ASSIMILATION AND ITS DISCONTENTS: THE CASE OF LOW BIRTH-WEIGHT IN LOS ANGELES*

BRIAN KARL FINCH
RAND

NELSON LIM
RAND

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*Please send all correspondence regarding this article to Brian K. Finch, RAND, 1700 Main Street, Santa Monica, CA 90407.

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ABSTRACT—We adapt the segmented assimilation theory to a model of population health, which posits that assimilation is actually harmful to migrants' health. We also extend models of independent individual and contextual factors to more directly test the theory of segmented assimilation—a theory that relies heavily upon interactions between individual and residential circumstances. Using year 2000 vital statistics data (140,472 birth certificates) merged with 2000 U.S. census data from Los Angeles County, we model the probability of being born low birth-weight among the native- and foreign-born. Results confirm an immigrant advantage at the individual level and protective effects of immigrant enclaves at the neighborhood (census tract) level. On the other hand, although living in disadvantaged neighborhoods is generally deleterious, this relationship is less severe among immigrants—less educated labor-migrants in particular. In addition, while residence in an enclave (less acculturated neighborhood) is universally salutary, highly acculturated neighborhoods are most harmful to professional migrants.

INTRODUCTION

Throughout the history of the United States, each wave of immigrants has incited concerns of the newcomers' quality, their ability to assimilate, and the burden the country must bear to assimilate them into "mainstream" America. Leaving the definition of mainstream aside, the often unstated assumption in the discussion about immigration is that assimilation is beneficial for everyone, including the immigrants themselves, natives, and society.

Some researchers contend that assimilation is in fact inevitable (Alba and Nee 1999). Despite the shifts in the countries of origin and a decline in level of education of recent immigrants, Card and his colleagues found little change in "the degree of intergenerational assimilation (measured by intergenerational correlations in education and earnings, or by interethnic marriage patterns)" among second generations of different immigration cohorts (Card, DiNardo, and Estes 2001: 228). On the other hand, given the level of racial segregation, concentration of poverty, and post-industrial urban economy, many researchers doubt that new immigrants will be able to take the "classical" assimilation route into mainstream society (Portes and Zhou 1993; Gans 1992; see also Borjas 1999). Instead, they postulate that under undesirable conditions, new immigrants may integrate into the urban underclass—creating a "rainbow underclass." While some emphasize the potential negative influence of segregation, other studies document a potential benefit of ethnic concentration. Researchers find that immigrants who settle into neighborhoods where their compatriots live have significant advantages over those who try to find their way among strangers (Zhou and Bankston 1998).

So far, the empirical ground for the debate on the future of immigrants and their children has been mainly descriptive of whether "the second generation decline" has actually occurred and

whether the experience of recent immigrants differs from that of past immigrants. (For example, see Perlmann and Waldinger 1997; Alba and Nee 1999). However, some studies have concentrated on the nature and causes of individual-level outcomes such as children's self-esteem, social identity, and educational achievement (Kao 1999; Kao and Tienda 1995; Rumbaut 1999; Portes and Rumbaut 2001).

In this study, we expand the debate by proposing a public health model of low birth-weight, which we base on the theory of segmented assimilation. More importantly, we examine the crucial—yet rarely tested—element of the theory: the interaction between individual characteristics and contextual factors.

Immigrant Health

The pattern of relatively advantaged health outcomes for immigrants may be a somewhat recent phenomenon in the United States (Guttman et al. 1998), but we cannot be certain, since national health surveys have only recently begun to collect information regarding ethnicity in general and Hispanic status in particular. For example, most national studies find that rates of Latino fetal deaths (Guendelman, Chavez, and Christianson 1994), infant mortality (DHHS 2000), low birth-weight (LBWT), and very low birth-weight (DHHS 2000)—are virtually identical to rates observed among non-Hispanic Whites and are significantly lower than those observed among non-Hispanic Blacks. Researchers have attributed this "Latino advantage" to the "selective migration" of healthy individuals (Marmot and Syme 1976; Weeks and Rumbaut 1991; Hummer et al. 1999a), many of whom may be significantly healthier than the populations from which they originated (Palloni and Morenoff 2002). Although most studies have focused on Latino sub-groups, a handful of studies find that this advantage accrues to most immigrant groups (see e.g., Frisbie, Cho, and Hummer 2001; Hummer et al. 1999a, 1999b). In short, what

is perceived to be a Latino paradox may be more accurately described as a more general immigrant paradox.[1]

Most studies also find that the initial health advantage observed among recent immigrants declines with time spent in the U.S. The decline is not necessarily a natural duration or aging effect, but may be the product of acculturation to United States society (for a review see Vega and Amaro 1994). These studies further suggest there are salutary aspects of native cultures that minimize stress, reduce the likelihood of engaging in poor health behaviors, and provide social support to minimize the effects of stress, unhealthy lifestyles and other health threats (Balcazar, Castro, and Krull 1995; Hazuda et al. 1988; Elder at al. 1998; Dixon, Sundquist, and Winkleby 2000). Acculturation to norms and ways of life of the United States may strip away these protective factors and lead to declining health. Conversely, those who are able to maintain the protective components of native cultures and ethnic affiliation are able to stave off the negative effects of acculturation. Research has shown that living among co-ethnics and/or relatively unacculturated subpopulations is protective of health (Scribner and Dwyer 1989; Harris 1999; Gorman 1999).

A few recent studies have advanced our understanding of explanations for immigrant health advantages considerably. Landale et al. (1999), using data from the Puerto Rican Maternal and Infant Health Study (PRMIHS), demonstrated that recent migrants to the United States mainland exhibited better infant health outcomes than childhood migrants and women born in the U.S., although known sets of risk and protective factors did not fully account for this advantage. A further analysis of PRMIHS data demonstrates that these advantages are due to both selective-migration processes and assimilation processes (Landale, Oropesa, and Gorman 2000); a separate analysis of National Longitudinal Mortality Study data confirms the deleterious effects

of assimilation (Abraido-Lanza et al. 1999). While much of this research is *framed* in terms of competing explanations for assimilation processes, none explicitly tests available theories.

Segmented Assimilation Theory and Health

One theory that lends itself particularly well to understanding processes of adaptation among immigrants is the theory of segmented assimilation.[2] This theory addresses the divergent processes by which individual immigrants experience mobility (upward or downward). We contend that these processes consist of adaptation and assimilation to cultural practices (e.g., diet/nutrition, experiences of stress, maintenance of support networks, risk behaviors such as substance use) that may have important implications for health as well.

According to the theory, new immigrants and their children face three possible paths to assimilation (Portes and Zhou 1993; see also Portes and Rumbaut 2001: 44-69). First, some immigrants, especially those with high levels of education, will be able to replicate the well-traveled path of European immigrants of the last great immigration of the 19th century (Alba and Nee 1999; Card, DiNardo, and Estes 2001). Over successive generations, they will integrate into the economy and acculturate into mainstream society. Second, newcomers may find barriers insurmountable and come to share the fate of the urban underclass instead. Third, immigrants may find refuge in their ethnic communities and find ways to assimilate into mainstream society, without falling victim to the cultural and structural constraints of the urban underclass.

Many researchers contend that, for low-skill immigrants and their offspring, the second path to assimilation is most likely, given the level of racial segregation in the U.S., the concentration of poverty, and the demand for skilled workers in the post-industrial urban economy (Gans 1992; Portes and Zhou 1993; Portes and Rumbaut 2001: 55-62; see also Borjas 1999). They postulate that new immigrants are most likely to be integrated into the urban underclass and the

environmental impact will be potentially overwhelming for children of immigrants. These researchers point to discouraging signs of downward mobility, indicating recent immigrants and their children may not be on a path of upward mobility. For example, researchers find that the longer immigrants have lived in the U.S., the more maladaptive the outcomes, measured in terms of school performance, aspirations, and number of children living in single-parent families (Kao and Tienda 1995; Rumbaut and Ima 1988; Suarez-Orozco and Suarez-Orozco 1995; Landale and Oropesa 1995). Similarly, Harker (2001) finds that first-generation young immigrants have better mental health compared to their native-born counterparts, while second-generation young immigrants are indistinguishable from the native-born.

But other researchers see these immigrants overcoming incredible odds (Zhou and Bankston 1998). Immigrants who settle in ethnic neighborhoods have significant advantages over those living in more diverse—and often higher socioeconomic—neighborhoods. Portes and Rumbaut (2001: 48) write, "Such communities can cushion the impact of a foreign culture and provide assistance for finding jobs. Help with immediate living needs, such as housing, places to shop, and schools for the children, also flow through these co-ethnic networks." Co-ethnic networks provide more than tangible necessities; they also furnish an alternative subculture for immigrant children to identify with. More importantly, a close-knit ethnic community with overlapping social networks can provide much-needed social support and informal social control by instilling social values and obligations in younger generations. Those immigrants who belong to such communities have a chance to fend off undesirable influences that are often associated with poor neighborhoods (Zhou and Bankston 1998).

However, independent of one's potential socioeconomic attainment and predicted mobility, acculturation and integration into either middle-class America or the urban underclass may have

negative health implications for immigrants. In this context, it is not the destination of assimilation, but the process of assimilation itself that may have a negative impact on immigrants' health. Segmented assimilation theory provides a general framework for the ways in which individual immigrants come to pursue and experience differential levels of integration into American life—the paradox being that assimilation is not without its "discontents" (Rumbaut 1997).

Although most tests of the segmented assimilation hypothesis relate to socioeconomic attainment, the theory is clearly defined in terms of cultural adaptation and the socialization processes that immigrants undertake. Most often, cultural adaptation is applied to adolescent socialization and the effects of acculturation on substance use and other delinquent behaviors are investigated (see e.g., Vega and Gil 1998; Nagasawa, Qian, and Wong 1996). Cultural adaptation and its subsequent effect on health outcomes does not, however, appear to follow the same path as occupational or socioeconomic mobility. In fact, adaptation to mainstream American culture among immigrants tends to result in the adoption of poor health behaviors and health deterioration (Rumbaut 1997).

It has been fairly well established that immigrants have health profiles that belie their inferior socioeconomic status (Markides and Coreil 1986). In fact, for most birth outcomes, immigrants have rates of low birth-weight and infant mortality that are similar to those observed among non-Hispanic Whites, who have far superior socioeconomic status (Hummer et al. 1999b). This paradox has been well documented at the individual level. Although the effect of selected migration of healthiest individuals from immigrant-sending countries is clearly at play (see e.g., Palloni and Morenoff 2002), these healthy profiles diminish with acculturation (Rumbaut 1997). Links between community characteristics and health have been established for

most race/ethnic groups (Robert 1999; O'Campo et al. 1997), and they have also been shown to exist among more recent immigrants (Collins and Shay 1994). Most studies of contextual effects, however, demonstrate connections between neighborhood poverty and health. Very few have demonstrated links between the acculturative context and health (c.f., Finch et al. 2000; Scribner and Dwyer 1989). Further, fewer studies have considered the interaction between individual and contextual factors, even though these key interactions lie at the heart of segmented assimilation theory (Portes 1997). We aim to fill this gap. In our empirical model of public health, we include individual characteristics as well as contextual factors. Most importantly, we explicitly include the interactions between the two sets of factors.

Hypotheses

While it would be impossible to simultaneously account for the breadth and depth of each of these individual and structural factors—and no data sets currently collect these variables comprehensively for reliable and commensurable health outcomes—we can certainly include some of the most important determinants of population health differences.

The literature in population health has identified nativity as a key individual factor (Rumbaut 1997; Vega and Amaro 1994), and residential neighborhood context as a key structural factor (Yen and Syme 1999). Nativity may broadly reflect several characteristics of individuals such as primary language spoken, cultural attachment and affinity, country of primary education, cultural norms and practices, the presence of stronger social support networks, ethnic identity, and the effects of health selection (i.e., that immigrants are healthier than residents of their origin population). Residential context may reflect both potential shocks to health due to both the material conditions of a neighborhood (e.g., propensity for crime, lack of capital investment, stressful living conditions) and the cultural context of the aggregate of

residents (e.g., immigrant enclaves or urban underclass conditions). For example, foreign-born individuals may be able to draw upon the resources available in immigrant enclaves because they are more likely to share a common language. Conversely, foreign-born individuals may be more resistant to the pressures of urban underclass living either due to a more supportive home environment or a general propensity to resist acculturation to non-normative patterns of behavior.

We adapted the theory of segmented assimilation to include the notion that mainstream adaptation may be deleterious to health (while recognizing that adaptation may be simultaneously beneficial for other outcomes such as upward economic mobility) and that underclass adaptation may also be deleterious to health. We specify three separate groupings of hypotheses concerning the relationship between nativity, neighborhood conditions, and occupational status and birth outcomes.

We selected low birth-weight as our key outcome because it has several useful analytical properties and because it is such a crucial health indicator of both current health and mortality risk and life-course health trajectories. First, reverse causation is minimized since infant health does not determine the acculturation status or residential context of mothers. Second, birth-weight is a fairly accurately measured health indicator that is not subject to the bias that other indicators of health among immigrant populations are. For example, self-reported health is thought to be artificially related to acculturation (Finch et al. 2002; Angel and Guarnaccia 1989) and passive studies of mortality are subject to return migration and may bias studies of acculturation effects on mortality (Palloni and Morenoff 2002).

Additionally, the consideration of low birth-weight as a particularly important health outcome is crucial for several well-established reasons. First, low birth-weight is highly

associated with the risk of infant mortality, particularly in the neonatal period (Gortmaker and Wise 1997). Second, low birth-weight infants are at higher risk for several crucial developmental and health outcomes, including cognitive development (Hack, Klein, and Taylor 1995), school difficulty and hyperactivity (McCormick, Gortmaker and Sobol 1990), and a higher prevalence of respiratory distress and asthma (Boardman, Finch, and Hummer 2001), just to name a few. In addition, it has been argued and documented that the disadvantages of adverse birth outcomes such as low birth-weight persist into late adolescence and adulthood (Elo and Preston 1992; Barker 1995; Boardman et al. 2002).

First, we hypothesize that we will observe an immigrant health advantage at the individual level (Hypothesis 1A) such that infants of foreign-born mothers will be less likely to be born with low birth-weight. In addition, we expect that infants born to mothers living in unacculturated neighborhoods will be less likely to be born with low birth-weight (Hypothesis 1B). We also expect to find the previously observed relationship between neighborhood disadvantage and risk of low birth-weight (Hypothesis 1C).

Second, we hypothesize that the effects of neighborhood conditions will moderate the relationship between nativity and low birth-weight. In particular, we expect that the effects of unacculturated neighborhoods will be more protective of infants of foreign-born mothers (Hypothesis 2A), while the effects of neighborhood disadvantage will be heightened among the native-born (Hypothesis 2B).

Third, we hypothesize that predicted risks for professional migrants will be higher than for those of labor migrants (Hypothesis 3A) and that unacculturated neighborhoods will be more protective of infants of foreign-born mothers than they will be for infants of native-born and

professional migrants (Hypothesis 3B). Further, we expect neighborhood disadvantage will have heightened deleterious effects on professional migrants and the native-born (Hypothesis 3C).

SUMMARY

H1: Both individual and contextual factors are related to low birth-weight

- H1A: At the individual level, nativity confers a health advantage such that infants of foreign-born mothers will be less likely to be born with low birth-weight.
- H1B: Infants born to mothers living in unacculturated neighborhoods will be less likely to be born with low birth-weight.
- H1C: Neighborhood disadvantage will be positively related to the risk of low birth-weight.

H2: The effects of neighborhood conditions will moderate the relationship between nativity and low birth-weight.

- H2A: The effects of unacculturated neighborhoods will be more protective of infants of foreign-born mothers
- H2B: The effects of neighborhood disadvantage will be heightened among the native-born.

H3: The risk of low birth-weight depends on the occupational status of migrants.

- H3A: The predicted risks of low birth-weight will be higher for professional migrants than for labor migrants.
- H3B: Unacculturated neighborhoods will be more protective of infants of foreign-born mothers than of infants of native-born and professional migrants.
- H3C: Neighborhood disadvantage will have heightened deleterious effects on professional migrants and the native-born.

DATA AND METHODS

Data

We utilize two data sets to conduct our analyses. First, we contacted the Los Angeles County Department of Health Services (LAC DHS) and received a vital records data file for all births (n = 165,932) occurring to residents of Los Angeles County in 2000.[3] A separate county agency (the Data Collection and Analysis Unit), relying on the most recent address files, was able to accurately geo-code maternal addresses into valid census tract codes for more than 97 percent of the birth mothers in the data.[4] Second, we merged data from the 2000 U.S. Census to each case in the vital records birth file at the census tract level. Although census tracts are administratively defined boundaries, their borders are drawn with respect to maintaining sociodemographic homogeneity and geographic consistency (e.g., they do not cross major freeways or water masses).

We excluded all cases for whom a census tract was unknown or incorrectly recorded, multiple births, extreme birth weights and gestation lengths that are most likely due to recording errors, resulting in the final analysis sample size of 140,472 infants.[5] These infants were born in 2,035 of the 2,052 populated census tracts in Los Angeles County. In addition, there were between three and 83 births per tract in our analysis file, with an average of 39.68 births per tract (median = 42). Census tracts in Los Angeles County represent, on average, an area of 2.5 square miles and contain just fewer than 6,000 people per tract (mean = 5,996).

Individual-Level Variables[6]

Our key dependent variable is a measure of low birth-weight (< 2500 grams);[7] just fewer than 5 percent (4.88 percent) of infants born in Los Angeles County were born low birth-weight in 2000. This is the only variable, other than infant sex, measured at the infant level; the

remainder of the individual-level variables relies on maternal reports and clinical records recorded in the birth certificate (see Table 1 for descriptive statistics). Our key predictor variable consists of two operationalizations; in the first case, nativity is recorded as mothers born in the United States (i.e., native-born) vs. mothers born in all other countries (i.e., foreign-born)—while a second type separates out labor-migrants from professional-migrants. This is accomplished by splitting the group of foreign-born mothers into those who have at least 16 years of education (professional-migrants) and those with 15 years or less (labor-migrants).

---TABLE 1 ABOUT HERE---

Mother's age is represented by a term raising the linear age (12-54) to a half-power (i.e., the square root) and including this term simultaneously with a raw age variable (i.e., $Age^{.5}$ and Age). This bowl-shaped function was curvilinear such that increasing age from 12 to 22 resulted in declines in low birth-weight risk with virtually no change in risk from age 22-32 and an increase in risk for women older than 33 years of age. Next, parity is defined as an interaction between age and number of births, as defined by Kleinman and Kessel (1987); this variable is only nominally collinear with age but does not affect the model or the estimate of our key variables. This variable is categorized into primiparous births, high parity, and low parity.[8] Marital status is represented by a dummy variable indicating married vs. unmarried and race/ethnicity is represented by sets of dummy variables for: Latino, Non-Hispanic White, non-Hispanic Black, non-Hispanic Asian, and Other.

Socioeconomic status is represented by several variables, including maternal education, the primary payer for the birth, and adequacy of prenatal care. Mother's education is specified in the regression models by a second-order fractional polynomial (similar to age) in which cubic education is included simultaneously with cubic education multiplied by the natural logarithm of

raw education. This reverse s-shaped function yields a monotonic decline across the distribution for the risk of being low birth-weight with flatter sections between 0-5 years of education and between 12 or more years of education. In other words, the largest negative slope in education effects occurs between five and 12 years of education. Payer-for-birth categories include private insurance, government (Medicaid, Medical, e.g.), self-pay, and other. The Kotelchuck Adequacy of Prenatal Care Utilization (APNCU) indicates prenatal care—an index that accounts for the observed negative effects of medically mandated over-utilization (Kotelchuck 1994). These categories include inadequate care, intermediate care, adequate care, adequate plus care, and missing/no care. Finally, the sex of the child is included as a dummy for male infants; this is included due to the increased risk of female infants being born low birth-weight in spite of the fact that infant sex is generally orthogonal to other determinants of low birth-weight status.

Contextual-Level Variables

We selected several variables to represent two constructs at the neighborhood (census tract) level: neighborhood disadvantage and neighborhood (un)acculturation. Four variables were averaged to create a scale of neighborhood disadvantage, including the percentage of persons in the census tract in poverty, the percentage of households receiving public assistance, the percentage of female-headed households, and the percentage of unemployed males.[9] These four items were highly correlated and yielded a Cronbach's Alpha (scale reliability coefficient) of .8468. In addition, neighborhood (un)acculturation was captured by three measures, including the percentage of persons in the tract who were foreign-born, the percentage of non-citizens in a tract, and the percentage of tract households who are linguistically isolated.[10] These three items also correlate highly together and yield an alpha of .9663. Descriptive statistics for the scales and individual items are presented in Table 2. Neighborhood acculturation and disadvantage are

also moderately positively related (r = .5169), so simultaneous controls are necessary in order to isolate any independent effects. However, collinearity did not appear to alter the results when both contextual-level variables are modeled simultaneously.

---TABLE 2 ABOUT HERE---

From the raw scales for these two variables, we employed a co-variate adjusted fractional polynomial approach coupled with a hypothetical understanding of these relationships to determine the best functional form. The form for each contextual predictor is as follows: a) neighborhood disadvantage, ln(Disadvantage); b) neighborhood unacculturation, (Un-acculturation)^2, ln(Un-Acculturation), and ln(Un-Acculturation)^2. The use of log-linear neighborhood disadvantage was simple, but the use of a third-order term simultaneous with a second- and first-order term in the model led to low tolerance levels and subsequent variance inflation. However, while multi-collinearity was most certainly present for the use of higher ordered terms in the same model, it did not affect statistical tests of significance, more than likely due to the large sample sizes—therefore, we did not find it necessary to center any of the neighborhood-level predictors. Neighborhood (un)acculturation yielded a reverse s-shaped function such that the middle ranges of acculturation had the highest effect on the risk of low birth-weight while the margins (low levels and high levels of acculturation) had the smallest effects on low birth-weight risk. This risk was monotonically increasing at high levels of acculturation, but became flat at low levels of acculturation. On the other hand, a simple natural logarithm of neighborhood disadvantage was the best-fitting functional form and is consonant with findings of diminishing deleterious effects of neighborhood poverty (e.g., O'Campo et al. 1997).

Statistical Model: Hierarchical Logistic Regression Model

We utilized a random-intercept hierarchical logistic regression model to conduct our multivariate analyses (Snijders and Bosker 1999).[11] This model accounted for the non-independence of individuals residing in the same census tracts and accounts for the invariance of neighborhood-level predictors (i.e., disadvantage and acculturation) within tracts. We used the *gllamm* procedure in Stata v. 8 to conduct these analyses since the maximum-likelihood estimation algorithm (i.e., *adaptive quadrature*) has been shown to be superior to those used in other, more conventional multi-level programs (Rodriguez and Goldman 1995; Rabe-Hesketh, Skrondal, and Pickles 2002). The model is as follows:

$$\log it(P_{ij}) = \gamma_{00} + \sum_{h=1}^{p} \gamma_{h0} x_{hij} + \sum_{k=1}^{q} \gamma_{0k} z_{kj} + \sum_{k=1}^{q} \sum_{h=1}^{p} \gamma_{hk} z_{kj} x_{hij} + U_{0j} + \sum_{h=1}^{p} U_{hj} x_{hij} + R_{ij}$$

where $\log it(p) = \ln\left(\frac{p}{1-p}\right)$

This model estimates the log-odds (logit) for the probability of being born low birth-weight for a full set of predictors and co-variates (γ_h) for various values of x for the i^{th} person in the j^{th} census tract (Snijders and Bosker 1999). Neighborhood level predictors—disadvantage and (un)acculturation in this case—are considered values of z for the j^{th} group and can be used to explain either average probabilities for low birth-weight across neighborhoods or variation in slopes across neighborhoods (i.e. cross-level interactions). Although testing for *random variation* of coefficients (nativity in this case) between census tracts is also possible with this flexible model, our theory dictates that variation in nativity *is* a function of community-level (un)acculturation and disadvantage. Therefore, we assume *a priori* that there is *non-random variation* in our key predictor, nativity.

Models are built according to the hypotheses previously specified and are presented in Tables 3-5. In particular, tests of the first hypothesis are presented in Table 3, tests of the second hypothesis are in Table 4, and tests for the third hypothesis are in Table 5. Reference categories for each of the dummy variables is included in brackets [ ]. We will proceed sequentially through each of the results, beginning with Table 3.

RESULTS

Model 1 of Table 3 indicates an immigrant advantage such that the native-born are 24 percent more likely to have infants born low birth-weight than the foreign-born. This relationship persists net of individual- and neighborhood-level controls (Model 5, Table 3). Further, unacculturated neighborhoods are protective of health such that infants born to mothers living in relatively unacculturated neighborhoods are less likely to be born low birth-weight, net of individual-level acculturation (nativity) and neighborhood disadvantage (see Figure 1).[12] As expected, neighborhood disadvantage has a deleterious effect on birth-weight, net of individual-level predictors (see Figure 2).

---TABLE 3 ABOUT HERE---

---FIGURE 1 ABOUT HERE---

---FIGURE 2 ABOUT HERE---

Table 4 includes statistical tests for the moderating effects of neighborhood conditions on nativity. Model 1 tests the hypothesis that neighborhood acculturation moderates nativity effects on the probability of low birth-weight. Statistical results show a significant interaction term between acculturation and nativity; however, plotting this relationship (Figure 3) demonstrates that this significant coefficient for the product-term may be an artifact of sample size. That is, the levels of acculturation in a neighborhood appear to have similar effects across the distribution

for infants born to both native- and foreign-born mothers, with a slight divergence at higher levels of acculturation.[13] Model 2 (see Table 4) predicts that neighborhood disadvantage also moderates the nativity affect on low birth-weight, and plotting this relationship (Figure 4) demonstrates that this interaction is both statistically and substantively significant. In particular, the effects of living in a disadvantaged neighborhood are less deleterious to infants born to foreign-born women than they are to infants born to native-born women.

---TABLE 4 ABOUT HERE---

---FIGURE 3 ABOUT HERE---

---FIGURE 4 ABOUT HERE---

Table 5 includes statistical tests for the individual effects of the more detailed measure of nativity as well as the potential moderating effects that neighborhood might have on the risk of low birth-weight. Model 1 of Table 5 predicts that labor-migrants experience better birth outcomes than the native-born while professional-migrants are similar to the native-born. However, net of individual-level controls, professional-migrants experience worse outcomes than the native-born (Model 2, Table 5). Interactions with neighborhood acculturation (Model 3, Table 5) indicate that predicted risks for low birth-weight converge for each of these groups in relatively unacculturated neighborhoods, while in highly acculturated neighborhoods, professional-migrants are at highest risk and labor-migrants at lowest risk of giving birth to a low birth-weight infant (see Figure 5). On the other hand, only the slope for labor-migrants is statistically different from the native-born (Model 3, Table 5). In addition, while professional-migrants are most at risk and labor-migrants least at risk, the slope for neighborhood disadvantage is largest among the native-born and smallest among labor-migrants (see Figure 6). Again, however, the slope for professional migrants is statistically different than that of the

native-born while the slope for labor migrants is (statistically) similar to the native-born (Model 4, Table 5).

---TABLE 5 ABOUT HERE---

---FIGURE 5 ABOUT HERE---

---FIGURE 6 ABOUT HERE---

DISCUSSION AND CONCLUSIONS

Using population-based data for all births in Los Angeles County in 2000, we were able to test expectations for a key health outcome, low-birth weight, among individuals with heterogeneous characteristics. Adapting the theory of segmented assimilation—in which assimilation is construed as *deleterious* to health—we were able to posit three divergent pathways that immigrants might follow after immigration to the United States and assess the applicability of this theory to health outcomes in general, and low birth-weight in particular. In general, results confirm that interactions between individual markers for acculturation and community characteristics are crucial in understanding why immigrants' health is thought to deteriorate over time in the United States. We now compare our hypotheses with our empirical results.

As expected, infants of immigrants experience healthier birth-weights (Hypothesis 1A), although this effect appears to be limited to labor-migrants. In addition, unacculturated neighborhoods are salutary (Hypothesis 1B), while disadvantaged neighborhoods increase the probability of giving birth to a low birth-weight infant (Hypothesis 1C). Nonetheless, these main-effect pathways have been generally well established in the public health and sociological literatures. Segmented assimilation theory offers a more nuanced expectation for these effects in an interactional framework, and we turn to these findings presently.

Recent immigrants are hypothesized to have greater access to familial social support networks (Perez and Padilla 2000), less likely to engage in risky-behaviors during pregnancy (Finch et al. 2000), and are protected from health shocks by a host of characteristics indicative of native culture (Scribner and Dwyer 1989). It is expected that these protective factors may erode over time in the U.S. such that the native-born (second generation) are less culturally distinct from individuals with long family tenures in the U.S. Our adapted theory suggests that the foreign-born may be more able to draw upon these protective resources from the community than the foreign-born, at least partially because of potential primary language differences (Hypothesis 2A). However, aside from a slight divergence at moderately high levels of acculturation (14-30 percent, e.g.), unacculturated neighborhoods are universally protective of health, net of the levels of poverty (i.e., neighborhood disadvantage) in the neighborhood. Similarly, we expect that foreign-born women may be less likely to engage in the maladaptive coping strategies of the underclass than the native-born because of language and cultural differences and due to the a higher probability for cultural protectiveness to be intact (Hypothesis 2B). Our findings generally confirm this result given that increasingly disadvantaged neighborhoods are more harmful to the native-born than the foreign-born.

To reiterate, the predicted immigrant health advantage applies largely to labor-migrants (Hypothesis 3A). Further, given that professional-migrants may be more upwardly mobile and have more chances for interaction with adherents to mainstream U.S. culture (residentially and through the workplace), it is expected that they will either be marginalized from, or draw less upon community resources available in unacculturated neighborhoods. Our empirical results confirm this such that highly acculturated neighborhoods are especially harmful to professional-migrants—although the effect of neighborhood acculturation among labor-migrants is

statistically indistinguishable from the effect among the native-born (Hypothesis 3B). In other words, professional-immigrants do appear to adapt more readily to mainstream norms, to the detriment of their health. Finally, although neighborhood disadvantage is universally deleterious to birth outcomes, it is less harmful among labor-migrants than it is for professional-migrants and the native-born (Hypothesis 3C). This result indicates that low-skilled migrants are at least partially inured to the effects of disadvantaged neighborhoods or are able to draw upon cultural resources in order to cope with the shocks associated with living in more impoverished neighborhoods. The fact that native-born infants are more likely to be born low birth-weight in disadvantaged neighborhoods provides indirect evidence that adaptation to underclass neighborhoods may be harming immigrant health further.

Therefore, while individual characteristics and choices surely help to determine the ways in which infant health is produced, structural factors play a role as well. From these analyses, the evidence suggests that residence in immigrant enclaves may stave off assimilation while simultaneously preserving good health. On the contrary, immigrants who settle in highly acculturated neighborhoods may assimilate more rapidly and erode any of the original health protectiveness that native cultures may have offered. In short, by adapting the theory of segmented assimilation to health, we are able to identify some of the broader, sociodemographic patterns through which individuals may come to assimilate and the effect this may have on their health.

Limitations

There are several limitations to our study worth discussing. First, what we gain in sample size and the sheer ability to test differences across a wide-range of neighborhoods, we lose in terms of the complexity of our measures. Thus, while empirical results using measures of

nativity and tract level acculturation are certainly consistent with the core of segmented assimilation theory, suggested key variables, and theoretical expectations for effects, more nuanced measures of acculturation, ethnic identity, and immigrant enclaves may yield richer results. Absent this type of data, however, this is not currently an option. Second, these results may be unique to birth outcomes and women, as are several findings related to the epidemiological paradox (Palloni and Morenoff 2002). Third, the use of administrative boundaries (i.e., census tracts) to represent one's range of contacts and acculturative context may be supplanted by self-defined interactional ranges in the future; again, however, current data collection efforts may not overcome this problem. On the other hand, self-defined and self-described neighborhoods may simply reflect response bias that is the result of compositional differences between neighborhood respondents, rather than true neighborhood differences (Sampson, Raudenbush, and Earls 1997).

Fourth, observed neighborhood effects may be endogenous to individual preferences and levels of acculturation such that observed effects may simply be the result of unmeasured levels of individual acculturation and/or neighborhood choice. Nonetheless, although this would dramatically change future approaches to testing the segmented assimilation theory, it still provides support for the acculturation hypothesis in the public health literatures (i.e., that health declines among immigrants are associated with increasing acculturation).[14] Finally, our ability to distinguish between labor- and professional-migrants is limited by the use of current levels of education. That is, we do not have a way of determining the level of education that one possessed at the time of immigration and therefore, the predicted effects of professional-migrants (i.e., worse birth outcomes, further amplified by contextual risk factors) may actually be effects for highly upwardly mobile labor-migrants.

FUTURE RESEARCH

Future research should test these processes using various populations, focusing particularly on adaptive strategies among first- and second-generation adolescents. In addition, more nuanced measures of assimilation may uncover more detailed pathways toward health declines and maintenance. For example, it may be that individuals with stronger ethnic identities may resist assimilation to a degree not anticipated by the use of simple nativity contrasts. Finally, the specific health behaviors, types of native social support, and pregnancy-specific practices should be included in longitudinal studies to determine the actual pathways through which these cross-sectional associations between assimilation and health may be working.

In conclusion, the theory of segmented assimilation is particularly suitable for adaptation to health outcomes, bearing in mind the paradox of assimilation with regards to cultural adaptation and its health consequences. Adoption of cultural norms is inherently linked to ultimate expectations regarding the processes of socioeconomic mobility. Therefore, while assimilation may bring with it its share of both potential upward mobility and discontents, assimilation may be utterly deleterious to immigrant health.

NOTES

[1] Much of the health literatures cited in this paper are specific to Latinos in general and/or Latino sub-groups; however, recent (yet sparse) research indicates an overall immigrant advantage and subsequent decline in health with acculturation. Therefore, although much of the cited literature may be for Latino groups, we posit that similar effects exist for most immigrant groups.

[2] This theory is formulated with the explicit intent of explaining disparate outcomes among immigrants and is therefore appropriately titled given that it is specified as the endpoint to acculturative and structural processes. However, this theory specifies that both individual acculturative characteristics and contextual/residential characteristics will partially determine the assimilation endpoints. Although acculturation may not be appropriately construed as a linear process, cultural orientation of the country of origin generally declines through generational processes such that second-generation immigrants are significantly less attached to cultural beliefs of the country of origin than are first-generation immigrants (Perez and Padilla 2000; Cuellar, Nyberg, and Maldonado 1997). Therefore, although it is not our intent to describe the health endpoints for these individuals—given that health is a dynamic process and measure—it is our intent to demonstrate that some of the individual and structural processes at play will at least partially predict the health profiles of immigrants.

[3] These data are only available through contract with the LAC DHS and are not available from the corresponding author. However, we will gladly refer inquiring researchers to the most direct contact and provide researchers with appropriate program files if requested.

[4] Although the public data records contain the census tract of residence for each birth mother, the data were geo-coded to 1990 census tracts and were based on old address files, which lead to a high rate of missing and incorrect tract numbers.

[5] These exclusions are split between individuals with higher socioeconomic status (excluded because their census tracts are not available in current address files since they are largely in new suburban developments) and individuals with lower socioeconomic status for whom birth certificate data (length of gestation and birth-weight) was erroneously recorded.

[6] Although the majority of our variables is categorical in nature, and hence, represented by dummy variables in each regression model, a few variables are measured continuously and several tests for various functional forms are considered to improve model fit and specification. In particular, we employ a fractional polynomial regression approach (co-variate adjusted) to determine the best functional form for each continuous variable (Royston and Altman 1994). In some instances, this approach led to implausible functional forms and those most consonant with current epidemiological knowledge on the relationships were chosen over higher-ordered terms that provided a slightly better model fit.

[7] Although birth-weight is determined by both gestational age at delivery and the fetal growth rate, low birth-weight infants account for approximately two-thirds of the nation's neonatal deaths (Kiely et al. 1994).

[8] Parity is defined as high in third or higher-numbered births to women less than 25 and fourth or higher-numbered births to women 25-29. Primiparous births are first births and all other births are considered low parity.

[9] Other approaches included creating a standardized score from various factor analysis specifications, but the presence of negative values in this factor score (i.e., those below the

mean) obviated the use of fractional polynomials that relied on logarithmic conversions. As with age and education, we employed a fractional polynomial regression approach combined with plausible functional shapes for these relationships to decide on the most accurate functional form.

[10] The census defines a linguistically isolated household as one in which no person age 14 or over speaks only English and no person 14 years or older who speaks a different language other than English, speaks English very well.

[11] A logit model is also preferable to a probit model since our dependent variable is a relatively rare even (just under 5% of the cases are low-birthweight). In short, the logit transformation is more sensitive to covariate effects at the tails of this distribution.

[12] Predicted probabilities are plotted only for the tenth to the 90th percentiles of the neighborhood distributions, and therefore do not project outside the observed range of the date.

[13] For ease of presentation, we will occasionally refer to a highly unacculturated neighborhood as an "ethnic enclave," although we do not select any arbitrary cutpoint at which we expect this qualitative change.

[14] On the other hand, if neighborhood residence is simply a proxy for duration, for example, than these results may simply indicate health attrition over time, rather than acculturation effects. This would be the case if more acculturated individuals moved out of enclaves and into neighborhoods with more members of the mainstream culture. Cross-tabulations indicate that foreign-born women are nominally older than native-born (~ one-half year) and that professional-migrants are (on average) four years older than both labor-migrants and the native-born. Additionally, women are only slightly older (< three years) in more acculturated

neighborhoods. It is doubtful that these differences in age would yield tremendous differences in levels of acculturation. In addition, age is controlled for in the multivariate regression models.

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Table 1. Descriptive Statistics

Variables	n-size	%	Mean	S.D.	Range	% LBWT
Neighborhood-Level Variables						
Tract-Level Disadvantage			14.79	6.96	0-100.00	
Tract-Level (Un)Acculturation			28.16	13.61	0-71.45	
Individual-Level Variables						
Nativity [Native Born]	60,493	43.06				5.45
Foreign Born	79,687	56.73				4.44
Missing	292	0.21				5.02
Nativity [Native Born]	60,493	43.15				5.45
Labor Migrant	68,535	48.89				4.39
Professional Migrant	11,152	7.96				4.77
Missing	292	0.21				5.02
Mother's Age			27.66	6.32	12-54	
Parity [1st Birth]	53,463	38.06				5.85
Low Parity	76,159	54.22				4.32
High Parity	10,814	7.70				4.32
Missing	36	0.03				2.78
Marital Status [Unmarried]	51,544	36.69				5.52
Married	88,928	63.31				4.52
Race/Ethnicity [White, NH]	25,574	18.21				3.89
Latino	87,976	62.23				4.50
Black, NH	11,706	8.33				9.41
Asian, NH	14,867	10.58				5.28
Other	133	0.10				5.63
Mother's Education			11.79	3.36	0-17	
Payer for Birth [Private Insurance]	67,533	48.08				4.58
Government	69,444	49.44				5.12
Self-Pay	3,185	2.27				6.15
Other	306	0.22				6.86
Prenatal Care [Adequate]	60,385	42.99				2.77
Inadequate	11,422	8.13				5.54
Intermediate	20,591	14.66				2.67
Adequate Plus	43,243	30.78				8.77
Missing/No Care	4,831	3.44				4.49
Sex of Chile [Female]	68,515	48.77				5.12
Male	71,457	51.26				4.67
Total	*140,472*	*100.00*				*4.88*

Table 2. Scale Construction: Neighborhood Disadvantage and Neighborhood Un-Acculturation

Construct/Variables	Cronbach's α	Mean	S.D.	Range
Neighborhood Disadvantage	*.8468*	*14.79*	*6.96*	*0.00-100.00*
Percent Persons in Poverty		20.72	12.29	0.00-100.00
Percent Persons Receiving Public Assistance Income		8.55	6.20	0.00-49.06
Percent Female Headed Households		20.98	8.36	0.00-72.32
Percent Males Unemployed		8.90	4.74	0.00-100.00
Neighborhood (Un)-Acculturation	*.9663*	*28.16*	*13.61*	*0.00-71.45*
Percent Persons Foreign-Born		39.26	15.16	0.00-79.10
Percent Persons Non-Citizens		25.69	13.62	0.00-66.90
Percent Households Linguistically Isolated		19.54	13.36	0.00-100.00

Note: These are computed for all 2,052 populated census tracts in Los Angeles County.

Table 3. Main Effects: Nativity Status and Neighborhood Characteristics

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Tract-Level Variables					
Ln(Disadvantage)			.2311**	.3204**	.1732**
Acculturation^2		.0112**		.0079**	.0081**
Acculturation^2 * Ln(Acculturation)		-.0056**		-.0041**	-.0041**
Acculturation^2 * Ln(Acculturation)^2		.0007**		.0005**	.0005**
Individual-Level Variables					
Nativity [Native Born]					
Foreign Born	-.2154**			-.2532**	-.0812*
Missing	.3936			.3989†	.3952†
Mother's Age$^{.5}$					-2.5826**
Mother's Age					.2707**
Parity [1st Birth]					
Low Parity					-.4279**
High Parity					-.3936**
Marital Status [Unmarried]					
Married					-.0736**
Race/Ethnicity [White, NH]					
Latino					-.0316
Black, NH					.6458**
Other					.1447
Mother's Education^3					.0006**
Mother's Education^3 * Ln(Education)					-.0002**
Payer for Birth [Private Insurance]					
Government					.1112**
Self-Pay					.4180**
Other					.4436†
Prenatal Care [Adequate]					
Inadequate					.6264**
Intermediate					-.0569
Adequate Plus					1.1978**
Missing/No Care					.4142**
Sex of Chile [Female]					
Male					-.1149**
Constant	-2.8528	-3.2329	-3.5691	-3.7508	2.0745
N-Size	140,472	140,472	140,472	140,472	140,472
Wald Chi-Square [df]	80.71 [2]	20.81 [3]	91.13 [1]	238.61 [6]	2984.45 [24]

Note: †p<.10; *p<.05; **p<.01.

Table 4. Interaction Effects: Nativity Status and Neighborhood Characteristics

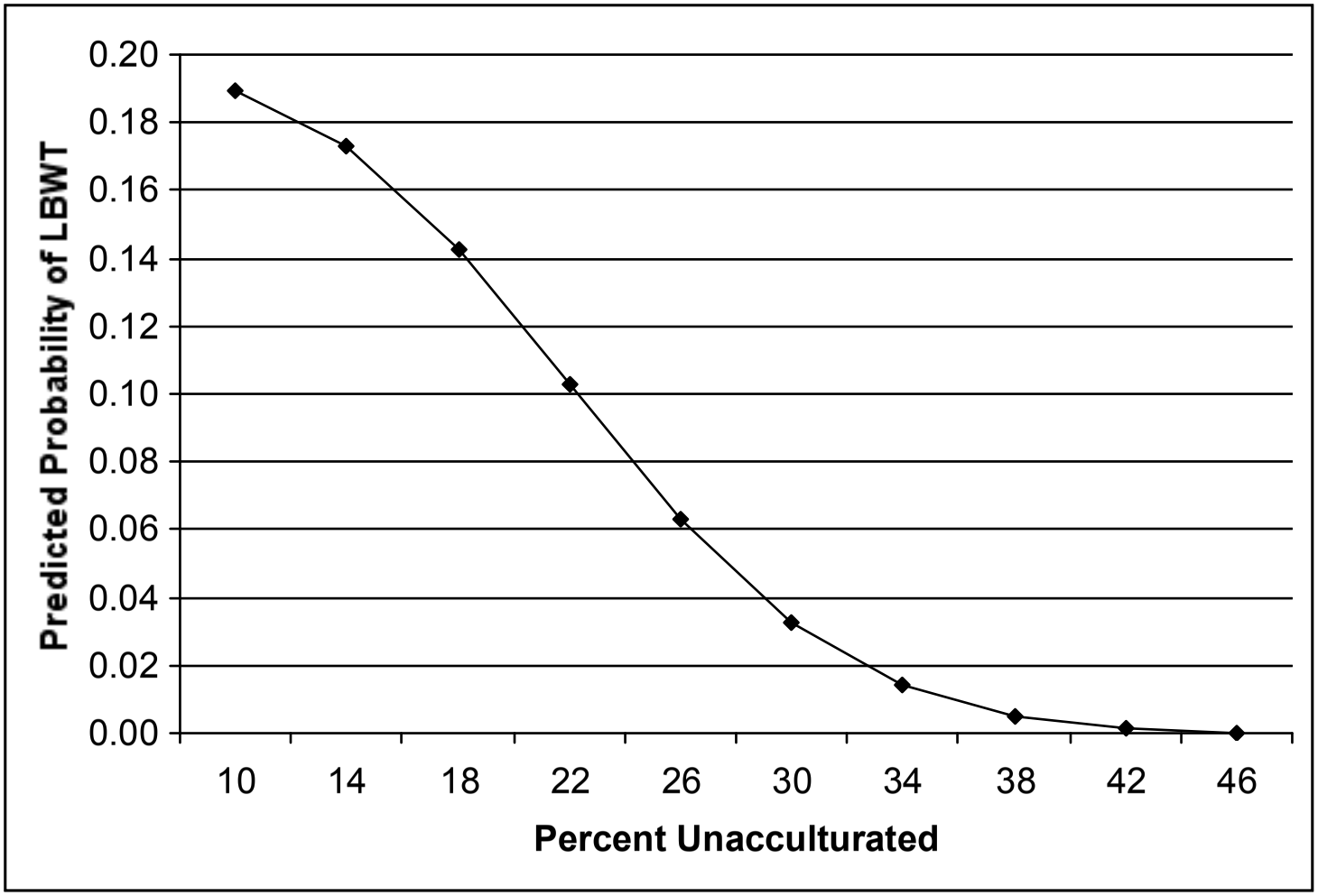
Variables	Model 1	Model 2
Neighborhood-Level Variables		
Ln(Disadvantage)	.1748**	.2694**
Acculturation^2	.0075**	.0066*
Acculturation^2 * Ln(Acculturation)	-.0038**	-.0034*
Acculturation^2 * Ln(Acculturation)^2	.0005**	.0004**
Individual-Level Variables		
Nativity [Native Born]		
Foreign Born	.0029	.4315**
Missing	.4268	-.2164
Mother's Age$^{.5}$	-2.5342**	-2.5253**
Mother's Age	.2664**	.2660**
Parity [1st Birth]		
Low Parity	-.4293**	-.4311**
High Parity	-.3975**	-.4010**
Marital Status [Unmarried]		
Married	-.0724**	-.0700*
Race/Ethnicity [White, NH]		
Latino	-.0367	-.0248
Black, NH	.6458**	.6092**
Other	.1423	.1382
Mother's Education^3	.0006**	.0005*
Mother's Education^3 * Ln(Education)	-.0002**	-.0002*
Payer for Birth [Private Insurance]		
Government	.1135**	.1152**
Self-Pay	.4160**	.4094**
Other	.4460†	.4458†
Prenatal Care [Adequate]		
Inadequate	.6254**	.6271**
Intermediate	-.0565	-.0553
Adequate Plus	1.1972**	1.1989**
Missing/No Care	.4136**	.4184**
Sex of Chile [Female]		
Male	-.1150**	-.1154**
Disadvantage * Foreign-Born		-.2029**
Disadvantage * Nativity Missing		.2327
Acculturation * Foreign-Born	-.0001**	
Acculturation * Nativity Missing	-.0001	
Constant	1.9443	1.7403
N-Size	140,472	140,472
Wald Chi-Square [df]	2992.31 [26]	3001.09 [26]

Note: †p<.10; *p<.05; **p<.01.

Table 5. Interaction Effects: Migrant Type by Neighborhood Characteristics

Variables	Model 1	Model	Model 3	Model 4
Neighborhood-Level Variables				
Ln(Disadvantage)	.3467**	.1727**	.1789**	.2258**
Acculturation^2	.0075**	.0072**	.0069**	.0064*
Acculturation^2 * Ln(Acculturation)	-.0039**	-.0036**	-.0035**	-.0033*
Acculturation^2 * Ln(Acculturation)^2	.0005**	.0005**	.0004**	.0004*
Individual-Level Variables				
Nativity [Native Born]				
Labor Migrant	-.2923**	-.1679**	-.1375**	.1479
Professional Migrant	-.0572	.2258**	.3434**	.4132†
Missing	.3963†	.4252†	.4406	-.2254
Mother's Age$^{.5}$		-2.4467**	-2.4174**	-2.4310**
Mother's Age		.2595**	.2569**	.2582**
Parity [1st Birth]				
Low Parity		-.4353**	-.4363**	-.4361**
High Parity		-.4092**	-.4122**	-.4113**
Marital Status [Unmarried]				
Married		-.0689*	-.0675*	-.0676*
Race/Ethnicity [White, NH]				
Latino		-.0084	-.0145	-.0073
Black, NH		.6432**	.6392**	.6232**
Other		.1483	.1431	.1437
Mother's Education^3		.0008**	.0008**	.0008**
Mother's Education^3 * Ln(Education)		-.0003**	-.0003**	-.0003**
Payer for Birth [Private Insurance]				
Government		.1137**	.1160**	.1157**
Self-Pay		.4040**	.4087**	.4009**
Other		.4432†	.4486†	.4444†
Prenatal Care [Adequate]				
Inadequate		.6242**	.6241**	.6249**
Intermediate		-.0572	-.0566	-.0562
Adequate Plus		1.1996**	1.1989**	1.2001**
Missing/No Care		.4140**	.4130**	.4167**
Sex of Chile [Female]				
Male		-.1149**	-.1148**	-.1152**
Disadvantage * Labor Migrant				-.1203*
Disadvantage * Professional Migrant				-.0853
Disadvantage * Nativity Missing				.2482
Acculturation * Labor Migrant			-.0000	
Acculturation * Professional Migrant			-.0002*	
Acculturation * Nativity Missing			-.0000	
Constant	-3.8102	1.7514	1.6430	1.6078
N-Size	140,472	140,472	140,472	140,472
Wald Chi-Square [df]	260.59 [7]	3015.84 [25]	3021.89 [28]	3021.62 [28]

Note: †p<.10; *p<.05; **p<.01.



Note: Predicted Probabilities for all figures are plotted only between the 10th and 90th percentiles of the neighborhood-level variable distributions.

Figure 1. Predicted Probability of Low Birth-Weight by Percent Unacculturated in the Census Tract

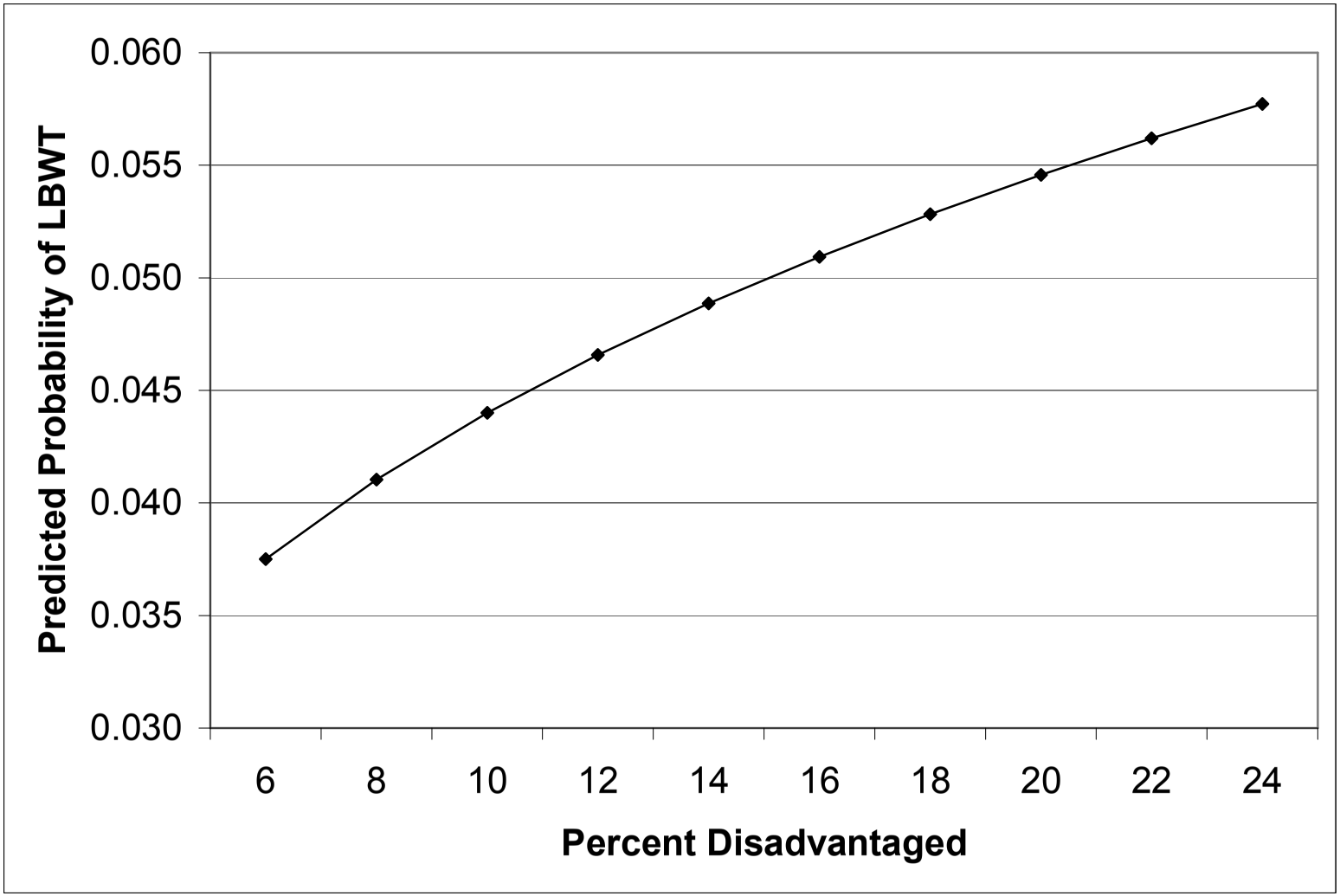


Figure 2. Predicted Probability for Low Birth-Weight by Percent Disadvantaged in the Census Tract

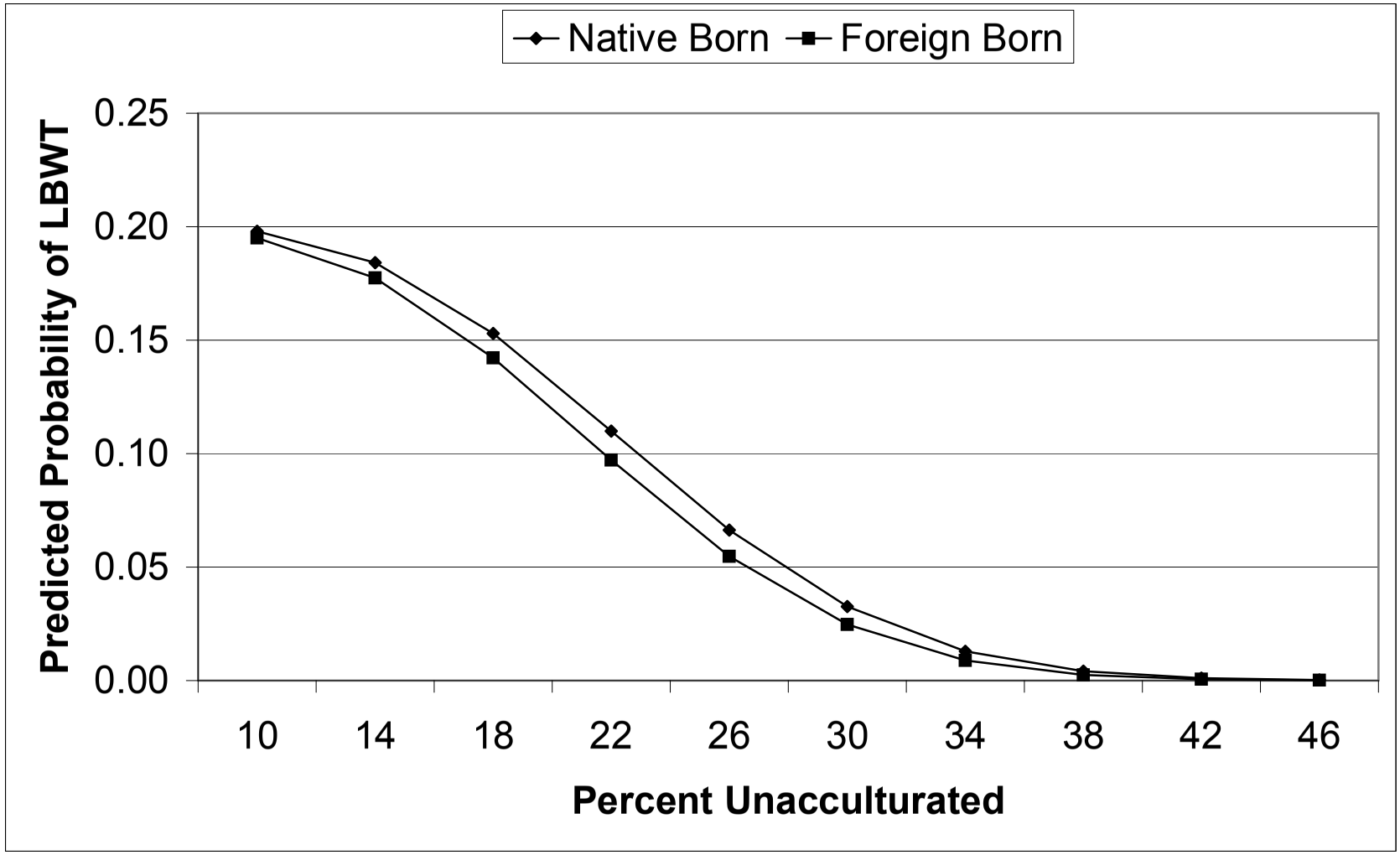


Figure 3. Predicted Probability of Low Birth-Weight by Percent Unacculturated in the Census Tract by Nativity Status

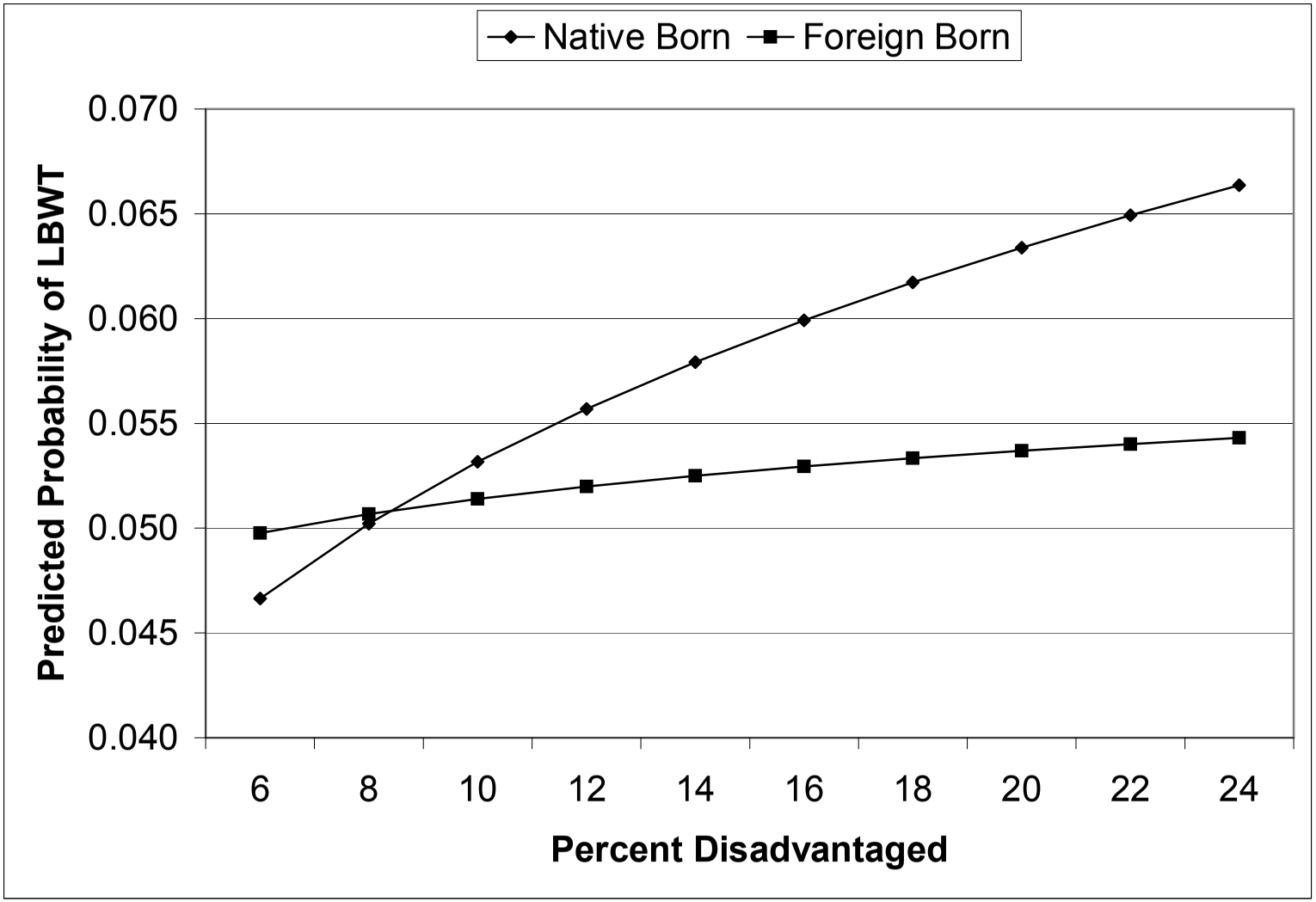


Figure 4. Predicted Probability for Low Birth-Weight by Percent Disadvantaged in the Census Tract by Nativity Status

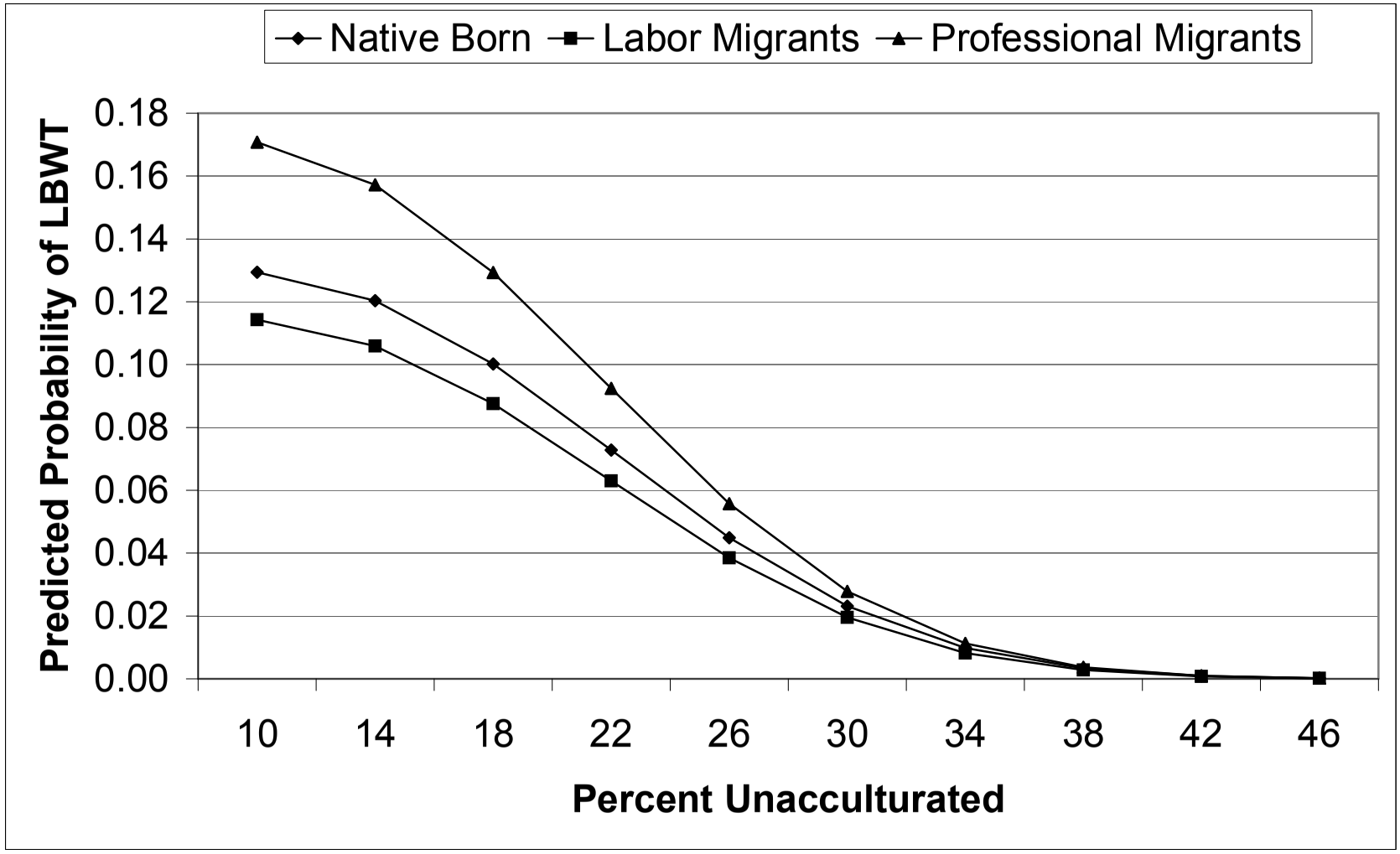


Figure 5. Predicted Probability of Low Birth-Weight by Percent Unacculturated in the Census Tract by Migrant Type

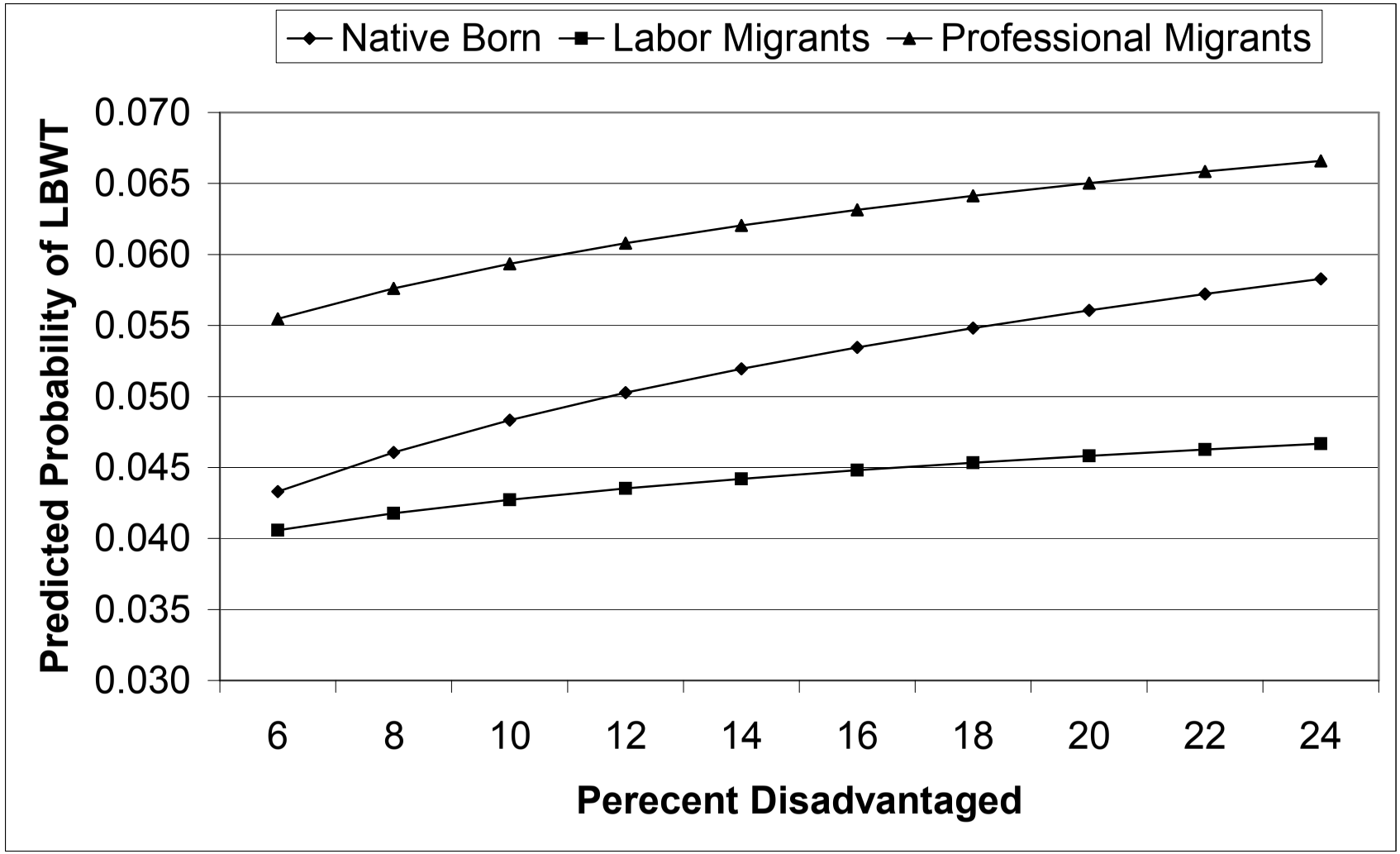


Figure 6. Predicted Probability for Low Birth-Weight by Percent Disadvantaged in the Census Tract by Migrant Type