives. But after 10-14 years of U.S. residence, assimilation has reduced the female (male) gap by 4.8 (4.9) percentage points. After 15 years of U.S. residence female (male) immigrants are actually 1.8 (1.7) percentage points more likely than white natives to be classified as limited in activities. To summarize, these results are consistent with an immigrant health assimilation process as opposed to permanent health differences across immigrant cohorts.

Overall these results confirm the existence of the HIE found in the previous literature. In particular, we find that immigrants are healthier upon arrival in the United States, however this health advantage declines (and/or is erased) with time in the United States.

5. Determinants of the Healthy Immigrant Effect

What explains the HIE? We examine three potential determinants: access to health care, poverty, and weight. While this is not an exhaustive list, other explanations (such as, return migration and the U.S. immigration screening system) are beyond the scope of our data.

5.1 Access to Health Care

The impact of health care assimilation by immigrants the longer they remain in the country will improve immigrant health relative to native health if it improves preventative health care screening, diagnosis and the treatment of health care problems (Leclere et. al., 1994, Laroche 2000, and McDonald and Kennedy 2004). On the other hand, improved health care access might lower self-reported health status among immigrants if it results in the diagnosis of previously unknown pre-existing conditions (McDonald and Kennedy 2004 and Jasso et. al. 2004). As such, it is difficult to predict the direction of the change in immigrant self-reported health status over time that results from changes in health care access.

However, we do know that immigrant health status is initially higher than that of natives and then falls towards American levels. Two things are therefore necessary for health care access to play a role in immigrant assimilation towards American health levels. First, immigrant health care access must change with the length of time that cohorts remain in the United States. Secondly, health care access must either fall the longer immigrants remain in the country, which seems incredibly unlikely, or must lead to the detection of previously unknown health problems which cause immigrants to report worse health.

In an attempt to examine these possibilities, we re-estimate equation (1) replacing the health outcome measures with an indicator variable for access to health care (=1 if the respondent visited a

doctor in previous 12 months). The results are presented in columns 1 and 3 in Table 3. As one would have expected, for every arrival cohort, immigrants have less access to health care upon arrival compared to their native counterparts, although the effect is more pronounced in more recent cohorts. However, there is no evidence that immigrants assimilate towards or away from native levels of health care access. Given the absence of health care access assimilation, immigrant health care access cannot explain changes in immigrant health, as access is constant and relative health is changing with time in the country.¹⁴

5.2 Poverty

As discussed earlier, it is well known that most immigrant groups enter the United States with lower incomes and subsequently converge towards native levels the longer they remain in the country (see the references on page 2). Given immigrant income assimilation and the general finding that health is positively related to income (Sorlie et. al., 1995), immigrants should become healthier the longer they remain in the country. This is exactly the opposite of the HIE: Immigrants arrive healthier and then become less healthy, not the other way around.

Unfortunately, the wage and income data in the NHIS is limited to a categorical measure of nominal family income (with a low top code and a high non-reporting rate) and an indicator variable for households falling below the poverty line. Given the high non-reporting for family income and the difficulty associated with converting nominal categories into real values over time, we restrict the analysis to the probability of being in poverty. We therefore re-estimate equation (1) replacing the health outcome measures with an indicator variable for poverty. The results are reported in columns 2 and 4 in Table 3. Consistent with previous studies, we find that all immigrant arrival

¹⁴ McDonald and Kennedy (2004) similarly find that health care access does not explain the HIE in Canada.

cohorts are more likely to be in poverty than their white native counterparts. As with access to health care, this is particularly true for more recent cohorts. The estimates in Table 3 also reveal a small amount of convergence towards lower native poverty rates. In particular, after 15 years in the country, male and female immigrants have closed 10-20 and 20-35 percent of the poverty gap depending on the arrival cohort, respectively. In sum, the poverty and health assimilation processes move in opposite directions in the NHIS data, which is incompatible with the HIE.

5.3 Weight

As previously stated, there is a growing literature documenting the ever-increasing American waistline and the rapidly growing incidence of obesity. The rising obesity rate is of great concern to policymakers due to the associated health risks (e.g., heart disease, stroke, some types of cancer, and diabetes) and hence costs. These facts suggest an alternative explanation for why immigrants become less healthy the longer they reside in the United States: immigrant weight levels may be approaching the unhealthy weight levels of their American counterparts. We focus on three weight measures: BMI (measured as kilograms/meters²), an indicator variable for overweight (equals one if $BMI \geq 25$, and zero otherwise), and an indicator variable for obese (equals one if $BMI \geq 30$, and zero otherwise).

5.3.1 Weight by Nativity

Do immigrants converge to unhealthy American weights? We begin to answer this question by simply graphing the average BMI for native whites, blacks and Hispanics as well as those for immigrants who arrived less than five years ago and immigrants who arrived fifteen or more years ago from 1989-96 (Figure 1). Consistent with Lakdawalla and Philipson (2002) and Cutler, Glaeser,

and Shapiro (2003), average weights rose for both men and women between 1989-96. While the average weight level differs across race groups, the weight trends are similar. In 1989 the average native white woman had a BMI of 24.5. Over the next seven years this rose by 4 percent to 25.4. The growth rate was about the same for native black and Hispanic women, but the starting levels were substantially higher. The average upward trend for men was slightly slower, with a growth rate of approximately 3 percent for all race groups. The major difference between men and women is that the racial spread is much smaller for men.

While the upward native trends are important for comparison, for our purposes the immigrant patterns are of greater consequence. The following two patterns are noteworthy. First, just as for natives, there is an upward trend for immigrants over time, holding years since arrival constant. Secondly, the longer immigrants reside in the U.S. the heavier they become. The BMI for the average female immigrant rises by approximately 6 percent between 0-4 years of U.S. residence and 15+ years of U.S. residence. To put this in context, the average female immigrant enters the country smaller than the average native white woman, but eventually completely converges or surpasses her. However, even after 15+ years of residence in the U.S. the average female immigrant has a lower BMI than the average native black or Hispanic woman. In contrast, while immigrant men approach native weights they remain lighter even after 15+ years of U.S. residence.

Figures 2 and 3 replicate Figure 1 for the percentage of people classified as overweight and obese, respectively. In both cases the patterns are very similar. The one noticeable difference is that there appears to be somewhat less immigrant convergence in obesity relative to BMI and the overweight designation. The remainder of the paper provides a more formal analysis of this immigrant convergence.

5.3.2 Immigrant Assimilation and Cohort Differentials

Table 4 presents the immigrant cohort and assimilation effects for equation (1) for our three weight measures by gender.¹⁵ The period effects indicate that Americans are getting heavier over time irrespective of the weight measure. Between 1989 and 1996, holding all else constant, the average female (male) BMI, probability of being overweight, and probability of being obese increased by 3.4 (2.8), 8.1 (8.0), and 5.0 (5.3) percentage points, respectively (see Appendix Table 2).¹⁶

As with the health outcomes, the uniformly negative cohort coefficients imply that both male and female immigrants from every arrival cohort entered the U.S. with lower BMIs, a lower proportion of overweight individuals, and a lower proportion of obese individuals than natives. Furthermore, we find no evidence of differences across cohorts (i.e., the magnitude of the coefficients are similar across arrival cohorts).

Turning to the assimilation effects, for female immigrants, the bulk of assimilation (regardless of the outcome measure) takes place within the first decade after arrival. The probability of being overweight (obese) increases by 6.4 (4.1) percentage points as female immigrants pass from 0-4 to 5-9 years in the United States, but thereafter increases only by 2.7 (2.5) percentage points. In contrast, male immigrants assimilate more slowly. The percentage of male immigrants designated overweight (obese), relative to their level during the initial four years of U.S. residence, rises by 2.1 (0) percentage points after 5-9 years, by 3.9 (0) percentage points after 10-14 years, and 8.5 (5.4) percentage points after more than 15 years (although some of these effects are imprecisely estimated).

Finally, weight growth from assimilation eventually erases the entire initial weight advantage

¹⁵ We use the natural logarithm of BMI (Ln BMI) for ease of interpretation. However, all results are similar if the models are estimated in levels.

¹⁶ The parameter estimates for age, age squared, years of education, and indicator variables for married, employed, residence in an urban area, region of residence, and survey year are presented in Appendix Table 2.

for all female immigrant arrival cohorts and a substantial fraction of the initial weight advantage for immigrant men. For example, during their first four years in the U.S. the 1981-1985 female (male) cohort had an incidence of being overweight that was 5.4 (15.3) percentage points below that of white natives. But after 10-14 years of U.S. residence, assimilation had more than completely narrowed the female gap and reduced the male gap by 3.9 percentage points. After 15 years of U.S. residence these female immigrants are actually 3.7 percentage points more likely than white natives to be classified as overweight and the male immigrant-native gap has been reduced to 6.8 percentage points. These results are consistent with an immigrant adjustment process as opposed to permanent cohort differences.

Overall, the general patterns found in terms of weight (irrespective of the measure) mirror the patterns found for general health measures. Immigrants arrive lighter (healthier), but become heavier (less healthy) with time in residence. This suggests that weight, which is largely determined by diet and exercise¹⁷ is an important contributing factor for explaining the HIE.

The results presented thus far combine all immigrant groups, irrespective of race/ethnic origin. However, white immigrants may be systematically different in terms of general health measures and weight than their black, Hispanic and other (Asians, Indians, etc.) counterparts. In this case, combining immigrants into one group may be quite misleading. As such, we re-estimate equation (1) separately for white, Hispanic, black, and other immigrants (relative to white natives).

In general, we find a HIE irrespective of racial/ethnic origin group, gender, or the health

¹⁷ Unfortunately, it is difficult to separate the contribution of diet and exercise from each other due to data limitations. There are two NHIS supplements (in 1990 and 1991) that include information on exercise. However, given the essentially cross-sectional nature of this data, it is impossible to separately identify cohort and assimilation effects in this data. That being said, simple comparisons of immigrant (combining cohort and assimilation factors) and native probabilities show that immigrant women are somewhat less likely to exercise regularly than native women, but no male differences are found. Although this evidence is somewhat difficult to interpret due to the inability to separate the cohort and assimilation effects, it does suggest that both diet and exercise play a role for women, while male weight assimilation is likely largely driven by dietary changes with time in U.S. residence.

measure considered (the results are, however, somewhat noisier due to small cell sizes). In particular, immigrants are healthier than their native counterparts upon arrival but then converge to the poor health rates of natives.¹⁸ As these results mirror those in Section 4, we do not report these estimates (they are, however, available upon request).

Tables 5a and 5b present the immigrant cohort and assimilation effects from estimating equation (1) for our three weight measures by race for women and men, respectively. Although they are not reported, the period effects once again indicate that people are getting heavier over time, this is not surprising as the period effect is estimated from natives. However, there are several important racial differences. First, with the exception of obesity rates, white female immigrants are indistinguishable from their native counterparts while white male immigrants from every arrival period initially had lower BMIs, probabilities of being overweight, and probabilities of being obese than their native counterparts. In particular, white male immigrants have BMIs that are 3-4 percent lower and overweight and obesity rates that are 11-14 and 7-11 percentage points lower, depending on the arrival cohort than their native counterparts. Further, they do not assimilate in terms of BMI but they do assimilate in terms of overweight and obesity rates. After 15+ years in the United States white male immigrants have narrowed the immigrant-native overweight gap by 11 percentage points and completely eliminated the obesity gap. In fact, white male immigrants are about 2 percentage points more likely to be obese than their white native counterparts after 15+ years of U.S. residence. Thus weight outcomes are likely important in explaining the HIE for white male immigrants but play a more limited role in explaining the HIE for white female immigrants.

Secondly, Hispanic female immigrants from every arrival period entered the U.S. with lower

¹⁸ The main exception is black immigrants. While they do arrive healthier than their white native counterparts, there is little evidence of assimilation with time in the country. However, we have very few black immigrants in our sample so these results should be interpreted with caution.

obesity rates but higher BMIs and overweight rates than native white women. Furthermore, the cohort coefficients are roughly similar in magnitude, although sometimes imprecisely estimated. Perhaps surprisingly, Hispanic female immigrants continue to get heavier in terms of BMIs and overweight rates the longer they remain in the United States. In addition, they completely converge in terms of obesity rates within the first decade of U.S. residence, and overtake white natives in terms of obesity after 10-14 years by about 4 percentage points.

The high and increasing female Hispanic immigrant weights are particularly interesting when considered in conjunction with the health and poverty assimilation patterns, which are inconsistent with the Hispanic Paradox: the finding of lower mortality rates among Hispanic immigrants despite their relatively low socioeconomic status (see Palloni and Arias 2003 and the references therein). Consistent with the paradox, Hispanic immigrant women are 6-10 percentage points (depending on their arrival cohort) more likely to be in poverty than their native born counterparts upon arrival and do not converge to native levels with time of residence. But inconsistent with the paradox, Hispanic women have lower probabilities of poor health at entry into the United States but assimilate to, or beyond, American levels of poor health within 10-15 years after arrival (the Hispanic poverty and health results are available upon request). However, the declining relative health of Hispanic immigrant women does match closely with their rising weights and is consistent with the higher rates of diabetes among Hispanic women (see Jasso et. al. 2004).

The pattern for Hispanic male immigrants is very different. The cohort coefficients show that Hispanic male immigrants from every arrival period are initially lighter (irrespective of the weight measure) than white native men. Moreover, they do not assimilate to white native levels. While the initial weight pattern is consistent with the initial health patterns, the convergence patterns with time in U.S. residence are contradictory. And unlike female Hispanic immigrants, the lack of

male Hispanic immigrant weight assimilation seems at odds with the relatively high rates of death due to diabetes among Hispanic men (National Vital Statistics Reports 2003).

Thirdly, black immigrants appear to be similar to their Hispanic immigrant counterparts in terms of the cohort effects, although unlike Hispanic immigrants, they do not assimilate in terms of weight. Caution, however, should be used in interpreting these results due to the small number of black immigrants.

Finally, while male and female immigrants in the other group from every arrival period entered the U.S. lighter than their white native counterparts, only female immigrants assimilate. For example, consider 1981-85 arrival cohort. During their first four years in the U.S. this female cohort had an incidence of being overweight that was 21.5 percentage points below that of white natives. After 5-9, 10-14, and 15+ years of U.S. residence, assimilation reduced the female gap by 8.4, 11.9, and 18.1 percentage points, respectively. In contrast to the results for white immigrants, weight outcomes appear to be an important factor in the HIE for other female immigrants but play a more limited role for other male immigrants.

Given the distinct native race patterns shown in Figures 1 through 3, the fact that Hispanic female immigrants enter the U.S. heavier than white native women, and the fact that Hispanic immigrants comprise the largest fraction of the U.S. immigrant population, Table 6 replaces the white native control group with a black and then Hispanic native control group for estimating the assimilation pattern for Hispanic women (and for completeness Hispanic men). This allows us to more fully describe to whom Hispanic immigrants are converging. In contrast to the white native comparison, Hispanic women enter thinner than and converge towards their native black and Hispanic counterparts.¹⁹ Given the more similar native black, white and Hispanic weights among

¹⁹ The main exception is while Hispanic women enter with lower BMIs than their black native counterparts, they do not

men described in Figures 1 through 3, it is not surprising that the results are fairly similar across control group specifications for Hispanic male immigrants. The main exceptions are the overweight and obese specifications using native Hispanic men as the control group. Here it is apparent that male Hispanic immigrants enter the U.S. with a much lower probability of being both overweight and obese than native Hispanic men, but the estimated convergence rate is the same as in all other specifications.

6. Conclusion

It is well documented that immigrants are in better health upon arrival in the United States than their American counterparts, but that this health advantage erodes over time: the HIE. We find support for the HIE in the NHIS using three measure of health (self-reported health status, health conditions, and activity limitations). Moreover, we find little evidence that greater medical access or reduced poverty rates improve immigrant health over time, but we do find substantial evidence that the weight assimilation patterns of immigrants closely mirror self-reported health assimilation. Overall immigrants arrive in the United States lighter than non-Hispanic white natives, but then converge towards, and in the case of women overtake, natives. However, this overall pattern is somewhat misleading. While non-Hispanic white female immigrants are indistinguishable from their non-Hispanic white native counterparts upon arrival, Hispanic female immigrants enter the U.S. heavier than non-Hispanic white natives and continue to get heavier the longer they reside here. On the other hand, male immigrants of all racial/ethnic origins generally enter the U.S. lighter than natives, and never fully assimilate.

Understanding the intricacies of the immigrant weight assimilation path may give us some

assimilate to black BMI levels.

insight into the causes of elevated American weight levels. The fact that most immigrant groups arrive thinner than Americans and then converge towards natives suggests that the new cultural or environmental factors that immigrants are exposed to alter their behavior. Unfortunately, their newly acquired eating habits and weight gain increase the probability of health problems and premature death as well as raise health care costs.

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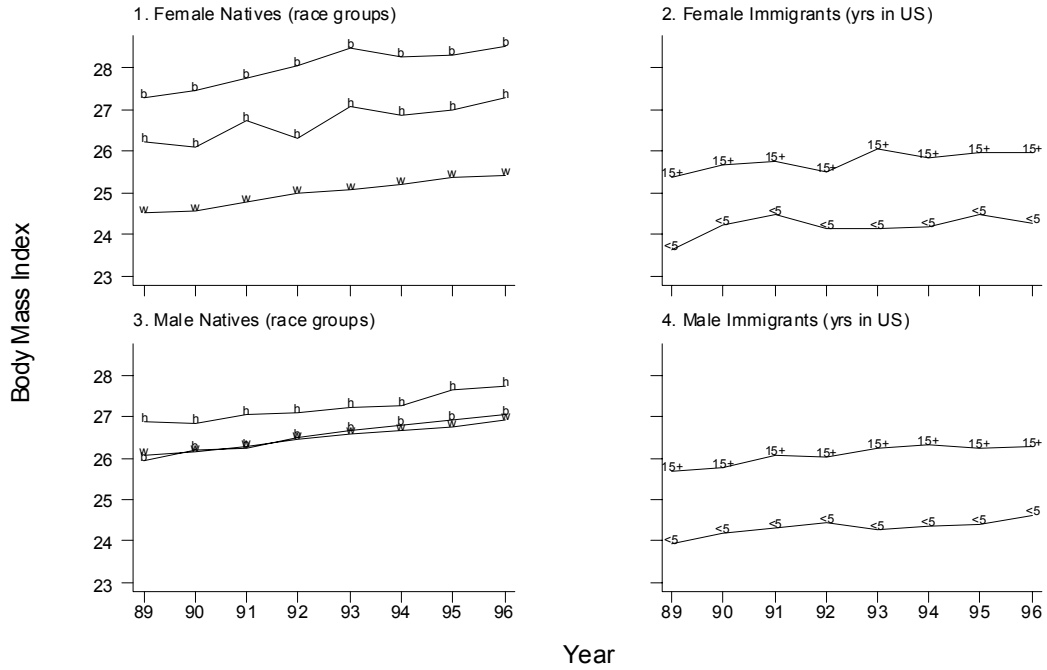


Figure 1. Body Mass Index by Race and Immigrant Status

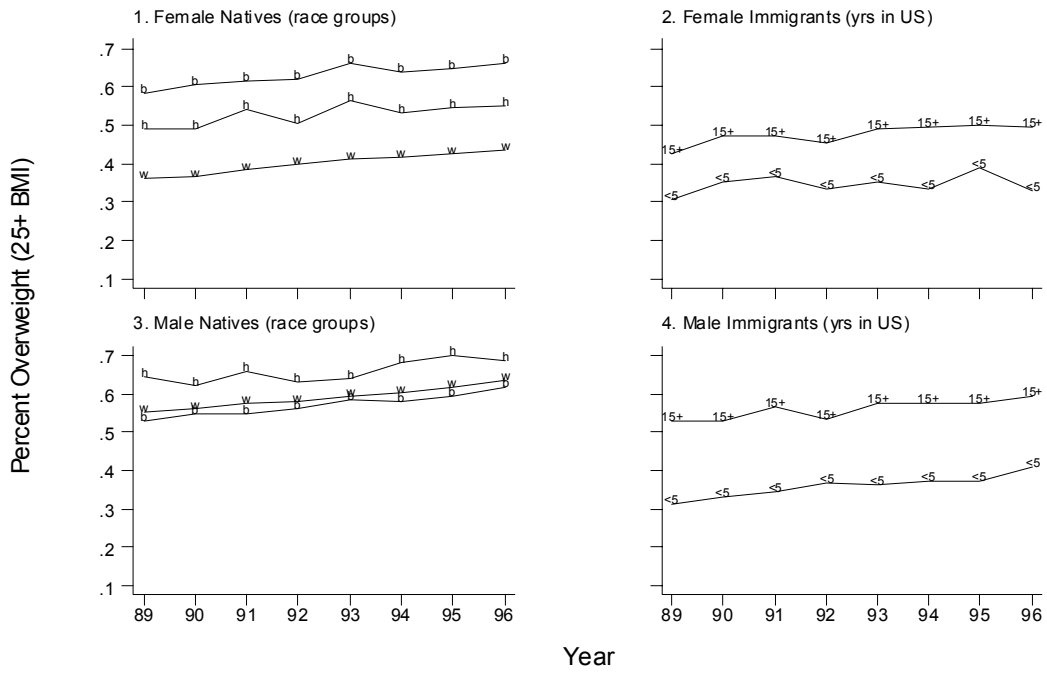
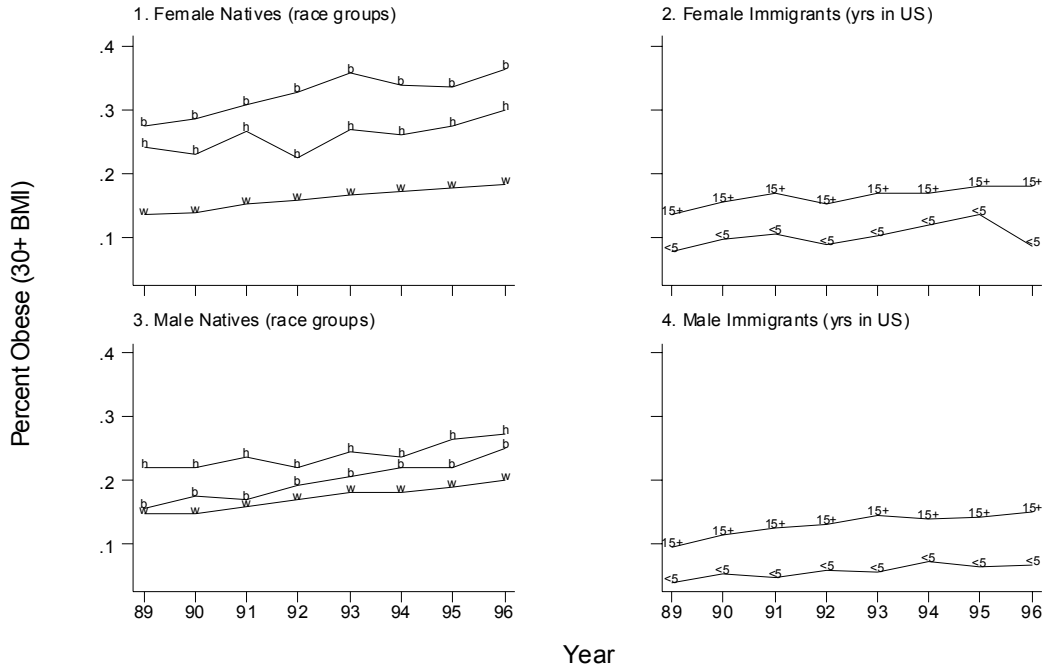


Figure 2. Percent Overweight by Race and Immigrant Status



Year
 Figure 3. Percent Obese by Race and Immigrant Status

Table 1. Summary Statistics by Gender and Nativity

	<u>Women</u>		<u>Men</u>	
	Natives*	Immigrants	Natives*	Immigrants
Poor Health	0.088 (0.284)	0.122 (0.327)	0.080 (0.271)	0.086 (0.280)
Health Conditions	0.466 (0.499)	0.342 (0.474)	0.403 (0.491)	0.264 (0.441)
Activity Limitations	0.145 (0.352)	0.108 (0.311)	0.140 (0.347)	0.090 (0.286)
Doctor Visits	0.826 (0.379)	0.753 (0.431)	0.659 (0.474)	0.552 (0.497)
Poverty	0.071 (0.257)	0.185 (0.388)	0.054 (0.226)	0.159 (0.365)
BMI	24.980 (5.497)	25.259 (4.842)	26.475 (4.390)	25.367 (3.826)
Overweight (BMI 25+)	0.400 (0.490)	0.438 (0.496)	0.590 (0.492)	0.485 (0.500)
Obese (BMI 30+)	0.161 (0.367)	0.145 (0.352)	0.171 (0.377)	0.097 (0.297)
Immigrated 1980 or Before		0.565 (0.496)		0.538 (0.499)
Immigrated 1981-85		0.158 (0.364)		0.179 (0.384)
Immigrated 1986-90		0.180 (0.384)		0.191 (0.393)
Immigrated 1991-96		0.097 (0.296)		0.092 (0.290)
0-4 Years Since Arrival		0.185 (0.388)		0.182 (0.386)
5-9 Years Since Arrival		0.169 (0.374)		0.188 (0.391)
10-14 Years Since Arrival		0.154 (0.361)		0.173 (0.378)
15+ Years Since Arrival		0.493 (0.500)		0.457 (0.498)
Age	39.875 (12.126)	38.778 (11.808)	39.726 (11.966)	37.737 (11.495)
Married	0.709 (0.454)	0.681 (0.466)	0.714 (0.452)	0.687 (0.464)
Years of Education	13.223 (2.403)	11.783 (4.119)	13.375 (2.644)	12.144 (4.265)
Working/Employed	0.686 (0.464)	0.569 (0.495)	0.854 (0.353)	0.823 (0.382)
Urban	0.758 (0.428)	0.940 (0.237)	0.756 (0.429)	0.943 (0.232)
Sample Size	171836	31123	164333	28698

NHIS data from 1989-96 for individuals aged 20-64. All statistics use NHIS annual weights.

* Refers to non-Hispanic white natives.

Table 2. Immigrant Cohort and Assimilation Effects of Health Status (Probit Results)

	<u>Women</u>			<u>Men</u>		
	Poor Health	Health Conditions	Activity Limitations	Poor Health	Health Conditions	Activity Limitations
<u>Cohort Effects</u>						
Immigrated 1980 or Before	-0.030 (0.009)	-0.223 (0.021)	-0.092 (0.008)	-0.019 (0.009)	-0.226 (0.019)	-0.084 (0.009)
Immigrated 1981-85	-0.027 (0.007)	-0.208 (0.016)	-0.083 (0.006)	-0.020 (0.006)	-0.204 (0.015)	-0.078 (0.006)
Immigrated 1986-90	-0.019 (0.004)	-0.211 (0.009)	-0.082 (0.004)	-0.015 (0.004)	-0.213 (0.008)	-0.078 (0.004)
Immigrated 1991-95	-0.009 (0.005)	-0.201 (0.010)	-0.083 (0.003)	-0.011 (0.005)	-0.207 (0.009)	-0.078 (0.003)
<u>Assimilation Effects</u>						
5-9 Years Since Arrival	0.024 (0.010)	0.038 (0.016)	0.029 (0.015)	0.025 (0.010)	0.058 (0.018)	0.028 (0.015)
10-14 Years Since Arrival	0.031 (0.015)	0.053 (0.024)	0.048 (0.022)	0.027 (0.014)	0.073 (0.025)	0.049 (0.023)
15+ Years Since Arrival	0.047 (0.018)	0.146 (0.026)	0.101 (0.029)	0.023 (0.015)	0.158 (0.029)	0.095 (0.030)
Sample Size	207,101	207,633	207,633	193,561	193,944	193,944

All models also include age, age squared, years of education, and indicators for married, employed, urban, region and survey year. NHIS annual weights used. Marginal results reported for all probit models. Bold coefficients are statistically significant at the 5% level or better.

Table 3. Immigrant Cohort and Assimilation Effects of Medical Access and Poverty (Probit Results)

	<u>Women</u>		<u>Men</u>	
	Doctor Visits	Poverty	Doctor Visits	Poverty
<u>Cohort Effects</u>				
Immigrated 1980 or Before	-0.065 (0.021)	0.053 (0.014)	-0.095 (0.025)	0.068 (0.015)
Immigrated 1981-85	-0.075 (0.016)	0.065 (0.012)	-0.094 (0.019)	0.075 (0.012)
Immigrated 1986-90	-0.111 (0.009)	0.098 (0.008)	-0.145 (0.011)	0.111 (0.008)
Immigrated 1991-95	-0.157 (0.011)	0.094 (0.008)	-0.175 (0.012)	0.122 (0.010)
<u>Assimilation Effects</u>				
5-9 Years Since Arrival	0.008 (0.010)	-0.005 (0.004)	-0.012 (0.014)	-0.004 (0.004)
10-14 Years Since Arrival	0.003 (0.016)	-0.002 (0.007)	-0.007 (0.021)	0.000 (0.006)
15+ Years Since Arrival	0.030 (0.016)	-0.019 (0.006)	0.042 (0.023)	-0.015 (0.005)
Sample Size	206,820	194,002	193,242	182,173

All models also include age, age squared, years of education, and indicators for married, employed, urban, region and survey year. NHIS annual weights used. Marginal results reported for all probit models. Bold coefficients are statistically significant at the 5% level or better.

Table 4. Immigrant Cohort and Assimilation Effects of Weight (OLS and Probit Results)

	<u>Women</u>			<u>Men</u>		
	Ln BMI	Overweight	Obese	Ln BMI	Overweight	Obese
<u>Cohort Effects</u>						
Immigrated 1980 or Before	-0.009 (0.008)	-0.057 (0.024)	-0.071 (0.013)	-0.040 (0.007)	-0.142 (0.025)	-0.084 (0.014)
Immigrated 1981-85	-0.017 (0.006)	-0.054 (0.018)	-0.075 (0.009)	-0.050 (0.005)	-0.153 (0.019)	-0.091 (0.010)
Immigrated 1986-90	-0.006 (0.003)	-0.017 (0.011)	-0.060 (0.006)	-0.053 (0.003)	-0.164 (0.011)	-0.097 (0.005)
Immigrated 1991-95	-0.020 (0.004)	-0.050 (0.011)	-0.060 (0.006)	-0.062 (0.003)	-0.165 (0.012)	-0.094 (0.006)
<u>Assimilation Effects</u>						
5-9 Years Since Arrival	0.019 (0.005)	0.064 (0.016)	0.041 (0.013)	-0.001 (0.004)	0.024 (0.015)	-0.004 (0.014)
10-14 Years Since Arrival	0.020 (0.007)	0.083 (0.023)	0.058 (0.020)	0.003 (0.006)	0.039 (0.022)	0.007 (0.021)
15+ Years Since Arrival	0.025 (0.008)	0.091 (0.026)	0.066 (0.023)	0.019 (0.007)	0.085 (0.024)	0.054 (0.027)
Sample Size	202,959	202,959	202,959	192,702	192,702	192,702

All models also include age, age squared, years of education, and indicators for married, employed, urban, region and survey year. NHIS annual weights used. Marginal results reported for all probit models. Bold coefficients are statistically significant at the 5% level or better.

Table 5a. Immigrant Cohort and Assimilation Effects of Weight for Women by Ethnic/Race Group (OLS and Probit Results)

	<u>White</u>			<u>Hispanic</u>			<u>Black</u>			<u>Other</u>		
	Ln BMI	Overwgt	Obese	Ln BMI	Overwgt	Obese	Ln BMI	Overwgt	Obese	Ln BMI	Overwgt	Obese
<u>Women</u>												
<u>Cohort Effects</u>												
Immigrated 1980 or Before	0.013 (0.015)	-0.048 (0.050)	-0.053 (0.031)	0.034 (0.012)	0.059 (0.039)	-0.054 (0.020)	0.092 (0.028)	0.234 (0.076)	0.063 (0.067)	-0.089 (0.014)	-0.261 (0.029)	-0.127 (0.012)
Immigrated 1981-85	0.000 (0.012)	-0.043 (0.037)	-0.072 (0.019)	0.026 (0.009)	0.043 (0.029)	-0.054 (0.016)	0.064 (0.020)	0.225 (0.059)	0.015 (0.044)	-0.079 (0.011)	-0.215 (0.026)	-0.116 (0.012)
Immigrated 1986-90	0.013 (0.006)	0.001 (0.021)	-0.058 (0.012)	0.038 (0.005)	0.089 (0.017)	-0.031 (0.011)	0.058 (0.010)	0.201 (0.036)	0.005 (0.026)	-0.074 (0.006)	-0.181 (0.017)	-0.104 (0.009)
Immigrated 1991-95	0.007 (0.007)	-0.017 (0.021)	-0.042 (0.013)	0.030 (0.005)	0.073 (0.017)	-0.023 (0.011)	0.045 (0.016)	0.160 (0.044)	0.036 (0.035)	-0.093 (0.006)	-0.212 (0.016)	-0.123 (0.006)
<u>Assimilation Effects</u>												
5-9 Years Since Arrival	-0.001 (0.009)	0.012 (0.031)	0.017 (0.027)	0.021 (0.007)	0.079 (0.024)	0.050 (0.020)	0.019 (0.017)	0.005 (0.050)	0.046 (0.041)	0.012 (0.009)	0.084 (0.034)	0.018 (0.032)
10-14 Years Since Arrival	-0.002 (0.014)	0.040 (0.047)	0.002 (0.038)	0.025 (0.011)	0.105 (0.034)	0.087 (0.031)	-0.002 (0.025)	-0.021 (0.069)	0.024 (0.054)	0.015 (0.013)	0.119 (0.047)	0.062 (0.052)
15+ Years Since Arrival	-0.011 (0.015)	0.022 (0.053)	-0.001 (0.042)	0.024 (0.012)	0.102 (0.040)	0.104 (0.036)	-0.016 (0.028)	-0.007 (0.079)	0.001 (0.055)	0.032 (0.015)	0.181 (0.054)	0.114 (0.068)
Sample Size	180,968	180,968	180,968	184,885	184,885	184,885	174,211	174,211	174,211	178,403	178,403	178,403

All models also include age, age squared, years of education, and indicators for married, employed, urban, region and survey year. NHIS annual weights used. Marginal results reported for all probit models. Bold coefficients are statistically significant at the 5% level or better.

Table 5b. Immigrant Cohort and Assimilation Effects of Weight for Men by Ethnic/Race Group (OLS and Probit Results)

	<u>White</u>			<u>Hispanic</u>			<u>Black</u>			<u>Other</u>		
	Ln BMI	Overwgt	Obese	Ln BMI	Overwgt	Obese	Ln BMI	Overwgt	Obese	Ln BMI	Overwgt	Obese
<u>Men</u>												
<u>Cohort Effects</u>												
Immigrated 1980 or Before	-0.029 (0.013)	-0.136 (0.051)	-0.105 (0.024)	-0.009 (0.010)	-0.053 (0.038)	-0.052 (0.025)	-0.015 (0.020)	-0.060 (0.086)	-0.043 (0.069)	-0.092 (0.011)	-0.298 (0.046)	-0.119 (0.023)
Immigrated 1981-85	-0.032 (0.009)	-0.108 (0.039)	-0.096 (0.020)	-0.016 (0.008)	-0.058 (0.029)	-0.064 (0.018)	-0.019 (0.016)	-0.035 (0.067)	-0.078 (0.044)	-0.103 (0.009)	-0.307 (0.035)	-0.128 (0.015)
Immigrated 1986-90	-0.038 (0.005)	-0.143 (0.021)	-0.098 (0.011)	-0.023 (0.005)	-0.078 (0.017)	-0.077 (0.010)	-0.029 (0.011)	-0.045 (0.043)	-0.095 (0.020)	-0.103 (0.005)	-0.308 (0.020)	-0.130 (0.007)
Immigrated 1991-95	-0.038 (0.006)	-0.127 (0.023)	-0.072 (0.014)	-0.041 (0.005)	-0.084 (0.019)	-0.093 (0.009)	-0.040 (0.013)	-0.067 (0.048)	-0.074 (0.030)	-0.106 (0.006)	-0.295 (0.021)	-0.130 (0.008)
<u>Assimilation Effects</u>												
5-9 Years Since Arrival	0.002 (0.007)	0.058 (0.029)	0.032 (0.033)	-0.008 (0.006)	0.018 (0.022)	-0.017 (0.019)	-0.032 (0.014)	-0.109 (0.058)	-0.057 (0.042)	0.001 (0.007)	0.005 (0.034)	-0.026 (0.036)
10-14 Years Since Arrival	0.002 (0.012)	0.064 (0.043)	0.056 (0.051)	-0.003 (0.009)	0.049 (0.031)	-0.007 (0.028)	-0.022 (0.018)	-0.013 (0.077)	-0.062 (0.055)	0.007 (0.010)	-0.001 (0.047)	-0.015 (0.052)
15+ Years Since Arrival	0.021 (0.013)	0.107 (0.046)	0.130 (0.065)	0.008 (0.011)	0.068 (0.036)	0.026 (0.036)	-0.031 (0.021)	-0.013 (0.087)	-0.082 (0.053)	0.011 (0.012)	0.042 (0.052)	0.013 (0.066)
Sample Size	172,548	172,548	172,548	176,805	176,805	176,805	166,279	166,279	166,279	170,069	170,069	170,069

All models also include age, age squared, years of education, and indicators for married, employed, urban, region and survey year. NHIS annual weights used. Marginal results reported for all probit models. Bold coefficients are statistically significant at the 5% level or better.

Table 6. Immigrant Cohort and Assimilation Effects of Weight for Hispanic Immigrants Compared to Black and Hispanic Natives by Gender (OLS and Probit Results)

	<u>Women</u>						<u>Men</u>					
	<u>Black</u>		Obese	<u>Hispanic</u>		Obese	<u>Black</u>		Obese	<u>Hispanic</u>		Obese
Ln BMI	Overwgt	Ln BMI		Overwgt	Ln BMI		Overwgt	Ln BMI		Overwgt	Ln BMI	
<u>Cohort Effects</u>												
Immigrated 1980 or Before	-0.052 (0.013)	-0.148 (0.041)	-0.191 (0.027)	-0.037 (0.014)	-0.113 (0.044)	-0.176 (0.030)	0.000 (0.012)	-0.052 (0.040)	-0.034 (0.032)	-0.042 (0.013)	-0.165 (0.043)	-0.111 (0.029)
Immigrated 1981-85	-0.065 (0.010)	-0.167 (0.031)	-0.186 (0.018)	-0.045 (0.010)	-0.120 (0.032)	-0.153 (0.017)	-0.015 (0.009)	-0.068 (0.030)	-0.063 (0.021)	-0.052 (0.009)	-0.178 (0.032)	-0.111 (0.016)
Immigrated 1986-90	-0.059 (0.006)	-0.122 (0.018)	-0.166 (0.012)	-0.034 (0.006)	-0.069 (0.019)	-0.128 (0.012)	-0.029 (0.005)	-0.094 (0.018)	-0.089 (0.011)	-0.062 (0.005)	-0.200 (0.019)	-0.122 (0.009)
Immigrated 1991-95	-0.072 (0.006)	-0.139 (0.018)	-0.162 (0.012)	-0.044 (0.006)	-0.080 (0.019)	-0.115 (0.011)	-0.050 (0.005)	-0.099 (0.020)	-0.110 (0.009)	-0.082 (0.006)	-0.207 (0.020)	-0.127 (0.007)
<u>Assimilation Effects</u>												
5-9 Years Since Arrival	0.014 (0.008)	0.067 (0.021)	0.058 (0.025)	0.019 (0.008)	0.081 (0.023)	0.064 (0.024)	-0.013 (0.007)	0.016 (0.023)	-0.032 (0.018)	-0.011 (0.007)	0.011 (0.024)	-0.021 (0.020)
10-14 Years Since Arrival	0.013 (0.011)	0.086 (0.031)	0.094 (0.039)	0.024 (0.012)	0.111 (0.035)	0.114 (0.039)	-0.011 (0.010)	0.051 (0.034)	-0.032 (0.027)	-0.008 (0.011)	0.044 (0.035)	-0.008 (0.031)
15+ Years Since Arrival	0.007 (0.013)	0.073 (0.037)	0.104 (0.044)	0.029 (0.015)	0.124 (0.042)	0.138 (0.043)	-0.002 (0.012)	0.074 (0.039)	-0.010 (0.034)	0.006 (0.013)	0.072 (0.042)	0.027 (0.038)
Sample Size	47,681	47,681	47,681	23,822	23,822	23,822	36,457	36,457	36,457	21,781	21,781	21,781

All models also include age, age squared, years of education, and indicators for married, employed, urban, region and survey year. NHIS annual weights used. Marginal results reported for all probit models. Bold coefficients are statistically significant at the 5% level or better.

Appendix Table 1. Variable Definitions

Variable Name	Definitions
Poor Health	=1 if SRHS=4 (fair) or 5 (poor)
Health Conditions	=1 if 1 or more health conditions are reported
Activity Limitations	=1 if activity or work is limited
Doctor Visits	=1 if 1 or more doctor visits in past 12 months
Poverty	=1 if below the NHIS poverty index
BMI	kilograms/meters ²
Overweight	BMI 25+
Obese	BMI 30+
Immigrated 1980 or Before	Immigrated to the U.S. in or before 1980 (see page XX for more detail)
Immigrated 1981-85	Immigrated to the U.S. between 1981-1985 (see page XX for more detail)
Immigrated 1986-90	Immigrated to the U.S. between 1986-1990 (see page XX for more detail)
Immigrated 1991-96	Immigrated to the U.S. between 1991-1996 (see page XX for more detail)
0-4 Years Since Arrival	Arrived in the U.S. 0-4 years ago
5-9 Years Since Arrival	Arrived in the U.S. 5-9 years ago
10-14 Years Since Arrival	Arrived in the U.S. 10-14 years ago
15+ Years Since Arrival	Arrived in the U.S. 15 or more years ago
Age	continuous measure from 20-64
Married	=1 if married
Years of Education	continuous measure from 0-18
Working/Employed	=1 if worked in past 2 weeks
Urban	=1 if reside in a MSA

Appendix Table 2. Weight Regressions (OLS and Probit Results) - Remaining Parameter Estimates

	<u>Women</u>			<u>Men</u>		
	Ln BMI	Overweight	Obese	Ln BMI	Overweight	Obese
Age	0.011 (0.000)	0.021 (0.001)	0.015 (0.001)	0.010 (0.000)	0.027 (0.001)	0.014 (0.001)
Age Squared	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Married	-0.016 (0.001)	-0.024 (0.003)	-0.037 (0.002)	0.026 (0.001)	0.093 (0.003)	0.027 (0.002)
Years of Education	-0.010 (0.000)	-0.026 (0.000)	-0.015 (0.000)	-0.003 (0.000)	-0.010 (0.000)	-0.009 (0.000)
Employed	-0.017 (0.001)	-0.036 (0.003)	-0.030 (0.002)	0.004 (0.001)	0.028 (0.004)	-0.014 (0.003)
Urban Residence	-0.019 (0.001)	-0.042 (0.003)	-0.028 (0.002)	-0.006 (0.001)	-0.014 (0.003)	-0.015 (0.002)
Midwest	0.012 (0.001)	0.023 (0.004)	0.018 (0.003)	0.002 (0.001)	-0.004 (0.004)	0.009 (0.003)
West	-0.003 (0.001)	-0.005 (0.003)	0.000 (0.002)	-0.003 (0.001)	-0.015 (0.004)	0.006 (0.003)
South	-0.009 (0.001)	-0.026 (0.004)	-0.008 (0.003)	-0.015 (0.001)	-0.053 (0.004)	-0.017 (0.003)
1990	0.003 (0.002)	0.013 (0.005)	0.003 (0.003)	0.002 (0.001)	0.009 (0.005)	0.000 (0.003)
1991	0.010 (0.002)	0.029 (0.004)	0.018 (0.003)	0.007 (0.001)	0.021 (0.004)	0.012 (0.003)
1992	0.016 (0.002)	0.042 (0.005)	0.023 (0.003)	0.012 (0.001)	0.027 (0.005)	0.022 (0.004)
1993	0.021 (0.002)	0.057 (0.005)	0.033 (0.004)	0.016 (0.001)	0.041 (0.005)	0.033 (0.004)
1994	0.025 (0.002)	0.063 (0.005)	0.039 (0.004)	0.019 (0.001)	0.051 (0.005)	0.036 (0.004)
1995	0.031 (0.002)	0.077 (0.005)	0.047 (0.004)	0.023 (0.001)	0.059 (0.005)	0.044 (0.004)
1996	0.034 (0.002)	0.081 (0.006)	0.050 (0.005)	0.028 (0.002)	0.080 (0.005)	0.053 (0.005)
Constant	3.083 (0.006)			3.045 (0.005)		
Sample Size	202,959	202,959	202,959	192,702	192,702	192,702

All models also include age, age squared, years of education, and indicators for married, employed, urban, region and survey year. NHIS annual weights used. Marginal results reported for all probit models. Bold coefficients are statistically significant at the 5% level or better.