Human Capital and Interethnic Marriage Decisions

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Abstract

Despite a longstanding belief that education importantly affects the process of immigrant assimilation, little is known about the relative importance of different mechanisms linking these two processes. This paper explores this issue through an examination of the effects of human capital on one dimension of assimilation, immigrant intermarriage. I argue that there are three primary mechanisms through which human capital affects the probability of intermarriage. First, human capital may make immigrants better able to adapt to the customs of the native culture thereby making it easier to share a household with a native. Second, it may raise the likelihood that immigrants leave ethnic enclaves, thereby decreasing the opportunity to meet potential spouses of the same ethnicity. Finally, assortative matching on education in the marriage market suggests that immigrants may be willing to trade similarities in ethnicity for similarities in education when evaluating potential spouses. Using a simple spouse-search model, I first derive an identification strategy to differentiate the cultural adaptability effect from the assortative matching effect, and then obtain empirical estimates of their relative importance while controlling for the enclave effect. Using U.S. Census data, I find that assortative matching on education is the most important avenue through which human capital affects the probability of intermarriage. Further support for the model is provided by deriving and testing its additional implications.

1 Introduction

The assimilation of immigrants has been an intensely debated topic both in academia

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and the media. The speed, measured in both years and generations, at which immigrants become indistinguishable from the native population has important implications for policies governing both the quantity and types of immigrants allowed into the country. Understanding the process through which assimilation occurs is also crucial for determining how best to aid their adjustment upon arrival. Although there is a significant body of literature in economics on the economic assimilation of immigrants, surprisingly little research has been done on what could be both a major catalyst for and result of the process: interethnic marriage.

Using a story of ethnic spillovers, Borjas (1992, 1993, 1995) explains why it takes many generations before the progeny of immigrants becomes indistinguishable from the native population: The human capital of children depends not only on the human capital of their parents but also on the ethnic environment in which they grow up. Children belonging to disadvantaged ethnic groups are exposed to social, cultural, and economic factors that can decrease their productivity (Borjas 1992). This implies that it could take many years for ethnic earnings and skill levels to converge to host country levels. If the reason it takes so many generations for immigrants to become like natives is the lack of exposure to natives, then a natural predictor and measure of assimilation is the degree of intermarriage.

Many empirical papers have found positive relationships between intermarriage and other aspects of assimilation. Meng and Gregory (2001) find that even after controlling for standard measures of human capital, intermarried immigrants in Australia have 15-23 percent higher earnings than non-intermarried immigrants[2]. This may be due to the critical role of social networks in the job search process (Battu, Mwale, Zenou 1988; Munshi 2003). Marrying a native certainly increases the proportion of natives in one's social circle, and since natives typically have lower unemployment rates and higher wages, forming relationships with them may have a positive effect on immigrants' labor market outcomes.

Intermarriage has an even greater role in the assimilation of the children of immigrants. Children with intermarried parents complete more years of schooling than do children with two immigrant parents (Chiswick and DebBurman 2003). Compared to children of two foreign-born parents, the odds of dropping out of high school are 27 percent lower for children with a native-born father and 22 percent lower for children with a native-born mother (Ramakrishnan 2004). Correspondingly, those second-generation immigrants with a native-born mother (father) earn on average \$2,300 (\$1,200) more per year than those with two immigrant parents (Ramakrishnan 2004). Children of intermarried immigrants are also more likely to marry outside of their ethnic group (Cohen 1977), potentially further reinforcing the positive effects of intermarriage on

[2] Caution should be used in interepreting this result since Kantarevic (2004) finds that after accounting for the positive selection into interethnic marriages, the intermarriage premium disappears.

other dimensions of assimilation through the generations.

Because schooling levels can be directly affected by public policy, it is particularly important to understand how human capital affects the probability of intermarriage. Previous empirical studies of the relationship between education and intermarriage have produced mixed results. A number of authors have found a positive relationship (e.g. Meng and Gregory 2001, Lichter and Qian 2001, Cohen 1977). However, Hwang, Saenz, and Aguirre (1996) find that Asian women with lower levels of education are more likely to outmarry racially. Kitano et al. (1984) find no relationship between occupational status and outmarriage for Chinese, Japanese, and Koreans in California. Based on other sets of studies, Lieberson and Waters (1988) conclude that the influence of education on endogamy is relatively small. In this paper, I develop a model that can reconcile all of these seemingly contradictory findings.

I argue that the mechanisms through which human capital affects ethnic endogamy (marriage within group) fall into three main categories. First, education may improve immigrants' abilities to adapt to the customs and culture of the host country. For example, educated immigrants may be more fluent in the host country's language, and so they can share a household with a native more efficiently. I call this explanation of the negative relationship between education and endogamy the *cultural adaptability effect*.

Another way in which education may decrease the likelihood of endogamy is through its effect on migration patterns. For example, by increasing the geographic scope of the labor market, education may result in outmigration from ethnic enclaves. Leaving areas with high foreign-born concentrations makes it more difficult to meet potential spouses of the same ethnicity and so the probability of intramarriage decreases. I call this the *enclave effect*.

Lastly, it has been widely shown in both the theoretical and empirical marriage literature that there is assortative matching on education in the marriage market. This implies that even if people do not care at all for marrying within ethnicity, there should be high endogamy rates if the distributions of education vary by ethnicity. In the more likely scenario that immigrants care both about a spouse's ethnicity and education level, because search is costly, they may be willing to trade off similarities in ethnicity for similarities in education. Regardless of whether immigrants have preferences for marrying within their ethnicity, the *assortative matching effect* implies that an increase in education should result in a decrease in endogamy for people in low education ethnic groups but an increase in endogamy for people in high education ethnic groups.

In this paper, I first derive an identification strategy to differentiate the cultural adaptability effect from the assortative matching effect, and then obtain empirical estimates of their relative importance while controlling for the enclave effect. I find that assortative matching on education is the most important avenue through which human capital affects the probability of intermarriage. Further credibility to the model is provided by deriving and testing its additional implications.

The empirical analysis is conducted solely on second-generation immigrants, the native born children of immigrants. Their marriage decisions are studied because they are less likely to suffer from language barriers and more likely to be exposed to the U.S. marriage market. Beyond these practical concerns, they are an interesting demographic group in themselves since although they are born and most likely raised in the U.S., they continue to exhibit marked preferences toward spouses of their ethnicity.

The structure of the paper is as follows. In Section 2, I provide a theoretical model of the interethnic marriage decision. A description of the sample used, descriptive statistics, the empirical specification of the model, and empirical results are given in Section 3. In Section 4, I present and test an additional implication of the model. Section 5 generalizes the model further and tests the empirical implications resulting from this further generalization. Section 6 concludes.

2 A Theoretical Model of Spouse-Search

Many sociologists and a few economists have produced descriptive papers detailing the extent and possible reasons for intermarriage, but very few have attempted to formally model the immigrant's decision of whom to marry.[3] In this section, a theoretical framework to describe interethnic marriage decisions is presented and then used to specifically analyze the effect of education on these decisions.

Starting with the pioneering work of Becker (1981), economists and sociologists have used economic theory to analyze and predict who marries whom. By assuming efficiency in the marriage market, Becker predicts positive assortative matching of spouses on any quantitative trait for which the marginal productivity of the husband's trait on household production depends positively on the wife's trait. He cites intelligence, education, health, fecundity, religion, and ethnic origin as examples of traits for which this is likely to be the case. Lam (1988) extends Becker's analysis to allow for gains from marriage due to the joint consumption, as opposed to production, of household public goods. The model presented below builds on these models but also incorporates the fact that in the 'real world,' because of search frictions and uncertainties, optimal matches do not always occur.

Figure 1 provides a game tree representation of the spouse-search process. For simplicity, the process is set up as a one-sided game in which the man proposes marriage to a woman if it is in his best interest and the woman always accepts the marriage proposal.[4] I assume that there are only two relevant types of women: Ethnics (women of the man's ethnicity) and Americans (women of a different ethnicity).[5] Each man lives for two periods. In the first period, the man randomly meets an Ethnic with prob-

[3] The only exception that I am aware of is Bisin and Verdier (2000). Linda Wong (2003) structurally models interracial marriages, but does not specifically study intermarriages among immigrants.

[4] Of course, the symmetric case where women make proposals and men always accept would imply symmetric results. An extension of the model to the case where women can reject proposals is discussed below.

[5] I use this naming convention because, although there are many different ethnicities, they usually segregate by ethnicity. Since immigrants of the third generation and above (Americans) constitute such a large proportion of the population, the most relevant decision usually simplifies to whether to marry within ethnicity or someone whose family has been in the host country for several generations.

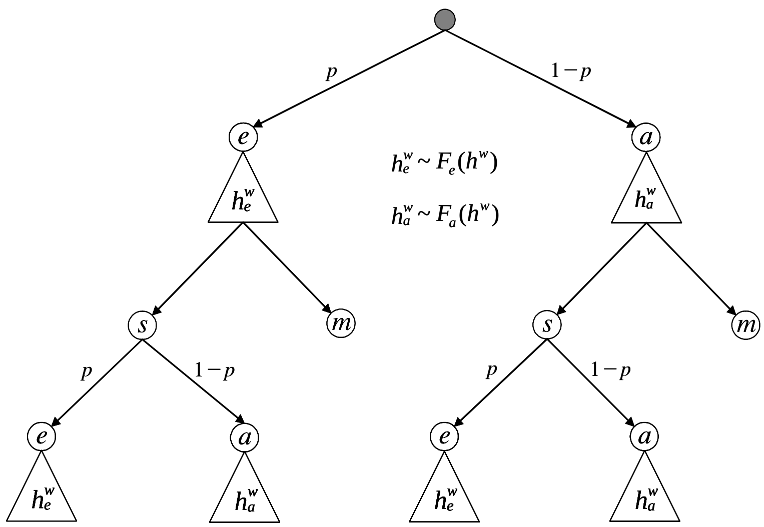

Figure 1: A Model of Spouse-Search

ability p and an American with probability $1 - p$. One can think of these probabilities as the proportion of the population that is of his own ethnicity within close geographic proximity. The woman he meets has a level of education, h^w, drawn from the distribution F_e if she is Ethnic and F_a if she is American. Let h_e^w denote a draw of education from the Ethnic distribution and h_a^w denote a draw of education from the American distribution. After observing the ethnicity and level of education of the woman with whom he is matched in the first period, the man decides whether to marry her or remain single until the second period. In the second period, the game is repeated but then he must choose either to marry the woman he is matched with or remain single for the remainder of his life. For simplicity, I will initially assume that everyone prefers marriage to anyone above being a life-long bachelor. Thus, the only decision made in this game is whether or not to marry in the first period. The man will choose to marry in the first period if his utility from the first period match is greater than his expected utility in the second period. I assume that although he does not know exactly with whom he will be matched in the second period, he does know the distributions of education in both populations and the probability of getting a draw from each population.

There are two important components to husband i's utility from marriage: his preferences for marrying within his ethnicity and within a similar education level. Because returns from marriage can result at least partially from the joint consumption of household public goods (Lam 1988), it is optimal for couples to sort in the marriage market according to their similar demands for these goods. Because so many goods jointly consumed in the household are related to ethnicity, it is efficient for immigrants to marry someone of the same ethnicity. Language, cuisine, holiday celebrations, and other family traditions are some examples of household public goods related to ethnicity. Preferences for household public goods can also be related to people's education levels. For example, education is related to liberal sex-role attitudes, a desire for fewer children (Davis 1982, Kohn 1977), preferences over how to spend leisure time together (Robinson 1977), and political views (Hyman and Wright 1977). Because children, joint vacations, and political conversations can all be considered household public goods, it is also efficient for couples to sort in the marriage market according to their demands for these public goods and, consequently, to sort by education level.

Because people prefer to marry within both their ethnic and education groups, but spouse search is costly, individuals may trade similarities in ethnicity for similarities in education. Preferences for similarities in education are modeled using a simple quadratic loss function composed of the difference between spousal education levels. The ethnicity of the spouse enters as an additively separable term, $T(h_i, X_i)$, in the utility function. This term is normalized to zero in the utility from marrying an American. Thus, the utility of an Ethnic man i from marrying an Ethnic and an American respectively can be written,

$$U_{ie} = T(h_i, X_i) - (h_e^w - h_i)^2 \quad (1)$$

$$U_{ia} = -(h_a^w - h_i)^2 \quad (2)$$

For simplicity, let $T(h_i, X_i) = a(X_i) - bh_i$ where X is a vector of all characteristics other than education that determine a man's taste for marrying an Ethnic, h_i is the man's level of education, and b is a parameter measuring the effect of the man's education on his taste for marrying within ethnicity. If tastes for ethnicity are non-negative, then $a(X_i) \geq bh_i$. If the cultural adaptability hypothesis is true, $T(h_i, X_i)$ depends negatively on education and so $b > 0$. Because educated individuals are better able to learn the customs and traditions associated with the native culture, they don't care as much for ethnicity-specific household public goods. The presence of $-bh_i$ in the expression for $T(h_i, X_i)$ captures this idea that immigrants with high levels of education may not consider ethnicity such an important characteristic in a spouse. Characteristics in the X vector could include, for example, personal ethnic identity, traditionality, religion, country of origin, age at marriage, and age.

The only decision made in this game is whether or not to marry in the first period. The man will marry in the first period if the utility he gets from marriage exceeds his expected utility in the second period. Supresssing subscripts, his expected utility from waiting, i.e. his reservation utility, can be written,

$$\begin{aligned} R &= pE[U_e] + (1-p)E[U_a] - \tau \\ &= p(T(h_i, X_i) - E[(h_e^w - h_i)^2]) + (1-p)(-E[(h_a^w - h_i)^2]) - \tau \end{aligned}$$

where $\tau > 0$ reflects the utility cost of delaying marriage due to intertemporal preferences. Note that the probability of being matched with someone of the same ethnicity remains the same in both periods. This equation can be rewritten as

$$R = -p(\sigma_e^2 + \overline{h_e^w}^2) - (1-p)(\sigma_a^2 + \overline{h_a^w}^2) + 2h(p\overline{h_e^w} + (1-p)\overline{h_a^w}]) - h^2 - pT(h_i, X_i) - \tau \quad (3)$$

where σ_e^2 is the variance of the distribution of education of the own ethnicity population, σ_a^2 is the variance of the distribution of education of rest of the population, and $\overline{h_e^w}$ and $\overline{h_a^w}$ are mean levels of education for Ethnic and American women respectively. To start, the variances for the populations will be assumed equal, $\sigma_e^2 = \sigma_a^2$, but deviations from this assumption are discussed in Section 5.

The probability of marrying in the first period given that he is matched with a woman of his own ethnicity is equal to the probability that the utility from that woman is greater than his reservation utility. This is,

$$\begin{aligned} \Pr(U_e &> R) = \Pr(T - (h_e^w - h_i)^2 > R) \\ &= \Pr(h - \sqrt{T-R} < h_e^w < h + \sqrt{T-R}) \\ &= F_e(h + \sqrt{T-R}) - F_e(h - \sqrt{T-R}) \text{ assuming } h_e^w \text{ continuous} \\ &\equiv F_e(L_e^u) - F_e(L_e^l) \end{aligned} \tag{4}$$

Similarly, if he is matched with an American,

$$\begin{aligned} \Pr(U_a &> R) = \Pr(-(h_a^w - h_i)^2 > R) \\ &= \Pr(h - \sqrt{-R} < h_a^w < h + \sqrt{-R}) \\ &= F_a(h + \sqrt{-R}) - F_a(h - \sqrt{-R}) \text{ assuming } h_a^w \text{ continuous} \\ &\equiv F_a(L_a^u) - F_a(L_a^l) \end{aligned} \tag{5}$$

Intuitively, L_e^u and L_e^l denote the upper and lower limits of acceptable levels of education for Ethnics while L_a^u and L_a^l denote limits for Americans. Note that because people have a preference for marrying within their ethnicity, $T > 0$, the range of education levels acceptable for Ethnics is greater than the range acceptable for Americans.

There are three ways in which a man can end up married to a woman of his own ethnicity by the end of the game. First, he can be randomly matched with an Ethnic (with probability p) in the first period and choose to marry her. Second, he can first be matched with an Ethnic, choose not to marry her, but be randomly matched with another Ethnic in the second period. Third, he can be matched with an American in the first period, decide not to marry her and be matched with a woman of his own ethnicity in the second period. Thus, the probability of endogamy can be written with three components[6]:

$$\begin{aligned} \Pr(\text{Endogamy}) \quad = \quad & p\Pr(U_e > R) + p(1 - \Pr(U_e > R))p + \\ & (1-p)\Pr(1 - \Pr(U_a > R))p \end{aligned} \tag{6}$$

Inserting equations (4) and (5) into (6) yields the expression

$$\begin{aligned} \Pr(\text{Endogamy}) \quad = \quad & p[F_e(L_e^u) - F_e(L_e^l)] + p^2[1 - (F_e(L_e^u) - F_e(L_e^l))] + \\ & p(1-p)[1 - (F_a(L_a^u) - F_a(L_a^l))] \end{aligned}$$

[6] The model can fairly easily be extended to a two-sided framework by incorporating a potential spouse's ability to reject a marriage proposal in the first period. Intuitively, the biggest change to the model is that it becomes more likely that people will be randomly matched in the second period (a smaller weight is given in the final expression to preferences). The qualitative implications of the model do not change.

By rearranging terms, a more intuitive expression can be written,

$$\Pr(\text{Endogamy}) = p + p(1-p)\{[F_e(L_e^u) - F_e(L_e^l)] - [F_a(L_a^u) - F_a(L_a^l)]\} \quad (7)$$

The first term in equation (7) represents the random matching component of the spouse search process while the second term represents the component arising from preferences. Naturally, the higher the probability of encountering an Ethnic, the higher the probability of marrying one and if $p = 0$, the probability of endogamy is zero while if $p = 1$ the probability of endogamy is 1. Figure 2 helps to understand the preference aspect of the model. The diagram depicts probability density functions for education levels of Ethnics and Americans. For this example, Ethnics are assumed to have lower levels of human capital than Americans. Recall that all Ethnics with education levels between L_e^u and L_e^l will be accepted while only Americans with education levels between L_a^u and L_a^l will be accepted. Thus, the difference between the area under the Ethnic distribution between L_e^u and L_e^l and the area under the American distribution between L_a^u and L_a^l represents the component of endogamy arising from preferences, unweighted by $p(1-p)$. In this example, because education of the man is very low and Ethnics have lower levels of education, the endogamy rate is greater than what is implied by random matching. The area under the Ethnic distribution between the outer acceptance limits and the inner acceptance limits represents tastes for ethnicity unrelated to people's preferences for similarities in education levels.

2.1 Cultural Adaptability Effect of Education

According to the cultural adaptability effect, an increase in education decreases a person's tastes for marrying within ethnicity because he or she can more easily assimilate to the host country. This implies that regardless of a person's ethnicity, an increase in education leads to a decrease in endogamy.

Proposition 1 *The effect of an increase in education on endogamy according to the cultural adaptability hypothesis is never positive.*

Proof: In order to look at the effect of education on endogamy solely through tastes, we need only take the derivative of equation (7) with respect to T and then take the derivative of T with respect to h. Thus,

$$\begin{aligned} \frac{\partial \Pr(\text{Endogamy})}{\partial T} &= \frac{1}{2}p(1-p)^2(T-R)^{-\frac{1}{2}}[f_e(L_e^u) + f_e(L_e^l)] + \\ &\quad \frac{1}{2}p^2(1-p)(-R)^{-\frac{1}{2}}[f_a(L_a^u) + f_e(L_a^l)] \\ &> 0 \end{aligned}$$

Since $\frac{\partial T}{\partial h} = -b$ and $b > 0$, by the chain rule, the effect of education through cultural adaptability is always negative regardless of h, p, or even whether one belongs to a high education ethnicity or a low education ethnicity.

As education increases, T approaches zero since, by construction, zero is the minimum value of T. As T approaches zero, the acceptable values of education for Ethnics

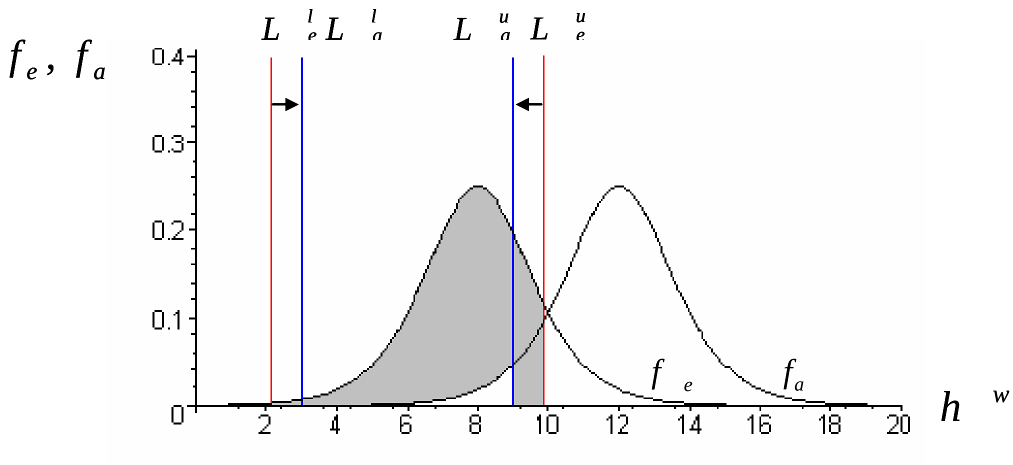

Figure 2: Cultural Adaptability Effect of Education

move closer and closer to the limits for Americans as depicted by the arrows in Figure 2. Thus, the shaded region in the figure necessarily decreases regardless of the distributions of education in the two populations and the man's level of education. This finding lets us identify the cultural adaptability effect in the data.

2.2 Assortative Matching Effect of Education

In order to clearly differentiate the assortative matching effect from the cultural adaptability effect, I will assume that immigrants have no taste for marrying within ethnicity, $T = 0$, and care only about marrying someone with a similar level of education. This assumption has two consequences. First, as can be seen from equation (3), the reservation utility increases by the size of the tastes weighted by the probability of being matched with an Ethnic, pT. More importantly, however, when $T = 0$, the range of acceptable levels of education in the first period is the same for Ethnics and Americans: $L_e^u = L_a^u$ and $L_e^l = L_a^l$. I let L^u denote the common upper limit of the acceptance region and L^l denote the common lower limit. The probability of marrying within ethnicity can then be written

$$\Pr(\text{Endogamy}) = p + p(1-p)\{[F_e(L^u) - F_e(L^l)] - [F_a(L^u) - F_a(L^l)]\} \quad (8)$$

Figure 3 depicts the preference portion of the probability of marrying within ethnicity for a person with a low level of education. The shaded region shows the probability of marrying within ethnicity above that which is implied by random matching. Notice that even with no preference for marrying within ethnicity, assortative matching on education can yield high endogamy rates if education distributions differ by ethnicity. As education increases, however, the acceptable limits shift rightward as shown by the

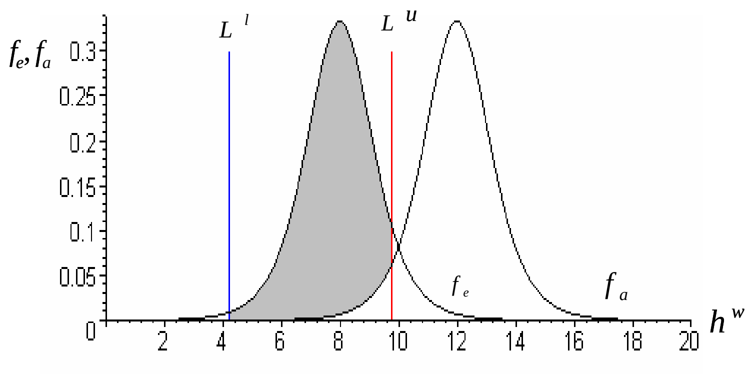

Figure 3: Probabilty of Endogamy when T=0

arrows in Figure 4 to levels of education that are more frequent among Americans than Ethnics. Of course, when Americans typically have less education than Ethnics, the acceptance limits shift toward education levels that are more frequent among Ethnics.

Formally, the derivative of equation (8) with respect to the man's education is

$$\begin{aligned} \frac{d\,\Pr(\text{Endogamy})}{dh} &= p(1-p)\left(1-\frac{dR/dh}{2\sqrt{-R}}\right)[f_e(L^u)-f_a(L^u)] - \\ & \quad p(1-p)\left(1+\frac{dR/dh}{2\sqrt{-R}}\right)[f_e(L^l)-f_a(L^l)] \end{aligned} \quad (9)$$

The first component of equation 9 represents the change in endogamy due to the shift of the upper limit and the second component represents the change due the shift of the lower limit. More specifically, $1-\frac{dR/dh}{2\sqrt{-R}}$ represents the amount by which the right hand side of the acceptance region (of wife's education levels) shifts with an increase in the man's education while $1+\frac{dR/dh}{2\sqrt{-R}}$ represents the shift in the left hand side of the acceptance region. Because of the quadratic loss resulting from differences in education levels between spouses, an increase in education of the man shifts the acceptance region (both the left and right hand side limits) to the right.

Proposition 2 *An increase in the man's education results in a shift to the right of the accepted values of education of possible wives.*

$$1-\frac{dR/dh}{2\sqrt{-R}} > 0 \textit{ and } 1+\frac{dR/dh}{2\sqrt{-R}} > 0$$

Proof: See Appendix A.

The effect of an increase in education on endogamy is illustrated in Figure 4. The darker shaded region represents the increase in endogamy resulting from the rightward

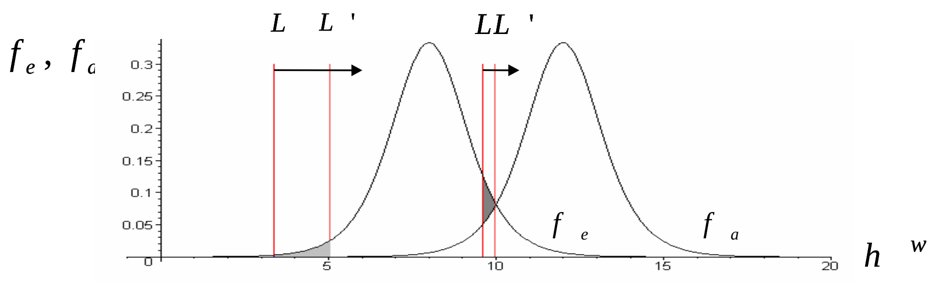

Figure 4: Assortative Matching Effect of Education on Endogamy

shift of the right-hand limit while the lightly shaded region represents the decrease in endogamy resulting from the rightward shift of the left-hand limit. For the example depicted in the diagram, since the darker shaded region is smaller than the lightly shaded region, the increase in education will result in a decrease in endogamy. This suggests an intuitive implication of assortative matching: an increase in education will lead to a decrease in endogamy for people in low education ethnicities and an increase for people in high education ethnicities. In actuality, however, the model requires a few additional conditions in order to predict this result.

Proposition 3 *Assuming $\sigma_e^2 = \sigma_a^2 = \sigma^2$, $T = 0$, and $\overline{h_e^w} < \overline{h_a^w}$, then there exists an $h^*(p, \sigma^2, \overline{h}_a^w, \overline{h}_e^w)$ such that if either $p > 1/2$ and $h > h^*$, $p < 1/2$ and $h < h^*$, or if $p = 1/2$, an increase in h will yield a decrease in the probability of marrying within ethnicity.*

$$\frac{d\Pr(\textit{Endogamy})}{dh} < 0 \text{ if } \overline{h_e^w} < \overline{h_a^w}$$

If $\overline{h_e^w} > \overline{h}_a^w$, the opposite is true. That is, if either $p < 1/2$ and $h > h^*$, $p > 1/2$ and $h < h^*$, or if $p = 1/2$, then an increase in h will yield an increase in the probability of marrying within ethnicity.

$$\frac{d\Pr(\textit{Endogamy})}{dh} > 0 \text{ if } \overline{h_e^w} > \overline{h_a^w}$$

Proof: See Appendix B.

For expositional purposes, I will defer a discussion of these conditions until Section 4. To summarize the implications of the model presented thus far, an increase in education always leads to a decrease in the probability of marrying within ethnicity through the cultural adaptability effect, but has differential implications through the assortative matching effect. The enclave effect is not directly modeled in that p is not a function of h. However, the enclave effect is accounted for in the empirical section of this paper when differentiating the cultural adaptability from the assortative matching effect.

3 The Data

3.1 Sample

This study uses the 1970 Form 2 PUMS metro sample in conjunction with the 1970 Fourth Count Population Summary Tape Files, SF 4. I study specifically the marriage decisions of second-generation immigrants because they are less likely to suffer from language barriers and their exposure to United States marriage markets is clearer. This specific sample is used because Form 2 in census year 1970 was the last time census respondents were asked for their parents' country of birth[7]. For the purposes of this paper, I will only consider marriage decisions of native-born children with two foreign-born parents. Since the PUMS only reports the father's country of birth if both parents are foreign born, the ethnicity of second-generation immigrants is determined by the father's birthplace. Since, according to the 2000 Current Population Survey, 98.5 percent of all children with two immigrant parents are children of immigrant parents from the same country, I do not think this limitation influences my central results.

Because the 1970 PUMS is only a one percent sample of the United States, it is very difficult to obtain accurate measures of the size of the ethnic group within close geographic proximity. The SF 4 contains 15 percent sample data inflated to represent the total United States population. Population items used in this analysis are counts of the foreign born and native born (of foreign or mixed parentage) constructed for each ethnicity at various geographic summarization levels. I am able to match the PUMS with the Summary Files by country, state, and county group subarea[8]. County groups are made up of an urban center and surrounding counties where economic activity is focused on the center. Since the central urban area is considered to be the labor market center, it is not unreasonable to believe that it is also the marriage market center. Many large county groups are divided into two or more subareas. These identify metropolitan areas or county components of metropolitan areas with more than 250,000 residents. In my sample, there is 1 country, 40 states, and approximately 280 county group subareas. There are over 2 million individual observations in the PUMS and over 400 thousand married couples where the spouse is present in the household. The analysis presented in this paper is performed on the 39,943 married second-generation male immigrants within ethnicities with over 1000 observations in the sample. I have completed the same analysis on second-generation females and results are qualitatively the same.

3.2 Variables

A second-generation male (both parents foreign born) is considered to be ethnically intramarried in this analysis if his wife has at least one parent born in the country of birth

[7] Since 1970, a question on ancestry has been asked, but there is no way to know how many generations families have been in the U.S.. It is also unclear what causes people to differentially associate with various ethnic backgrounds.

[8] The finest geographic partition within the PUMS metro sample is the county group. The SF 4 files do not contain population counts for county groups, but do contain them for counties. I simply sum county counts within county group to get the county group information.

Marriage Type	Number	Percentage
Immigrant, Same Ethnicity	1252	3.3
2nd Generation, Same Ethnicity	8188	21.6
American	19949	52.7
Immigrant, Differerent Ethnicity	2013	5.3
2nd Generation, Different Ethnicity	6250	16.5
Immigrant, Parents Same Ethnicity	189	0.5
Total	37841	100

Table 1: Frequencies of Marriage Types

his father. Note that by this definition, a second-generation male will be considered ethnically intramarried if he marries an immigrant, a woman whose parents were both born abroad, or a woman with one parent born abroad, as long as the couple shares a common ethnicity. In more technical terms, y, the endogamy dummy, is equal to one if the ethnicity of the husband is the same as the ethnicity of his wife and zero otherwise.

In the PUMS, education is measured in levels. In order for the regression coefficients to be more easily interpreted, I construct the years of education variable, $Education$, by mapping these levels into the average number of years it takes for people to complete them according to Chiswick and DebBurman (2004). A dummy variable for whether or not English is a person's native language, $Non\text{-}English$, is used as a proxy for ethnic identity which is in the X vector in the model. Parents choose the mother tongue of their children. Children of parents with strong ethnic attachments are more likely to have a non-English mother tongue and identify with their parents' country of birth (Stevens 1987). $Non\text{-}English$ takes on the value one if English is not the native tongue and zero if it is. Age is another variable in the X vector. Since children have gained more independence from parents as society has modernized in the past century (Kalmijn 1991a), parental preference for the intramarriage of their children is less of a salient factor in ethnic preferences of younger second-generation immigrants. The variable, $Ethnic\ Group\ Size$, is used as a proxy for the probability of meeting someone of the same ethnicity, p. It is constructed using the summary data file by dividing the number of people of that ethnicity (immigrant or native born with at least one parent born abroad) by the number of people in the population. When regressions are run for smaller geographic partitions than the entire country, average levels of education are also specific to the person's residence. For example, average education in ethnicity in the person's county group is used for the county group level regressions.

3.3 Descriptive Statistics

Table 1 presents the distribution of types of marriages for second-generation male immigrants. Note that even though Americans (3rd generation or above immigrants) make up around 85 percent of the population, only about half of second-generation men marry Americans. In fact, one in every four second-generation men marry within their

Ethnicity	Endogamy Rate	Percentage of Population in Ethnicity	Percentage of Population in Ethnicity in County Group	Mean Years of Schooling	Standard Deviation
Canada	17.24	1.49	4.55	11.47	3.41
Mexico	53.61	1.15	6.42	8.30	4.10
Sweden	10.05	0.40	0.95	11.20	3.08
Ireland	13.53	0.71	1.58	12.40	3.14
Italy	42.92	2.09	5.10	10.79	3.10
Austria	12.65	0.48	0.81	11.19	3.29
Czechoslovakia	17.54	0.37	0.85	10.86	2.91
Germany	10.41	1.78	2.39	11.02	3.23
Hungary	11.58	0.30	0.56	11.14	3.25
Poland	31.75	1.17	2.44	10.94	3.26
Yugoslavia	19.98	0.22	0.53	11.31	3.13
Lithuania	20.02	0.16	0.33	11.50	2.97
Russia	34.75	0.96	2.22	12.62	3.52

Table 2: Descriptive Statistics by Ethnicity

ethnicity. Since second-generation immigrants as a group make up only around 3 percent of the entire population, the fact that 21 percent of second-generation immigrants marry second-generation women *of their own ethnicity* is something to be noticed.

The prevalence of endogamous marriages becomes even more apparent when comparing actual rates of endogamy with endogamy rates implied by random matching for each ethnicity. As seen in Table 2, for example, since Italians constitute 2.09 percent of the population of the U.S., random matching within the U.S. would imply an endogamy rate of 2.09 percent. The actual endogamy rate of 43 percent is over 20 times this amount. As discussed above, it may not be reasonable to compare endogamy rates to the rates implied by random matching within the entire country since marriage markets do not extend to the entire country. Since immigrants and their children tend to live in or near ethnic enclaves, it makes more sense to look at the ethnic population proportions within states and county groups. The average Italian lives in a county group in which Italians make up 5 percent of the population. This still isn't even close to the endogamy rate of 43 percent. Even in the county group with the largest proportion of foreign stock of any particular ethnicity, Mexicans make up 40 percent of the population in that county group. As expected, the random matching rate of 40 percent within the county group is closer to the actual endogamy rate of 53 but it remains lower. Table 2 also presents ethnicity specific statistics on education levels. Notice that there are significant differences in average number of years of education among ethnicities. Average years of education ranges from a little over 8 years for Mexicans to over 12

				Implied Endogamy Rates			
Mexicans				1970 Census, SF 4		1970 PUMS	1979 NLSY
Years of Education	Number Married Males	Education Distribution of Females	Actual Endogamy	Max County Group	Mean County Group	Mean Neighborhood	Mean Zip Code
				p=.40	p=.07	p=.181	p=.50
0-4	15	0.24	0.72	0.86	0.44	0.67	0.90
4-6	193	0.30	0.65	0.60	0.16	0.34	0.70
6-8	252	0.13	0.63	0.40	0.08	0.18	0.50
8-10	764	0.25	0.50	0.26	0.04	0.10	0.35
10-12	228	0.05	0.36	0.21	0.03	0.08	0.28
12-14	266	0.02	0.47	0.15	0.02	0.05	0.21
14-16	205	0.01	0.26	0.13	0.02	0.05	0.19
Russians				p=.059	p=.024	0.078	0.003
0-4	25	0.03	0.16	0.06	0.03	0.08	0.003
4-6	390	0.14	0.35	0.06	0.03	0.08	0.003
6-8	407	0.09	0.29	0.04	0.02	0.05	0.002
8-10	1312	0.47	0.42	0.06	0.02	0.08	0.003
10-12	493	0.12	0.38	0.06	0.02	0.08	0.003
12-14	661	0.09	0.38	0.06	0.03	0.08	0.003
14-16	760	0.06	0.34	0.11	0.05	0.15	0.006

Table 3: Evidence of Preferences for Ethnicity

years for Russians. Standard deviations are around three for all ethnicities.

Because of the substantial amount of dispersion in education levels across ethnicities, assortative matching on education implies that the distributions of education must be considered in order to get a sense for tastes for endogamy. In Table 3, implied endogamy rates for Mexicans, the least educated ethnicity, and Russians, the most educated, are constructed by assuming that people randomly match within education group in close geographic proximity. Due to the limited sample size, I assume that within ethnicity, education distributions do not differ by geography. Since I know the education distributions for Mexicans and Russians as well as Americans, I can calculate implied endogamy rates for different measures of the relevant size of ethnic group with a straightforward application of Bayes Rule.[9] As expected, the actual endogamy rates presented in column 3 of Table 3 tend to decrease as education increases for Mexicans and slightly increase for Russians. Implied endogamy rates shown in columns 4-7 mirror these patterns for four different estimates of the relevant size of ethnicity.

[9] To be more specific, the implied endogamy rate is actually the probability of matching with an ethnic given that one must match with someone in the same education group. Thus,

$$\Pr(Match = e|H = h) = \frac{\Pr(H = h|Match = e)\Pr(Match = e)}{\Pr(H = h)}$$

where $Pr(H = h) = Pr(H = h|Match = e)Pr(Match = e) + Pr(H = h|Match = a)Pr(Match = a)$ The probability that the person is matched with someone of the same ethnicity is p while the probability that the person is matched with someone of a different ethnicity is $1 - p$.

In column 4, implied endogamy rates are shown for the county group subareas with the largest proportions of Mexicans and Russians respectively. Even for the county group composed of 40 percent Mexicans, implied endogamy rates are significantly smaller than actual endogamy rates for second generation immigrants with more than six years of education. The discrepancy is even clearer when calculating implied endogamy rates for the mean proportion of Mexicans in each county group (column 5). Column 6 reports implied endogamy rates using Borjas' estimate of the mean proportion of Mexicans in the neighborhoods of second-generation Mexicans[10] (Borjas 1995). Again, for all but the lowest education group, actual endogamy rates range from being double to ten times as high as implied endogamy rates. Even for the largest estimate of the relevant size of the population, 50 percent, actual endogamy rates are higher than implied rates for all Mexicans with more than 6 years of education. Using 1979 NLSY data, Borjas' arrives at this estimate by taking the mean proportion of Mexicans in the zip codes of Mexicans[11]. For reference, the U.S. is divided into over 40,000 neighborhoods and nearly 2000 zip codes.

Russians are more educated and less segregated than Mexicans. Implied endogamy rates are highest for Russians with more than 16 years of schooling. Even when using the largest estimate of the relevant size of ethnicity, 7.8 percent, actual endogamy rates are 2-4 times as high as implied endogamy rates. All in all, although assortative matching on education within close geographic proximity explains a significant portion of endogamy rates, a considerable amount can only be attributed to preferences for marrying within ethnicity.

The cultural adaptability effect implies that tastes for ethnicity decrease as education increases. In terms of Table 3, this suggests that the difference between actual endogamy rates and implied endogamy rates should be decreasing as education increases for both ethnicities. In actuality, however, the difference is slightly increasing in education, but the effect is not statistically significant.

In Table 4, means and standard deviations of second-generation males are shown for various characteristics by whom they marry. Men who marry within their ethnicity have on average one less year of education than their intermarrying counterparts. Their wives follow this pattern almost exactly. For all of the different ethnicities and the population as a whole, education of the husband is positively correlated with education of the wife. Men who marry within their ethnicity are slightly older than those who marry out. This suggests a downward trend in ethnic endogamy through time. Wives' ages follow the same pattern. Approximately eighty percent of all second-generation males do not have English as their native language. Not surprisingly, men with a non-English native tongue are more likely to marry within their ethnicity.

[10] Borjas admits that his estimates should be interpreted with caution since the mean number of observations in a neighborhood is 26 and the interquartile range is 9.

[11] This estimate is not directly comparable to the others since NLSY respondents were asked, "What is your origin or descent?" as opposed to own and parental country of birth. Thus, 3rd and higher generation immigrants are included in the NLSY estimate

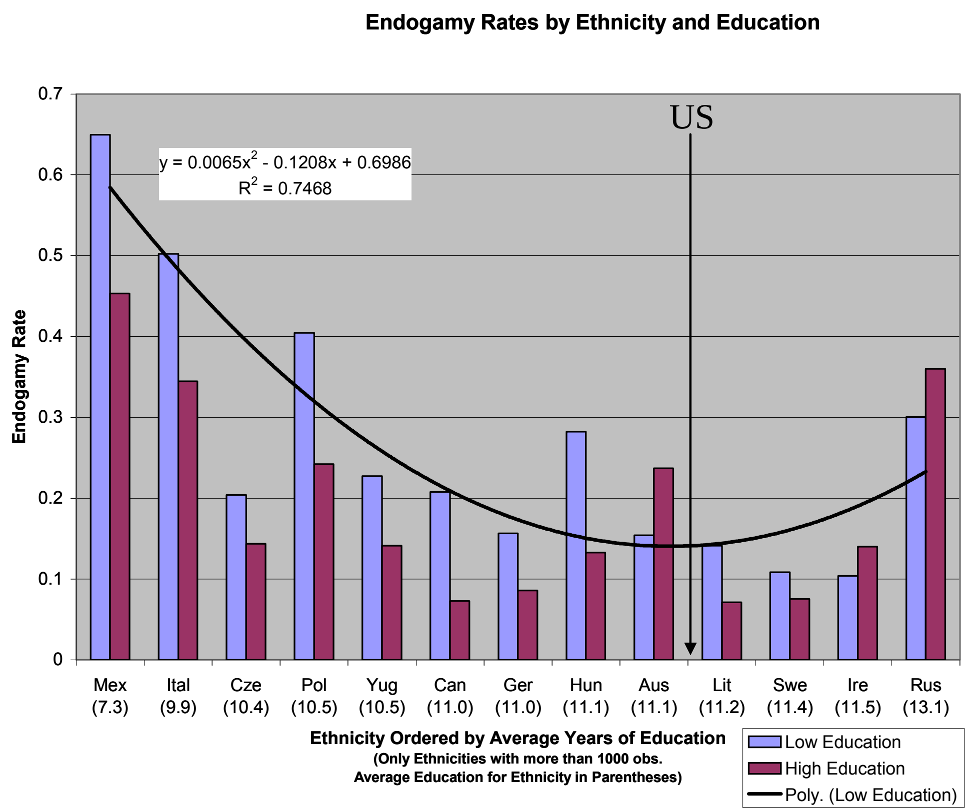

Figure 5: Evidence of Assortative Matching on Education

	Exogamous Couples		Endogamous Couples		All	
	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error
Husband						
Age	49.36	9.89	51.30	8.92	49.90	9.67
Education	11.46	3.30	10.38	3.47	11.16	3.38
Non-English	0.76	0.43	0.88	0.32	0.79	0.41
Wife						
Age	45.75	10.14	48.55	9.17	46.53	9.96
Education	11.46	2.53	10.16	2.99	11.10	2.73
Non-English	0.34	0.47	0.84	0.37	0.48	0.50

Table 4: Descriptive Statistics for Second-Generation Men and their Wives by Marriage Type

Figure 5 graphs endogamy rates by ethnicity and level of education. Ethnicities are ordered on the x axis by average level of education. The darker bars show endogamy rates for the top 50 percent education levels for that ethnicity while the lighter bars show endogamy rates for the bottom 50 percent. The black line in the middle marks the average level of education in the U.S. as a whole, 11.20. Superimposed on the bar chart is a fitted polynomial through the low education endogamy rates. As predicted by the assortative matching model, the curve has a U shape. That is, the highest endogamy rates are for ethnicities with average education levels furthest away from the average education in the population. Moreover, for ethnicities with average education levels less than the U.S. average, within ethnicity, highly educated people typically have lower endogamy rates than lowly educated people. The opposite is generally true for ethnicities with average education levels above the U.S. average.

3.4 Empirical Specification and Results

The first approach taken to disentangle the cultural adaptability effect from the assortative matching effect of education on endogamy is to test for the differential impact of education depending on the average education in one's ethnic group. The following probit model is estimated:

$$\begin{aligned}\Pr(y_{ijk} &= 1) = \beta_0 + \beta_1 h_{ijk} + \beta_2 h_{ijk}(\overline{h^w_{jk}} - \overline{h^w_{a\,k}}) + \beta_3(\overline{h^w_{jk}} - \overline{h^w_{a\,k}}) \\ &+\beta_4 p_{jk} + \beta_5 p^2_{jk} + \beta_6 X_{ijk} + \epsilon_{ijk}\end{aligned} \quad (10)$$

In this model, y_{ijk} is a dichotomous indicator equal to one if man i in ethnicity j in geographical area k is married within his ethnicity and zero otherwise. In the empirical analysis, $Education$ is used to proxy for h, $Average\ Group\ Education$[12] for $\overline{h^w_e}$ and

while they are not included in the various census estimates.

12 Averages constructed from less than 50 observations were dropped from the analysis.

Endogamy	1	2	3
Education	-0.019	-0.012	0.000
	(-2.61)**	(-1.69)+	(0.04)
Size of Ethnicity in County Group		4.506	4.162
		(5.65)**	(5.07)**
Size of Ethnicity in County Group^2		-8.550	-8.355
		(-4.58)**	(-4.11)**
Education*(Avg Group-Avg American)			**0.008**
			(2.11)*
Avg Group-Avg American			-0.110
			(-5.05)**
Age	0.006	0.008	0.009
	(2.22)*	(3.37)**	(5.56)**
Non-English Native Tongue	0.163	0.146	0.135
	(5.70)**	(4.54)**	(5.39)**
Observations	20109	20109	20109

Robust z-statistics in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%

Table 5: Probit Marginal Effects on Endogamy

$Average\ American$ for $\overline{h_a^w}$. The share of the population belonging to i's ethnicity, p, is captured by $Group\ Size$. The vector of characteristics which capture tastes for marrying within ethnicity, X, includes Age and $Non\text{-}English\ Native\ Tongue$. Tables 5 and 6 report variants of equation (10) estimated as probit models.

The theoretical model implies that the effect of education through cultural adaptability is always negative while its effect through assortative matching depends on ethnicity. More specifically, assortative matching implies that an increase in education will lead to a decrease in the probability of marrying within ethnicity for people belonging to low education ethnicities while the opposite is true for those belonging to high education groups. In particular, the larger the difference between average education in the ethnic group and the rest of the population, the stronger will be the assortative matching effect. Thus, we expect $\beta_1 < 0$ if the cultural adaptability effect is true and $\beta_2 > 0$ if the assortative matching effect is true. By including the proportion of the population in his ethnicity living in this geographical area, any effect of education will be purged of the enclave effect discussed in the introduction of this paper. Although the formal proof is not included in this paper, the size of ethnicity increases endogamy, but at a decreasing rate. This implies that $\beta_4 > 0$ and $\beta_5 < 0$.

Recall that according to the enclave effect, as education increases, people tend to move out of ethnic enclaves and so have a lower probability of meeting potential spouses of the same ethnicity. The PUMs does not contain information about whether people grew up in ethnic enclaves and if so, when they moved out, so I cannot measure the enclave effect directly. However, if I assume that after acquiring education, people

Endogamy	Country	State	County Group
Education	0.001	0.005	0.000
	(0.1)	(0.89)	(0.04)
Size of Ethnicity in County Group	30.724	9.12	4.162
	(2.03)*	(4.23)**	(5.07)**
Size of Ethnicity in County Group^2	-883.444	-56.891	-8.355
	(-1.53)	(-2.58)**	(-4.11)**
Education*(Avg Group-Avg American)	**0.009**	**0.009**	**0.008**
	(1.90)+	**(2.23)***	**(2.11)***
Avg Group-Avg American	-0.155	-0.125	-0.11
	(-3.83)**	(-4.54)**	(-5.05)**
Age	0.007	0.009	0.009
	(6.39)**	(5.76)**	(5.56)**
Non-English Native Tongue	0.103	0.114	0.135
	(4.56)**	(5.50)**	(5.39)**
Observations	39943	29041	20109

Robust z-statistics in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%

Table 6: Probit Marginal Effects on Endogamy for Different Geographic Partitions

move to where they are living at the time of the survey, search for a spouse, marry, and remain in roughly the same location, the size of ethnicity variable should completely purge β_1 and β_2 of the enclave effect of education. Admittedly, these conditions are quite strong, but biases resulting if these assumptions do not hold are not large. They will be discussed below.

Table 5 compares marginal effects from different specifications of a probit model conducted at the county group level. Notice that when education along with controls for preferences for marrying within ethnicity (Age and $Non\text{-}English\ Native\ Tongue$) are the only variables included on the right hand side of the regression, education has a negative and significant impact on the probability of in-marriage. Regression results suggest that one more year of education leads to a .02 decrease in the probability of marrying within ethnicity. According to the model, the effect of education could be small either because there is simply little effect of education on the probability of interethnic marriage or because the different avenues through which education affects intermarriage (i.e. cultural adaptability effect, assortative matching on education effect, and enclave effect) have opposing effects which cancel each other out. Controls for endogamy preference have the expected signs. Second-generation immigrants with a non-English mother tongue are significantly more likely to marry within their ethnicity and older people are more likely to marry within ethnicity.

When controlling for group size in specification (2), the effect of education alone (cultural adaptability effect) decreases by almost 50 percent and is only significant at the 10 percent level. As expected, the larger the ethnic representation in the county group in which he lives, the more likely a second-generation immigrant is to marry within his ethnicity. In fact, for a very small ethnicity, an increase in the proportion of the population in one's ethnic group by .01 will result in an initial .04 increase in the probability of marrying endogamously. Because migration rates are so high in the U.S., this estimate should not be taken too seriously. The negative coefficient on the square of ethnic size does suggest that the slope is decreasing in ethnic size as predicted by the model.

The interaction term is added in specification (3) to differentiate the assortative matching effect from the cultural adaptability effect. According to the assortative matching theory, an increase in education has different effects depending on the ethnicity to which a person belongs. In fact, as seen in Table 5, leaving constant the portion of the effect of education that changes depending upon the ethnicity of the person, the effect of education alone is not statistically different from zero. Thus, there is no support for the cultural adaptability effect of education.[13]

Specific examples are useful for interpreting the magnitude of the assortative matching effect of education. The effect of an increase in education has the greatest impact on second-generation immigrants from countries whose mean education values are very different from the rest of the population. For example, a Mexican second-generation male with an eighth grade education, the average education for Mexicans (See Table 2), will decrease his probability of marrying a Mexican by 2.36 percentage points, 0+.008(8.44-11.39) by acquiring one additional year of education. (Mexicans have an average of 8.44 years of education while Americans have an average of 11.39.) This suggests that his decision to finish high school leads to an 8.4 percentage point increase in the probability of intermarriage. On the other hand, for an average Russian second-generation immigrant, an additional year of education increases his probability of intramarriage by 1.37 percentage points, 0+.008(13.1-11.39). Finishing college leads to a 3.97 percentage point increase in the probability of marrying another Russian.

As suggested above, some caution must be used in the interpretation of these results because of the poor measure of opportunity of meeting others of the same ethnicity used in the analysis. Even if the perfect measure of their availability at the time and place that spouse-searchers were making their marriage decisions did exist, it still wouldn't be a perfect control for opportunity because people choose where to live. If with more education, immigrants move away from ethnic enclaves for the same reasons that they are less likely to marry an Ethnic according to the cultural adaptability mechanism, then the coefficient on education is biased toward zero. The empirical literature suggests that

[13] It is unclear, however, whether parents' country of birth is the most appropriate measure of ethnicity. There are many countries with very different cultures within them, and these countries are more likely to have lower endogamy rates all else equal. For example, a Russian Jew may have more in common ethnically with a Polish Jew than a non-Jewish Russian. If this heterogeneity within countries is correlated with education, the coefficients on education may be biased. As a test of whether the coefficients are biased, I included a measure of religious pluralism (obtained from Barro 2003) in the empirical specification. As expected, the coefficient on religous pluralism had a negative sign and the coefficients on the education variables remain almost exactly the same.

education always has a nonnegative effect on outmigration, and so it is unlikely that the coefficient capturing the assortative matching effect is biased. For this reason, we can treat the cultural adaptability coefficient either as an upperbound of the true effect or we can simply interpret it as the cultural adabtability effect purged of its effect through location decisions.

Beyond these problems is the issue that what is used in the analysis is the size of the ethnic group at the place and time of the survey as opposed the time and place the spouse searcher was activley engaged in the marriage market. It is conceivable that immigrants who randomly marry Americans are more likely to leave enclaves because their spouses are not bound to the enclave. Alternatively, immigrants may have been predominantly exposed to Ethnics when they were searching for a spouse but because of their education, they may have both married an American (by either the cultural adaptability effect or assortative matching) and moved away from their enclave post-marriage. The signs of the bias differ depending on which story is told, but a few empirical techniques suggest that the bias is not large. First, I run the empirical analysis solely on those couples where the husband is living in the same county that he was five years previous to the survey date but the wife moved counties with the five years before the survey date. The presumption is that these couples married within that five year period and that the husband is facing roughly the same opportunity for endogamous marriage as he was while searching for a spouse. I find that the coefficients on the education variables remain roughly the same in terms of size and significance suggesting that although there may be a bias, it isn't very large. I also ran the empirical analysis on the entire sample using the size of the ethnic group (at the time of the survey) in the man's state of birth, and again, the results do not change qualitatively. This is not controlling for the enclave effect in that it is not capturing people's migration decisions as a result of an increase in education. However, if people are more likely to search for a spouse in their state of birth, necessarily pre-marriage, than in their state of residence at the time of the survey, then this measure of opportunity will be the more appropriate one. Moreover, the fact that the coefficients on education do not change suggests that my imperfect control for the enclave effect is not significantly biasing the results[14].

It is not necessarily the case that the county group is the most relevant marriage market. Table 6 shows that for three different geographic partitions, assortative matching is the most important avenue through which education affects endogamy.

To summarize, there is no empirical support for the theory that highly educated men have a more efficient technology for adapting to the customs of people of different ethnicities and backgrounds, but there is support for the theory that marriage market participants are willing to sacrifice having similar ethnic traits in order to have similar levels of education.

3.5 Extreme Values of Male Education

[14] Regression tables for both of these empirical tests are available from the author upon request.

3.5.1 Theory

Although it is very intuitive that an increase in education yields an increase in endogamy for people in high education ethnicities and a decrease for people in low education ethnicities, the model presented in Section 3 does not always predict this relationship. In fact, whether or not this relationship holds depends on two factors: the man's education, h, and the probability, p, that he is matched with someone of his ethnicity. Specifically, an increase in education can result in an increase in endogamy even for people in low education ethnicities if p is high enough and h is low enough or if p is low enough and h is high enough. Similarly, an increase in education can result in a decrease in endogamy for those in high education ethnicities if both p and h are either low enough or high enough. For simplicity of exposition, I will continue under the assumptions that ethnicity of a spouse does not enter immigrants' utility functions, that is $T = 0$, and that variances of the education distributions of Ethnics and Americans are equal.

For pedagogical purposes, I will start with the case where p is neither high nor low but exactly $1/2$: Ethnics are just as likely to come across other Ethnics as they are Americans. This suggests that the level of education corresponding with expected utility in the second period is fairly close to the education level corresponding with the intersection of the Ethnic and American education distributions. Moreover, it implies that the acceptance region limits always lie on opposite sides of the intersection (A formal proof of this is provided in Appendix B). Thus, even if a person in a low education ethnicity has a very low level of education, the rightward shift of his upper limit will always result in an increase in the probability of marrying an American. Similarly, if his education is very high, the rightward shift of the lower limit always results in a decrease in the probability of marrying an Ethnic.

Symmetric results follow when Ethnics typically have more education than Americans. The rightward shift of the left hand limit will result in a decrease in the probability of marrying an American even if the man's education level is very high. The rightward shift of the right hand limit will result in an increase in the probability of marrying an Ethnic if the man's education level is very low. To conclude, if $p = 1/2$, an increase in h will always lead to a decrease in endogamy for people in low education ethnicities and an increase in endogamy for people in high education ethnicities. This will not always be the case if $p \neq 1/2$.

Figure 6 is a graphical representation of what can happen when h increases. Consider a spouse-searcher with a very low level of education in a low education ethnicity living in an area where he is considerably more likely to meet an Ethnic than an American. Figure 6 illustrates acceptance regions for the case where p is high and h is low. Notice that for both levels of education, the acceptance regions lie over education levels that Ethnics are more likely to have than Americans[15]. As seen in Figure 6, this means

[15] The condition that he is very low educated in a low education ethnicity implies that he is not likely to accept an American in the first period because Americans typically have much higher education levels than he does. The condition that probability of meeting someone of

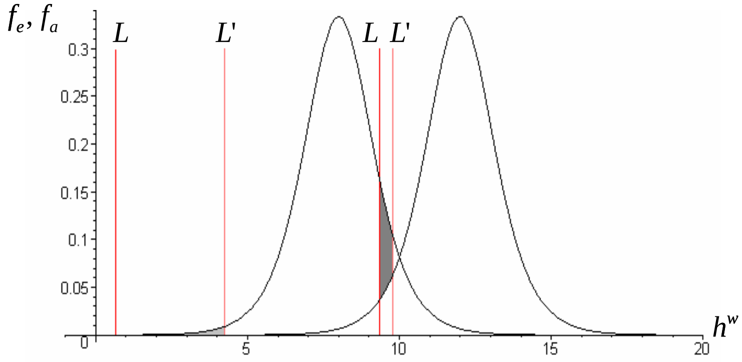

Figure 6: Change in the Probability of Intramarriage when p is High and h is Low

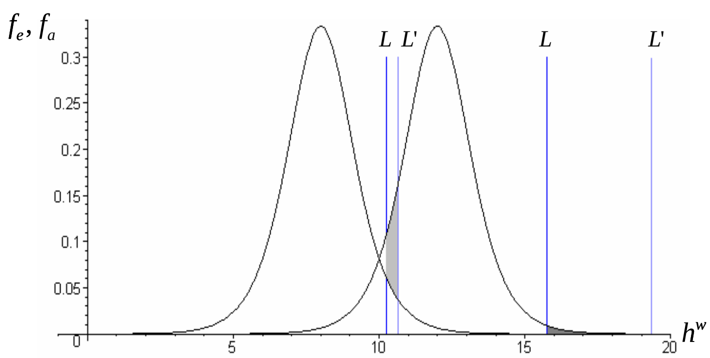

Figure 7: Change in the Probability of Intramarriage when p is Low and h is High

	$\overline{h}_e^w < \overline{h}_a^w$		$\overline{h}_e^w > \overline{h}_a^w$	
	h low	h high	h low	h high
$p > \frac{1}{2}$	$\downarrow$	$\uparrow$	$\uparrow$	$\downarrow$
$p = \frac{1}{2}$	$\downarrow$	$\downarrow$	$\uparrow$	$\uparrow$
$p < \frac{1}{2}$	$\uparrow$	$\downarrow$	$\downarrow$	$\uparrow$

Table 7: Effect of an increase in Education

that an increase in education could actually result in an increase in the probability of marrying an Ethnic. The reason is that the increase in the probability of marrying an Ethnic due to the rightward shift of the right hand limit of the acceptance region, the lightly shaded area in Figure 6, is greater than the decrease in the probability resulting from the rightward shift of the left hand limit, the darker shaded area. Because of the increase in the number of Ethnic marriages in the first period, fewer people are randomly matched with an American in the second period and thus the probability of ending up with someone of the same ethnicity actually increases[16].

Using a similar logic, again under the assumption that Ethnics typically have less education than Americans, an increase in the probability of marrying an Ethnic could result for a very well educated man in a low education ethnicity if the probability of being matched with an Ethnic is very low. Figure 7 depicts the same density functions as Figure 6, but acceptance regions are shown for the case where p. is low and h is high. In this scenario, the entire acceptance region lies over levels of education more likely for Americans than Ethnics. As shown in Figure 7, the increase in the probability of accepting an American in the first period resulting from the rightward shift of the right hand limit of the acceptance region, the lightly shaded area, is less than the decrease resulting from the rightward shift of the left hand limit, the darker shaded area. With fewer acceptances of Americans in the first period, people are more likely to become randomly matched with Ethnics in the second period and so the probability of marrying an Ethnic by the end of the game actually increases.

All of this information is summarized in Table 7.

his own ethnicity is very high implies that the level of education corresponding with the expected utility in the second period is close to the mean of the Ethnic distribution. This implies that the right-hand limit of the acceptance region lies to the left of the intersection of the two distributions.

[16] In the real world, however, one can always choose to stay single and so the very bad matches do not necessarily occur. Consider the extreme case where people would marry someone who generates utility greater than reservation utility but would rather stay single than marry anyone who generates less utility than that. For concreteness, assume Ethnics typically have more education than Americans. In this scenario, an increase in education would never lead to an increase in the probability of marrying an Ethnic but would also not lead to a decrease for the lowly educated in large ethnicities. To be general, even in the case where spouse-searchers have the option of remaining single, if p>1/2 then an increase in education will have less of an effect on lowly educated immigrants than highly educated immigrants.

3.6 Empirical Test

In order to formally test the implication that the effect of education depends not only on the ethnic group to which one belongs but also on the size of this group and one's level of education, regression analysis must be used. The model implies that an increase in education for immigrants in low education ethnicities with either very high levels of education in small ethnic groups or low levels of education in large ethnic groups leads to an increase in the probability of marrying within ethnicity. Conversely, an increase in education for immigrants in high education ethnicities with either very high levels of education in large ethnic groups or low levels of education in small ethnic groups leads to a decrease in the probability of marrying within ethnicity. To test these implications, I divide the sample according to whether average levels of education are greater than or less than average American levels and then run probit regressions of the following model on each of the two samples:

$$\Pr(y_{ijk} = 1) = \gamma_1 h_{ijk} + \gamma_2 h_{ijk}^2 + \gamma_3 p_{jk} h_{ijk} + \gamma_4 p_{jk} h_{ijk}^2 + \gamma_5 p_{jk} + \gamma_6 X_{ijk} + u_{ijk}$$

A strict interpretation of the model implies that for both samples $\gamma_1 < 0,\ \gamma_2 > 0, \gamma_3 > 0$ and $\gamma_4 < 0$. This is because for both high and low education ethnicities, an increase in h leads to an initial increase in endogamy and a subsequent decrease if $p < 1/2$ but an initial decrease and subsequent increase if $p > 1/2$. Since the effect of education on endogamy should generally be negative for low education ethnicities and positive for high education ethnicities, an additional condition must hold: the minimum endogamy rate for low education ethnicities should occur for a level h less than the corresponding h for high education ethnicities. This implies that

$$\frac{\gamma_1^L + \gamma_3^L p}{-2(\gamma_2^L + \delta_4^L)} > \frac{\gamma_1^H + \gamma_3^H p}{-2(\gamma_2^H + \gamma_4^H)}$$

if $p < 1/2$ and

$$\frac{\gamma_1^L + \gamma_3^L p}{-2(\gamma_2^L + \gamma_4^L)} < \frac{\gamma_1^H + \gamma_3^H p}{-2(\gamma_2^H + \gamma_4^H)}$$

if $p > 1/2$ where the superscript H corresponds to high education ethnicities and L to low education ethnicities.

It could be that the positive effect of education for low education ethnicities and the negative effect for high education ethnicities occurs for combinations of p and h outside the range of the data. In this scenario, we should still expect to see that the effect of h changes at an increasing rate (convex shape of endogamy equation) when p is less than a half and at a decreasing rate (concave shape of endogamy equation) when p is greater than a half. This would imply that $\gamma_1^H > 0$ when $p < 1/2$, $\gamma_3^L < 0$ when $p > 1/2$, and γ_4^L when $p > 1/2$. The data in fact implies a combination of these signs for the marginal effects.

Another issue is that for no county group in the data is the size of ethnicity of any ethnicity greater than a half. This does not mean that the probability of meeting someone of the same ethnicity is always necessarily less than a half. It is reasonable to believe that the marriage market is concentrated at the neighborhood level as opposed to the county group level. Although I do not use data at the neighborhood level I can infer from Borjas' measures of size of ethnicity in the neighborhood (Borjas 1995) that neighborhood concentrations are on average about 3 times as high as county group concentrations (See Table 3 for Mexican and Russian examples). However, because neighborhoods in the Borjas sample have only about 30 residents, I simply look for the relationships based on whether p is relatively small or large as opposed to whether it is above or below one half.

Tables 8 and 9 present marginal effects for probit regressions run on low and high education ethnicities respectively at the county group level. That is, $Size\ of\ Ethnic\ Group$ was constructed with the population of the county group as a base. Consistent with the previous set of regressions, an increase in education leads to a decrease in endogamy rates for low education ethnicities (Table 8) and an increase for high education ethnicities (Table 9): One more year of education leads to a .04 decrease in the probability of marrying within ethnicity for people in low education ethnicities and increase in the probability for people in high education ethnicities (although this increase is insignificant) when controlling for only age and the square of education (Column 1).

Notice that in Table 8, the marginal effect of education decreases in absolute value in specification (2) from -0.042 to -0.035 when size of ethnicity (and its square) are added to the model. This suggests that the enclave effect may exist but is not the only reason why education decreases the probability of marrying within.

More interesting, however, is what occurs when the education-ethnicity size interactions are included in specifications (3) and (4). Coefficients of interest all have the expected sign and, except for the square of education, are all significant at the 5 percent level for low education ethnicities. The coefficients suggest that the effect of education on endogamy is decreasing at a decreasing rate when $Size\ of\ Ethnic\ Group$ <.016 and decreasing at an increasing rate when $Size\ of\ Ethnic\ Group$ <.016. In fact, when $Size\ of\ Ethnic\ Group$ >.15, regression results imply an initial increase in endogamy and a subsequent decrease just as predicted by the theory.

For high education ethnicities, all coefficients but the one on the square of education are significant at the 10 percent level, but the signs do not correspond to the strict interpretation of the theory. They are, however, consistent with the looser interpretation discussed above. Although regression results do not suggest a decrease in endogamy with an increase in education for very high levels of education, when $Size\ of\ Ethnic\ Group$<.0004, education increases endogamy but at a decreasing rate. When $Size\ of\ Ethnic\ Group$ is between .0004 and .048, an increase in education increases endogamy at an increasing rate. Finally, when $Size\ of\ Ethnic\ Group > .048$, an increase in education results in a decrease in endogamy for very low levels of education, but eventually the effect is positive as expected.

Because these results could be due simply to the high collinearity between the square term of education and its linear counterpart, spline regressions were run with corresponding specifications. Results were similar.

Endogamy	1	2	3	4
Education	**-0.042**	**-0.035**	**-0.033**	**-0.018**
	(-6.59)**	**(-4.69)****	**(-3.11)****	**(-2.02)***
Education^2	**0.000**	**0.000**	**0.000**	**0.000**
	(1.92)+	**(0.83)**	**(0.73)**	**(0.35)**
Size of Ethnicity		4.152	2.938	3.244
		(4.88)**	(2.94)**	(3.80)**
Size of Ethnicity^2		-8.521	-7.07	-7.254
		(-4.02)**	(-2.86)**	(-3.57)**
Education*Group Size			**0.108**	**0.118**
			(3.01)**	**(3.48)****
Education^2*Group Size			**-0.005**	**-0.006**
			(-3.61)**	**(-4.90)****
Avg Group Edu-Avg Edu			-0.046	-0.069
			(-2.79)**	(-7.61)**
Non-English				0.161
				(4.09)**
Age				0.011
				(10.42)**
Observations	14720	14720	14720	14720

Robust z-statistics in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%

Table 8: Probit Marginal Effects on Endogamy for High Education Ethnicities

Endogamy	1	2	3	4
Education	**0.010**	**0.014**	**0.055**	**0.074**
	(1.04)	**(1.33)**	**(2.01)***	**(1.94)+**
Education^2	**0.000**	**0.000**	**-0.002**	**-0.002**
	(0.23)	**(0.45)**	**(-1.60)**	**(-1.61)**
Size of Ethnicity		2.170	12.568	13.093
		(0.42)	(1.75)+	(1.88)+
Size of Ethnicity^2		15.566	25.099	13.475
		(0.23)	(0.34)	(0.17)
Education*Group Size			**-1.556**	**-1.539**
			(-3.47)**	**(-2.61)****
Education^2*Group Size			**0.051**	**0.050**
			(2.49)*	**(2.00)***
Avg Group Edu-Avg Edu			0.084	0.071
			(1.68)+	(1.24)
Non-English				0.074
				(2.01)*
Age				0.007
				(1.73)+
Observations	5389	5389	5389	5389

Robust z-statistics in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%

Table 9: Probit Marginal Effects on Endogamy for Low Education Ethnicities

Ethnicity	Standard Deviation
Yugoslavia	2.77*
Czech	2.79*
Italy	2.84*
Hungary	2.87*
Germany	3.03
Lithuania	3.03
Poland	3.04
Canada	3.06
Russia	3.09
Mexico	3.98*

*Statistically different from American standard deviation at 5% level.
American Standard Deviation: 3.05

Table 10: Education Standard Deviations by Ethnicity

4 Unequal Variances

Until now, I have been assuming that the variances of the education distributions of the two populations are the same, but this is not necessarily the case. The table below shows standard deviations of education for the ethnicities used in this analysis. Notice that half of the ethnicities have standard deviations which are statistically different from the American standard deviation.

Through the use of some examples, I will examine the effect of differences in variances on the implications drawn from the theoretical model discussed above. The proof of the cultural adaptability effect does not change without the equal variance assumption: Regardless of whether variances are the same, an increase in education always leads to a decrease in endogamy through the cultural adaptability effect. The proof of the assortative matching effect, however, is responsive to this assumption. For simplicity, again I assume that there $T = 0$.

4.1 Theory

Recall that the probability of endogamy can be written,

$$\begin{aligned}\Pr(\text{Endogamy}) &= p + p(1-p)\{[F_e(h+\sqrt{-R}) - F_e(h-\sqrt{-R})] - \\ &\quad [F_a(h+\sqrt{-R}) - F_a(h-\sqrt{-R})]\}\end{aligned}$$

and that the reservation utility can be written,

$$R = -p(\sigma_e^2 + \overline{h_e^w}^2) - (1-p)(\sigma_a^2 + \overline{h_a^w}^2) + 2h(p\overline{h_e^w} + (1-p)\overline{h_a^w}]) - h^2 - \tau$$

Although the variances do enter the reservation utility (the larger the variances, the more negative the reservation utility), the major effect of dropping the equal variance assumption will come from the difference in shape of the distributions, F_e and F_a. To see this more clearly, I assume that Ethnic education is distributed with a mean of 8 and female American education has a mean of 12, but now I let the Ethnic distribution have a standard deviation of 4 and the American distribution a standard deviation of 2. I assume that $p = 1/2$ so that the effect of an increase in education is unambiguous if variances are equal.

In the top panel of Figure 8, the two density functions are depicted along with acceptance regions for people with high levels of education. It should be clear from this picture that in general, an increase in education of the spouse-searcher results in the acceptance region lying over education levels more common among Americans. However, when the spouse-searcher has a high enough level of education, for example, $h = 13$ as shown in the figure, an increase actually leads to an increase in the probability of marrying an Ethnic. Because the Ethnic distribution has a larger variance, it is more likely to meet an Ethnic with a very extreme (high) level of education even though Americans typically have higher education levels. The bottom panel of Figure 8 shows the probability of in-marriage for various levels of education of the spouse-searcher. Notice that although an increase in education typically results in a decrease in endogamy, for very high levels of education, a further increase results in an increase in endogamy if the variance of the Ethnic distribution is larger than the variance of the American distribution.

Figure 9 depicts logistic distributions with the same means as Figure 8 but the variances are reversed. When Americans have the larger variance, again it is true that in general an increase in education leads to a decrease in endogamy, but for spouse-searchers with very low levels of education, an increase can actually lead to an increase in endogamy. Figure 9 illustrates this case when h increases from 5 to 7. Spouse-searchers with extremely low levels of education are willing to marry those Americans with extremely low levels of education. With an increase in education, these spouse-searchers become unwilling to marry these Americans and so they become more likely to marry Ethnics. The bottom panel of Figure 9 shows that an increase in education results in an increase in endogamy for spouse-searchers with very low levels of education, but a decrease for everyone else.

For ethnicities with average education levels above that of the American average, the basic relationships remain the same but the probability of in-marriage is typically increasing as opposed to decreasing. When the Ethnic variance is larger than the American variance, an increase in education can lead to a decrease in endogamy for men with

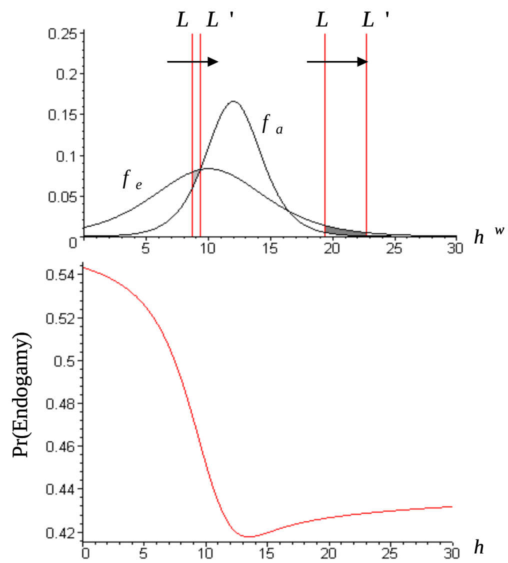

Figure 8: Effect of Education when $\overline{h}_e^w < \overline{h}_a^w$ and $\sigma_e > \sigma_a$

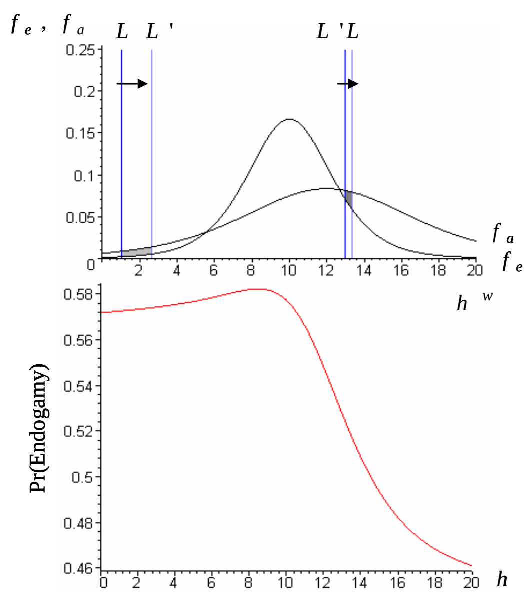

Figure 9: Effect of Education when $\overline{h}_e^w < \overline{h}_a^w$ and $\sigma_e < \sigma_a$

	$\overline{h}_e^w < \overline{h}_a^w$		$\overline{h}_e^w > \overline{h}_a^w$	
	h low	h high	h low	h high
$\sigma_e^2 > \sigma_a^2$	$\downarrow$	$\uparrow$	$\uparrow$	$\downarrow$
$\sigma_e^2 < \sigma_a^2$	$\uparrow$	$\downarrow$	$\downarrow$	$\uparrow$

Table 11: Effect of an Increase in Education when p=1/2

low levels of education. Similarly, when the Ethnic variance is smaller than the American variance, an increase in education can lead to a decrease in endogamy for men with very high levels of education. All of these results are summarized in Table 9.

4.2 Empirical Tests

To test these implications, again I divide the sample according to whether average levels of education are greater than or less than the average American education and then run probit regressions of the following model on each of the two samples:

$$\begin{aligned}\Pr(y_{ijk} &= 1) = \theta_1 h_{ijk} + \theta_2 h_{ijk}^2 + \theta_3 h_{ijk} I_{(\sigma_{jk} > \sigma_{ak})} + \theta_4 h_{ijk}^2 I_{(\sigma_{jk} > \sigma_{ak})} + \\ &\theta_5 I_{(\sigma_{jk} > \sigma_{ak})} + \theta_6 p_{jk} + \theta_7 p_{jk}^2 + \nu_{ijk}\end{aligned}$$

where $I_{(\sigma_{jk} > \sigma_{ak})}$ is a dichotomous variable equal to one if $\sigma_{jk} > \sigma_{ak}$ and zero otherwise. The model predicts that for both samples $\theta_1 > 0,\ \theta_2 < 0, \theta_3 < 0$ and $\theta_4 > 0.$ This is because for both high and low education ethnicities, an increase in h leads to an initial decrease in endogamy and a subsequent increase if $\sigma_{jk} > \sigma_{ak}$, but an initial increase and subsequent decrease if $\sigma_{jk} < \sigma_{ak}$. Since the effect of education on endogamy should generally be negative for low education ethnicities and positive for high education ethnicities, an additional set of conditions should hold:

$$\frac{\theta_1^L + \theta_3^L}{-2(\theta_2^L + \theta_4^L)} > \frac{\theta_1^H + \theta_3^H}{-2(\theta_2^H + \theta_4^H)} \tag{11}$$

$$\frac{\theta_1^L}{-2\theta_2^L} < \frac{\theta_1^H}{-2\theta_2^H} \tag{12}$$

The superscript H corresponds to high education ethnicities and L to low education ethnicities.

Tables 12 and 13 present marginal effects for probit regressions run on low and high education ethnicities respectively at the county group level. Again, column (1) shows that an increase in education leads to a decrease in endogamy rates for low education ethnicities (Table 12) and an increase for high education ethnicities (Table 13), but the coefficients are not significant. Education-standard deviation interactions are added in specification (2). For low education ethnicities, the coefficients of interest all have the expected signs and all but θ_1 are statistically significant. For high education ethnicities, however, no coefficient is statistically different from zero in the second column.

Endogamy	1	2	3
Education	**-0.01**	**0.018**	**0.012**
	(-1.06)	**(1.53)**	**(1.00)**
Education^2	**0.000**	**-0.002**	**-0.001**
	(0.62)	**(-3.35)****	**(-2.99)****
Size of Ethnicity	3.748	3.702	3.412
	(4.50)**	(4.54)**	(4.05)**
Size of Ethnicity^2	-7.518	-7.345	-7.233
	(-3.69)**	(-3.60)**	(-3.56)**
Avg Group Edu-Avg Edu	-0.0685	-0.071	-0.071
	(-7.57)**	(-10.25)**	(-10.17)**
Age	0.011	0.011	0.011
	(10.39)**	(10.55)**	(10.59)**
Non-English	0.161	0.161	0.161
	(4.06)**	(4.04)**	(4.06)**
Education*$I_{(\sigma e-\sigma a)}$		**-0.037**	**-0.035**
		(-3.75)**	**(-3.36)****
Education^2*$I_{(\sigma e-\sigma a)}$		**0.002**	**0.002**
		(4.29)**	**(3.98)****
$I_{(\sigma e-\sigma a)}$		0.141	0.13
		(2.71)**	(2.30)*
Education*Group Size			0.081
			(2.62)**
Education^2*Group Size			-0.005
			(-4.17)**
Observations	14720	14720	14720

Robust z-statistics in parentheses
* significant at 5%; ** significant at 1%

Table 12: Probit Marginal Effects on Endogamy for Low Education Ethnicities

One may notice that this empirical specification and the expected signs of the parameters mirror those of the size of ethnicity implication in the previous section. If education-ethnicity size interactions are not included in the regression, the coefficients on education-standard deviation interactions could be biased if standard deviation and ethnicity size are correlated. Thus, in specification 3, both sets of interactions are included. Note that for low education ethnicities, the coefficients on the size of ethnicity interactions and standard deviation interactions remain significant and maintain the expected sign patterns. For high education ethnicities, the coefficients remain insignificant. This suggests that variances in educations of ethnic groups are not sufficiently different from the variance in the American distribution to result in the patterns described above. Because the high education coefficients are not measure precisely, one should not put too much weight on inequalities 11 and 12. While inequality 12 does hold, inequality 11 does not.

Endogamy	1	2	3
Education	**0.02**	**0.024**	**0.082**
	(1.15)	**(0.95)**	**(2.14)***
Education^2	**-.000**	**-0.001**	**-0.003**
	(-0.88)	**(-1.06)**	**(-2.13)***
Size of Ethnicity	0.977	1.734	14.624
	(0.16)	(0.3)	(2.40)*
Size of Ethnicity^2	30.113	19.042	0.793
	(0.37)	(0.25)	(0.01)
Avg Group Edu-Avg Edu	0.068	0.064	0.067
	(1.21)	(1.16)	(1.18)
Age	0.007	0.007	0.007
	(1.74)	(1.68)	(1.67)
Non-English	0.075	0.069	0.067
	(2.07)*	(1.89)	(1.83)
Education*$I_{(\sigma e-\sigma a)}$		**-0.002**	**-0.002**
		(-0.07)	**(-0.06)**
Education^2*$I_{(\sigma e-\sigma a)}$		**0.001**	**0.001**
		(0.36)	**(0.35)**
$I_{\sigma e-\sigma a}$		-0.023	-0.025
		(-0.09)	(-0.1)
Education*Group Size			-1.635
			(-2.50)*
Education^2*Group Size			0.053
			(1.87)
Observations	5389	5389	5389

Robust z-statistics in parentheses
* significant at 5%; ** significant at 1%

Table 13: Probit Marginal Effects on Endogamy for High Education Ethnicities

5 Conclusion

An important channel through which intergenerational assimilation occurs, arguably the most important, is marriage to a native. Qian and Lichter (2001) write, “The progeny of mixed marriages often take on multiple ethnic identities, which in successive generations, further erodes ethnic distinctiveness while potentially hastening the process of assimilation.” This paper examines the effect of human capital on the intermarriage decisions of second-generation immigrants.

Three avenues through which education affects the likelihood of intermarriage are presented in this paper. The cultural adaptability effect suggests that educated people are better able to adapt to different customs and cultures. Since immigrants with more human capital have a better 'technology' for adapting to the host society, they are more likely to marry natives. The enclave effect suggests that educated immigrants are more likely to move out of their ethnic enclaves because, for example, they have larger geographic labor markets. They are, therefore, less likely to meet possible spouses of their own ethnicity and so, naturally, less likely to marry them. Lastly, the assortative matching effect posits that marriage surplus increases when education levels of husband and wife are similar. This implies that given a costly search process, educated immigrants may be willing to substitute similarities in ethnicity for similarities in education. I develop a model of assortative matching which predicts that an increase in education for immigrants in highly educated ethnicities should actually decrease the likelihood of intermarriage while the opposite is true for men in low education ethnicities.

Using U.S. Census data on second generation immigrants, I find that indeed the effect of education differs by ethnicity suggesting that assortative matching is the most important avenue through which education affects the probability of intermarriage. In fact, although there is some evidence of the enclave effect, after accounting for the assortative matching effect, the cultural adaptability theory has no support from the data. Second generation immigrants do exhibit marked preferences for marrying within their ethnicity, but contrary to the predictions of the cultural adaptability effect, these preferences are not related to education. Robustness checks of the implications of the model lend further support for the assortative matching model.

The results from this analysis can be interpreted beyond the realm of marriage decisions; interethnic marriages are a measure of the broader interaction between immigrants, of any generation, and natives. Presumably, human capital affects intermarriages in the same ways it affects any association between different people. Given the abundant literature on the importance of networks in determining wages, employment rates, occupational status, and schooling levels, the social integration of immigrants to the host society plays an important role in their economic integration.

If the assimilation of immigrants is in fact a policy goal, the conclusions from this paper can provide some insights into both immigration and education policy. Given the correlation in education levels between parents and their offspring, the fact that education affects second-generation endogamy mainly through assortative matching has implications towards which immigrant groups should be given priority when formulating immigration policy. Specifically, it implies that those ethnic groups with average education levels closest to the U.S. level can more easily integrate into U.S. society. In fact, given the evidence that all else equal, immigrants prefer to marry within their ethnicity, it may be even more beneficial to give priority to the people with education levels most similar to U.S. average levels but that are in the least educated ethnic groups. Because of the greater scarcity of potential spouses of both the same ethnicity and education level, these immigrants would be most likely to associate with natives.[17]

[17] Of course, if this policy were implemented, then in the long run, the low education ethnic group could no longer be considered a low education group at least in the U.S..

The role of human capital in intermarriage decisions also provides an indirect avenue through which education policies could catalyze the assimilation process of immigrants and their children. The fact that education works mainly through assortative matching suggests that it is the immigrants at the bottom of the education distribution that have the most to gain from education policies. For example, because education only has a positive effect on interethnic marriage rates for low education ethnicities, policies aimed at increasing high school graduation rates would be more beneficial than policies providing scholarships for graduate schools. In the end, many insights into the assimilation process can be gained from studying the marriage decisions of immigrants and their descendents.

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Appendix A. Proof of Proposition 1

To show that $1-\frac{dR/dH}{2\sqrt{-R}}$ and $1+\frac{dR/dH}{2\sqrt{-R}}$ are both positive, we must prove that $|dR/dH| < 2\sqrt{-R}$. This implies that $|dR/dH|^2-(2\sqrt{-R})^2 < 0$. Since $R = p(-E[(h_e^w-h_i)^2]+(1-p)(-E[(h_a^w-h_i)^2]$, $dR/dH = 2(p\overline{h}_e^w + (1-p)\overline{h}_a^w - h)$. Thus,

$$\begin{aligned}\left(\frac{dR}{dH}\right)^2 &= 4[p^2 h_e^{w2} + 2p\overline{h_e^w}\bar{a} - 2p^2\overline{h_e^w h_a^w} + \overline{h_a^w}^2 - 2p\overline{h_a^w}^2 + p^{2\overline{h_a^w}2} \\ &\quad -2p\overline{h_e^w}h - 2\overline{h_a^w}h + 2p\overline{h_a^w}h + h^2]\end{aligned}$$

Expanding -R, we arrive at

$$\begin{aligned}-R &= E[(h_e^w - h_i)^2] + (1-p)(-E[(h_a^w - h_i)^2]) + \tau \\ &= p(\sigma_e^2 + \overline{h_e^w}^2) + (1-p)(\sigma_a^2 + \overline{h_a^w}^2) - 2h(p\overline{h_e^w} + (1-p)\overline{h_a^w}]) + h^2 + \tau \\ &= p\sigma_e^2 + p\overline{h_e^w}^2 - 2p\overline{h_e^w}h + ph^2 + (1-p)\sigma_a^2 + \overline{h_a^w}^2 - p\overline{h_a^w}^2 - \\ &\quad 2\overline{h_a^w}h + 2p\overline{h_a^w}h + h^2 - ph^2 + \tau\end{aligned}$$

So,

$$\begin{aligned}\left(\frac{dR}{dH}\right)^2 - 4(-R) &= 4[p(1-p)(-\overline{h}_e^w + \overline{h_a^w})(\overline{h}_e^w - \overline{h_a^w}) - p\sigma_e^2 - (1-p)\sigma_a^2 - \tau] \\ &< 0\end{aligned}$$

Since $dR/dH = 2(p\overline{h}_e^w + (1-p)\overline{h}_a^w - h)$,this means that $\frac{dR/dH}{2\sqrt{-R}} \in (-1,0)$ if $h < p\overline{h}_e^w + (1-p)\overline{h_a^w}$, $\frac{dR/dH}{2\sqrt{-R}} \in (0,1)$ if $h > p\overline{h}_e^w + (1-p)\overline{h_a^w}$, and $\frac{dR/dH}{2\sqrt{-R}} = 0$ if $h = p\overline{h}_e^w + (1-p)\overline{h_a^w}$. Therefore, $1 - \frac{dR/dH}{2\sqrt{-R}}$ and $1 + \frac{dR/dH}{2\sqrt{-R}}$ are always positive.

Appendix B. Proof of Proposition 2

A sufficient condition for the signability of equation (9) is that L^u and L^l lie on opposite sides of the intersection of the two pdfs. Because the utility function is strictly concave, to do this, we need to show that utility from the level of education where the two pdfs intersect, $U(\frac{\overline{h_e^w + h_a^w}}{2})$ is greater than the reservation utility, R. Because of the shape of the utility function, this condition is enough to guarantee that the maximum accepted education level lies to the right of the intersection and the minimum always lies to the left. Evaluating utility from the mean of the two average education levels, we arrive at

$$U(\frac{\overline{h_e^w + h_a^w}}{2}) = -[\frac{\overline{h_e^w + h_a^w}}{2} - h]^2 \tag{B-1}$$

$$= -\frac{1}{4}\overline{h}_e^{w2} - \overline{h}_e^w\overline{h_a^w} + \frac{1}{2}\overline{h}_e^w\overline{h_a^w} - \frac{1}{4}\overline{h_a^w}^2 + h\overline{h}_e^w + h\overline{h_a^w} - h^2 \tag{B-2}$$

Recall from the proof of Proposition 1, that

$$R = -p(\sigma_e^2 + \overline{h_e^w}^2) - (1-p)(\sigma_a^2 + \overline{h_a^w}^2) + 2h(p\overline{h_e^w} + (1-p)\overline{h_a^w}]) - h^2 - \tau \tag{B-3}$$

Thus, if $p = \frac{1}{2}$,

$$U(\frac{\overline{h}_e^w + \overline{h_a^w}}{2}) - R = \frac{1}{4}(\overline{h_e^w} - \overline{h_a^w})^2 + \frac{1}{2}\sigma_e^2 + \frac{1}{2}\sigma_a^2 + \tau \tag{B-4}$$

$$> 0 \tag{B-5}$$

Since L^u and L^l lie on opposite sides of the intersection of the pdfs and by Proposition 1, $1 - \frac{dR/dH}{2\sqrt{-R}}$ and $1 + \frac{dR/dH}{2\sqrt{-R}}$ are always positive, we can sign Equation 9 as long as we know which is greater, $\overline{h}_e^w$ or $\overline{h_a^w}$. If $\overline{h}_e^w < \overline{h_a^w}$, then $fe(L^u) - f_a(L^u) < 0$ and $-f_e(L^l) + f_a(L^l) < 0$ and so we can say that $\frac{dP(\text{Endogamy})}{dh} < 0$. If $\overline{h}_e^w > \overline{h_a^w}$, then $f_e(U) - f_a(U) > 0$ and $-f_e(L) + f_a(L) > 0$ and so we can say that $\frac{dP(\text{Endogamy})}{dh} > 0$. If $\overline{h}_e^w = \overline{h}_a^w$, then $f_e(L^u) - f_a(L^u) = 0$ and $-f_e(L^l) + f_a(L^l) = 0$ and so we can say that $\frac{dP(\text{Endogamy})}{dh} = 0$.

Appendix C. Proof of Proposition 3

The most direct way to prove that the sign of the effect of h on the probability of intramarriage changes at a certain value of h, is to set the derivative of the probability of intramarriage, Equation (9), to zero and then to solve for h (and then of course checking concavity conditions). Unfortunately, it is computationally difficult to arrive at closed form solution for h using this technique. However, it is fairly simple to arrive at a value for h that provides a sufficient condition for the expected signs of the effect of education on the probability of intramarriage. For convenience, equation (9) is rewritten below,

$$\begin{aligned}\frac{d\,\mathrm{Pr}(\text{Endogamy})}{dh} &= p(1-p)(1-\frac{dR/dh}{2\sqrt{-R}})[f_e(L^u)-f_a(L^u)]+ \\ &\quad p(1-p)(1+\frac{dR/dh}{2\sqrt{-R}})[-f_e(L^l)+f_a(L^l)]\end{aligned} \tag{C-1}$$

I start with the case where $\overline{h}_e^w < \overline{h}_a^w$. Since $\sigma_e^2 = \sigma_a^2$, the two distributions only cross once and this crossing occurs at μ where $\mu = \frac{\overline{h}_e^w + \overline{h}_a^w}{2}$. Thus, for $h > \mu$, $f_e(h) < f_a(h)$ and for $h < \mu$, $f_e(h) < f_a(h)$. Naturally, $f_e(\mu) = f_a(\mu)$. By Proposition 2, $1 - \frac{dR/dh}{2\sqrt{-R}}$ and $1 + \frac{dR/dh}{2\sqrt{-R}}$ are always positive. Since Ethnics typically have less education than Americans, $\overline{h}_e^w < \overline{h}_a^w$, $f_e(L^u) < f_a(L^u)$ and $f_e(L^l) > f_a(L^l)$. Therefore, equation (9) is signable as long as L^u and L^l are on opposite sides of μ. In other words, $L^u{>}\mu$ and $L^l < \mu$. In order to find the h that guarantees this condition, I simply set $L^u{=}\mu$ and solve for h which I call h^* Because of the symmetry of L^u and L^l, this yields the same h^{**} as setting $L^l{=}\mu$. Thus, one can see that

$$h^{**} = \frac{\frac{1}{4}[-4p\sigma_e^2 - 4p\overline{h_e^w} + 4\sigma_a^2 + 3\overline{h_a^w}^2 - 4p\sigma_a^2 - 4p\overline{h_a^w}^2 - 2\overline{h_a^w h_e^w} - \overline{h_e^w}^2]}{\overline{h}_e^w(2p-1) - \overline{h_a^w}(2p-1)}$$

It is easy to see from this equation that if $p = 1/2$, h^{**}does not exist, thus it is beneficial to consider what happens when p is greater than and less than one half separately.

First, if $p > 1/2$, then $h^{**}{<}\mu, L^l < \mu$, and by construction of h^{**}, $L^u = \mu$. Since $L^l < \mu$ and $\overline{h}_e^w < \overline{h}_a^w$, $f_e(L^l) > f_a(L^l)$. Since $L^u = \mu$, $f_e(L^u) = f_a(L^u)$ but if $h{>}h^{**}$, $L^u > \mu$. and so $f_e(L^u) < f_a(L^u)$. Thus, all of the components of equation (9) are signable if $h{>}h^{**}$. Specifically, if $p > 1/2$ and $\overline{h}_e^w < \overline{h}_a^w$, then for any $h{>}h^{**}$, $\frac{dP(Endogamy)}{dh} < 0$.

If p<1/2, then $h^*{>}\mu$ and by construction of h^*, $L^l = \mu$. Since $L^u > \mu$ and $\overline{h}_e^w < \overline{h}_a^w$, $f_e(L^u) < f_a(L^u)$. Since $L^l = \mu$, $f_e(L^l) = f_a(L^l)$, but if $h < h^*$, $L^l < \mu$ and so $f_e(L^u) < f_a(L^u)$. Thus, all of the components of equation (9) are signable if $h < h^{**}$. Specifically, if $p < 1/2$ and $\overline{h}_e^w < \overline{h}_a^w$, then for any h$<h^{**}$, $\frac{dP(Endogamy)}{dh} < 0$.

The proofs work exactly the same way when $\overline{h}_e^w > \overline{h}_a^w$.

Appendix D. Conditions Hold in General

If the distributions of education are similar for men and women within each ethnicity, then *in general*, an increase in education for people in low education ethnicities will lead to a decrease in endogamy while the opposite is true for those in high education ethnicities. To show this, again I use the example where h_e^w ~logistic$(8, \frac{3}{4})$ and h_a^w

~$\text{logistic}(12, \frac{3}{4})$. In Figure 10, h^*, which is derived formally in Appendix 2 is graphed for different values of p. The axes are switched so that the dependent variable, h^* is on the x axis and the independent variable, p, is on the y axis. This is done so that it is easier to compare the distribution of education for Ethnics with the $h^{*\prime}s$ that guarantee the expected relationships between education and the probability of in-marriage. If $\overline{h_e^w} < \overline{h_a^w}$, then for combinations of h and p in the top left and bottom right sections of the top panel in Figure 10, an increase in h *may* lead to an increase in the probability of marrying within ethnicity. We can see from the bottom panel that these values of education are very unlikely in the population of Ethnic women. Most Ethnic women have values of education that may only yield the unexpected relationships for few values of p. If the distribution for Ethnic men, the decision-makers in this analysis, is similar to that of Ethnic women, then the unexpected results should rarely occur. If $\overline{h_e^w} > \overline{h_a^w}$, then the upper right and lower left regions are combinations of p and h that yield a decrease in the probability of intramarriage. Notice that if $p = 1/2$, the derivative always has the expected sign. The further away p is from 1/2 the smaller h can be in order to generate the unexpected results. Also notice that for $h = 10$, the half-way point between average educations for the two populations, the derivative always has the expected sign.

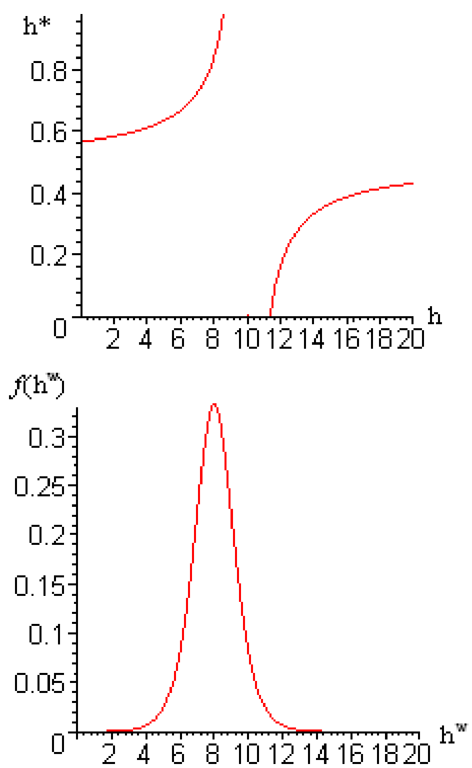

Figure 10: Low Frequency of Unexpected Results