CENTRE FOR ECONOMIC RESEARCH

WORKING PAPER SERIES

2004

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WP04/02

January 2004

DEPARTMENT OF ECONOMICS
UNIVERSITY COLLEGE DUBLIN
BELFIELD DUBLIN 4

The Fertility of the Irish in the United States in 1910

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Abstract

In most western societies, marital fertility began to decline in the nineteenth century. But in Ireland, fertility in marriage remained stubbornly high into the twentieth century. Explanations of this focus on the influence of the Roman Catholic Church in Irish society. These arguments are often backed up by claims that the Irish outside of Ireland behaved the same way. This paper investigates these claims by examining the marital fertility of Irish Americans in 1900 and 1910. We find that Irish fertility patterns did not survive the Atlantic crossing. The Irish in America had smaller families than couples in both rural and urban Ireland. But Irish immigrants still had large families relative to the native-born population in the U.S. This higher marital fertility of Irish immigrants cannot be attributed to differences in other population characteristics. Conditional on observable characteristics, Irish immigrants had larger families.

Keywords: Ireland, United States, Fertility, Fertility Transition, Immigration

JEL classifications: J13, N3

This paper is part of a larger project on the fertility transition in Ireland. Oliver Linton is part of the larger project and provided useful econometric guidance here. Lindsay Gadzik and Steven Nafziger provided excellent research assistance. The authors thank Thomas Mroz, Robert Rowthorn, and participants at seminars at the NBER DAE Summer Institute, Hull, Mannheim, Cambridge, Oxford, McGill, Queens, and Rutgers for helpful comments and suggestions.

In most western European societies marital fertility began to decline by the 1880s at the latest. Ireland is an exception: it showed little sign of any decline before the turn of the century. Ireland's crude birth rate did fall in the late nineteenth century, but this was due to increases in the age at marriage and the fraction of the population that never married. Among those who did marry, fertility remained high. Irish exceptionalism is often attributed to cultural factors -- especially the role of the Catholic Church and its views on sexuality and women. But it is also argued that the distinctiveness of Irish fertility patterns owes more to economic than to cultural factors. Industrialization progressed much more slowly in Ireland than in other parts of western Europe. At the turn of the century, Ireland was still predominantly agricultural, and as a consequence, Irish women had few work opportunities outside the home. Moreover, emigration reduced the pressure on farming couples to limit family size. The costs and benefits of children were different in Ireland than in other parts of Europe, and these differences may also help explain why the Irish lagged behind other western Europeans in reducing marital fertility (Ó Gráda 1993: Ch. 5; Guinnane 1997).

This debate mirrors a more general debate about the causes of the fertility transition. Although the precise definition of that transition is in dispute, most definitions emphasize the adoption of deliberate means of controlling fertility within marriage. In Europe especially the transition marked a change from the regulation of overall fertility via the control of nuptiality to the control of fertility by the process of reducing the size of completed families. The debate over why this transition occurred has been shaped to a large extent by the Princeton Project on the European Fertility Decline (or EFP). Carlsson (1966) has usefully divided explanations of fertility transitions into two groups – innovation/diffusion and adjustment. The former, stressed by the EFP, holds that the adoption of fertility control within a population represents a new behavior originating in new knowledge or changes in the moral acceptability of contraception. The latter, on the other hand, states that fertility control reflects couples' rational adaptation to changing economic and social circumstances. The debate over Irish fertility patterns is a microcosm of this more general debate. The cultural explanations of Irish fertility patterns assert that the

Irish maintained moral objections to limiting family size; the economic explanations assert instead that high marital fertility was a rational response to the costs and benefits of having children in Ireland.

One method of investigating the determinants of Irish marital fertility a century or so ago would be to look for differences in fertility choices across different groups in Ireland. Did Catholics have more children than Protestants? Were there class differences in family size? Such an investigation is underway (Guinnane, Moehling, and Ó Gráda 2001). This study, however, takes a different tack, looking instead beyond the shores of Ireland for insights into Irish fertility. For much of the nineteenth century over one-quarter of every Irish birth cohort immigrated to the United States.[1] In the U.S., Irish immigrants encountered very different economic and social conditions than those they left behind. They left a predominantly rural and agricultural society to settle in large cities and work in factories. They also encountered a native-born population that had been controlling fertility within marriage for several generations. Arguments about the distinctiveness of Irish demographic patterns are often "clinched" by claiming that Irish-Americans behaved just like the Irish in Ireland. But such claims are usually not backed up by data. There has, in fact, been very little research directly comparing the demographic behavior of the Irish who left and those who remained.

We begin by comparing marital fertility in the U.S. and in Ireland. These comparisons reveal that Irish fertility patterns were not merely transplanted across the ocean. But they also suggest that Irish immigrants did not simply adopt the fertility patterns of the native-born U.S. population. To delve further into this process of change, we estimate multivariate models of marital fertility for Irish immigrants and their daughters and compare them to models estimated for the native-born population.

[1]For a recent survey of the historiography of the Irish in the U.S., see Doyle (1999). The Irish went to several countries, including Canada, Australia, and Great Britain, but the overwhelming majority went to the U.S. Our focus on the Irish in the U.S. also reflects in part the availability of large national datasets with a fertility question similar to that found in the 1911 Irish Census.

The fertility of the Irish in the early twentieth century

Irish immigration to the U.S. began long before the Great Famine, but the famine changed its scale as well as its character. In the early 19th century many Irish emigrants migrated as families. Post-famine migrants were overwhelmingly single, young adults. Unlike other immigrant groups for which individual migration was the norm, Irish men and women migrated in about equal numbers. The Irish, therefore, did not suffer from the gender imbalance common among other immigrant groups in the U.S. (Guinnane 1997, 104-5). Another notable and related aspect of this migration was that few Irish immigrants returned home. The Dillingham Commission estimated that between 1908 and 1910, only 7 Irish people left the U.S. per 100 who entered. For Northern Italians, in contrast, 63 people left per 100 who entered over this period (Guinnane 1997, 107).

These patterns had important consequences for the fertility behavior of the Irish in the U.S. Marital and fertility decisions, for the most part, were made in the U.S. In 1910, for instance, only about 12 percent of Irish-born married women had married before arriving in the U.S. compared to 25 percent of German-born and 49 percent of Italian-born married women. This would seem to suggest that the fertility behavior of the Irish, perhaps even more so than that of other groups, should have been influenced by the conditions facing them in America. Adding to this the likelihood that migrants self-selected from the sending population, surely we should expect the fertility patterns of the American Irish to have been very different to those they left behind.

But Irish immigrants in the U.S. maintained strong links to their Irish heritage. Most notably, they brought their church with them, and established Catholic churches and schools with a distinctive Irish caste in the U.S. In 1900, about half the U.S. Catholic population was Irish, but 62 percent of the bishops were Irish and half of those were in fact born in Ireland (Dolan 1992, 143-4). Even in 1900, after the Irish had become integrated into many aspects of American urban life, the Irish, particularly recent immigrants, still settled in "Irish" neighborhoods. Social interactions still took place mainly within the Irish community. Among those Irish-women who married in America, 70 percent married Irish-born men or the sons of Irish-born immigrants.

So *a priori*, there are reasons to expect Irish demographic patterns to persist after immigration to America. Previous studies have examined this issue by comparing the behavior of Irish Americans to native-born Americans or other groups. A number of studies document the high marital fertility of Irish immigrants relative to the native-born population in the nineteenth century (e.g., Glasco 1973; Ryan 1981; Hareven and Vinovkis 1975; Haines 1980). But the strongest case for the persistence of Irish demographic patterns comes from Morgan, Watkins, and Ewbank's (1994) study of fertility using data from the 1910 U.S. Census. They find that both first- and second-generation Irish immigrants had low total fertility rates, lower in fact than did native women of native parentage. But just as in Ireland, these low total fertility rates were due to the lower nuptiality of Irish immigrants and their higher mean age at marriage. Marital fertility, however, was quite high. Morgan, Watkins, and Ewbank argue that these patterns were unique to the Irish. Some groups like the Poles exhibited almost no fertility control; other groups like the native-born reduced fertility by fertility control in marriage. But only the Irish reduced their fertility through their marriage patterns.

However, Foley and Guinnane (1999) bring into question the "distinctiveness" of the Irish pattern. They argue that the differences between Irish-American and native marriage patterns were due more to differences in population characteristics than to differences in the proclivity to marry. The Irish in the U.S. were overwhelmingly urban, and most Irish males held relatively low-paid, low-status jobs. Native whites with these characteristics were only slightly more likely to marry than the Irish-born. Foley and Guinnane further show that celibacy rates were much lower among the Irish in the U.S. than in Ireland. In 1911, 25 percent of women aged 45 to 54 in Ireland had never married. In 1910 in the U.S., the corresponding figure for Irish-born women was only 16 percent.

The comparison of fertility in Ireland and the U.S. in the early twentieth century is greatly facilitated by the fact that the 1911 Irish census and the 1900 and 1910 U.S. censuses asked similar questions about fertility. All three censuses asked married women how many children they had borne and how many of those children were still alive on the census date.[2] However, the forms in which these data are available to us today differ greatly across the censuses. The Irish Census published tabulations of all the fertility data collected in its *General Report*. These tabulations disaggregated couples by five-year age-at-marriage intervals for both the husband and wife, and one-year duration intervals for marriages of less than five years and five-year intervals for marriages of five or more years. Tables were provided for all Ireland, the county boroughs, Belfast, and Dublin. In contrast, the U.S. Census Bureau produced no tabulations or analysis of the fertility data until the 1940s, when it published some tabulations of the 1910 data. These tabulations, however, were not disaggregated by ethnicity. Fortunately, the Dillingham Commission (a.k.a. the U.S. Immigration Commission) used data from the 1900 Census in its study of immigrant fertility. The limitations of these data are that they pertain to a few select geographic areas (Rhode Island, Cleveland, rural Ohio, Minneapolis, and rural Minnesota) and to a select group of women (women under the age of 45, married 10 to 19 years). The other sources for the U.S. data are the Public Use Microdata samples 1900 and 1910 Censuses. These are rich sources for examining the fertility choices of individuals or couples, but once these data are disaggregated by ethnicity, age at marriage, and duration of marriage, the cell sizes are quite small, and caution must be used when comparing data derived from a sample to data derived from a census.

Given the available data, we make two sets of comparisons. First, we consider the women studied by the Dillingham Commission: women aged less than 45 who had been married 10 to 19 years.[3] These women would still be in their child-bearing years at the census. Comparisons of the fertility levels

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[2] The censuses did differ in the population that was asked these questions. The Irish Census asked these questions only of currently married women, while the U.S. Censuses asked them of all ever-married women.

[3] Due to the nature of the Irish Census tabulations, the Irish data analyzed are not quite analogous to the U.S. data. The data reported in Table 1 pertain to women married 10 to 14 years who married before age 35 and women married 15 to 19 years who married before age 30. This grouping likely biases measured fertility downwards relative to what it would have been if we could identify just women under the age of 45. This is because this grouping includes more women who married after age 30 than would

of these women may, however, understate differences in fertility control. For instance, if Irish immigrants stopped childbearing before their sisters in Ireland, these data may lead us to underestimate the amount of control among Irish immigrants relative to women in Ireland. So we also consider the fertility of women likely to have completed their child-bearing: women who married in their twenties who had been married 25 to 34 years. For this, we construct estimates for the U.S. population using the 1910 PUMS.

Table 1 presents the data on women still in their child-bearing years. From the Irish Census data, we present the data for all Ireland, the county boroughs, and a "rural" Ireland constructed by subtracting the county borough numbers from the all Ireland numbers.[4] For the U.S. we present the data from the Dillingham Commission for 1900 and estimates for the entire U.S. and the urban, non-South in 1910 constructed from the 1910 Public Use Sample.

In 1911 Ireland, 45 percent of women married 10 to 19 years had 6 or more children and the mean number of children ever-born to these women was 5. Teitelbaum (1984) argued that there was no decline in decline in marital fertility in Ireland, and hence no fertility control in marriage, before the 1920s. But other scholars, using the census data, have found evidence of a modest fertility transition already in train by 1911 (David et al. 1988; Ó Gráda and Duffy 1995; Guinnane 1997). The shift was most noticeable in urban areas, but even in rural areas patterns varied with religion and social class. Nonetheless, as the data in Table 1 attest, marital fertility in Ireland was still quite high in 1911, three or four decades after marital fertility had begun to decline in the rest of Northern Europe.

Did Irish immigrants in the U.S. also have such high marital fertility? The answer that emerges from Table 1 is somewhat mixed. In Rhode Island and Cleveland, where there were large concentrations of Irish immigrants, fertility levels of the first-generation Irish were very close to those prevailing in

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be found in a sample of women married 10 to 19 years who were under the age of 45.

[4]Ó Gráda (1991) has pointed out the problems inherent in this division. The county boroughs include only the very large cities. Approximately 20 percent of the population classified as "rural" by this method would have been classified as "urban" by the U.S. Census definition (places of 2,500 or more

urban Ireland. In Irish county boroughs, 40 percent of women had 6 or more children and the mean number of children ever born was 4.7; in Cleveland, 41 percent of first-generation Irish immigrants had 6 or more children and the mean number of children ever-born was 4.8. But Irish immigrants who settled in Minneapolis, where the Irish were less common, had lower fertility.

Another test of the persistence of Irish demographic patterns is the degree to which they were passed on to the children of immigrants, or the so-called second-generation of immigrants. But a word of caution is in order here. Our basic sources, the 1900 and 1910 censuses, are cross-sections, and we must bear that in mind in interpreting our findings. The difference between the first and the second generation in the United States is not simply generational. Irish-born people alive in the United States in 1910, and still in their child-bearing years, left Ireland well after the Great Famine of the 1840s. The second-generation Irish, on the other hand, were the children of people who left a much poorer Ireland much earlier in the nineteenth century. They were raised in the United States but by people whose experience in Ireland was very different from those who constitute our first generation. In Table 1, following the Dillingham Commission, second-generation Irish immigrants are defined as native-born women whose parents were both born in Ireland. On the whole, the fertility of the second generation was lower than that of the first. A larger fraction of second-generation women than first-generation women had families of 2 or fewer children and a smaller fraction had families of 6 or more.

The marital fertility of the Irish in America was lower than that prevailing in Ireland, particularly if one groups together the first and second generation of Irish immigrants. More striking is the gap between the fertility of Irish immigrants and that of native born whites of native parentage in the U.S. In Cleveland in 1900, 60 percent of native-born white women compared to only 9 percent of Irish-born women had two or fewer children. The mean number of children ever-born to native whites was half that of Irish immigrants. But Irish immigrant fertility was high relative to that of native-whites even when including rural areas and the Southern U.S., the areas of high native-born fertility. In the 1910 PUMS,

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population).

the mean number of children born to native-born women aged under 45 and married 10 to 19 years was 3.8 -- much higher than the mean for the native-born population in urban areas, but much lower than the mean for Irish immigrants, 4.5. Even the second generation had higher fertility than native-born whites, suggesting that even after a generation in the U.S. there was still a difference between Irish and native-born fertility patterns.

The comparisons of the fertility levels of women who had completed child-bearing only bring into greater relief the patterns that emerge from Table 1. In order to refine the comparisons between the native-born population and Irish immigrants, we limit the sample to urban areas (population 2,500 or more) outside the South. These areas accounted for four-fifths of the Irish-born population in 1910. Figure 1 presents the cumulative distributions of children ever-born for women married in their twenties, who had been married 25 to 34 years in 1910 or 1911. Here we see more clearly the divergence between Irish immigrants and their countrywomen who remained in Ireland. At all parities, the distribution for Irish immigrants lies well above those of both the urban and rural Irish. The median number of children ever-born for Irish immigrants was between 5 and 6 compared to between 6 and 7 for the urban Irish and over 7 for the rural Irish. Irish fertility patterns were not just transplanted to the U.S. But the gap between Irish immigrants and the native-born white population in the U.S. was much larger than that between Irish immigrants and their countrywomen in Ireland. The median number of children ever-born for native whites was between 2 and 3.

Multivariate models of fertility

Marital fertility among Irish immigrants in the U.S. was lower than that in Ireland. Irish demographic patterns were not simply transplanted across the ocean. The differences observed may reflect the self-selection of migrants to the U.S. or else the adaptation of these migrants to the new environment they encountered. But either explanation casts doubt on the standard cultural explanation of the reluctant participation of the Irish in the fertility transition. The adaptation story indicates that the

Irish did respond to economic and social conditions. The selection story indicates that there was heterogeneity in fertility behavior in the Irish population. Perhaps more importantly, it provides another explanation as to why marital fertility in Ireland remained so high: those Irish most inclined to control fertility left Ireland.

But just as striking is the large fertility gap that remained between Irish-Americans and the native-born white population. Foley and Guinnane have shown that differences in marriage patterns between Irish immigrants and native-born whites during this period were due primarily to differences in the other characteristics of these groups. Does the same hold for the marital fertility gap? To answer this question we must estimate models of marital fertility. Such models will also allow us to examine variation in fertility patterns within the Irish immigrant population and by so doing, may provide insights into how the fertility transition took place. For instance, was fertility higher in places with higher concentrations of Irish immigrants? Did those who immigrated as children have lower fertility than those who immigrated as adults? Likewise, can the differences between the fertility patterns of first- and second-generation immigrants be explained by differences in their socio-economic characteristics or do these differences indicate differences in behavior conditional on these characteristics?

For this purpose, we use the 1910 PUMS made available through the Integrated Public Microdata Series (IPUMS). The 1910 IPUMS dataset is a 1-in-250 national random sample of households enumerated in the 1910 census. Ruggles (1995) discusses the design of this sample in detail. Only the 1900 and 1910 U.S. Censuses asked questions about fertility and child mortality. The advantage of the 1910 Census for our purposes is that it also asked about the number of times an individual had been married. The data on number of years married collected in the census only pertain to the current marriage. So only for women in their first marriage do we have accurate data on the number of years at risk to have a marital birth.

While the demographic data available in the 1910 census are fairly rich, the economic information is much more limited. The only information we have is on occupation, home ownership, and male and female literacy. Today in many countries, both developed and developing, more highly educated women have on average fewer children. The most significant weakness of the census data for our purposes, however, is the lack of information on religion. Like all U.S. censuses, the 1910 census is silent on religious affiliation. Immigrants from Ireland included both Catholics and Protestants, although by the late nineteenth century, most were Catholic. The absence of data on religion prevents us from separating the effects of being Catholic from the effects of being Irish.

We can, however, ask a somewhat related question: Did a couple's fertility behavior vary with the size of the Catholic population in its area? The Census Bureau conducted a census of religious bodies in 1906, collecting information on membership and the value of church property by denomination. It tabulated and published these data for counties. The ICPSR has coded all of the county-level data on membership. These data combined with data on total population from the 1910 census can be used to construct a "percent Catholic" variable. This variable could be thought of as a proxy for religious affiliation, representing the probability that a couple is Catholic. A more compelling justification for its inclusion, though, is that it may capture "neighborhood effects." If Catholics really did have higher fertility, the social norm in Catholic areas would be to have larger families. Couples in these areas, regardless of their own religious affiliation, might accordingly have more children ever-born.[5]

Estimating empirical models of fertility poses some challenges. Ordinary least-squares (OLS) only reveals the effects of variables on the conditional mean. With a 'count' variable like the number of children ever-born, we are often interested in the entire distribution, rather than just the mean. In fact, focussing on means can often obscure differences between groups. As a case point, consider the data in Table 1 for Cleveland. Irish immigrants had on average 4.8 children ever-born compared to 2.4 for the native-born white population. But the distributions around these means were not symmetric. In fact, the two distributions skew in opposite directions. Sixty percent of native born women had two or fewer

[5]Guinnane, Moehling, and Ó Gráda (2001) find that fertility behavior in suburban Dublin in 1911 varied with the fraction of couples on one's *street* who were Protestant. Couples on predominantly Protestant streets had smaller families than those who lived on Catholic streets.

children whereas over forty percent of the Irish immigrants had six or more. Another problem stems from the likely endogeneity of infant mortality. The first problem has straightforward solutions; the second, unfortunately, does not.

Count Models

The most commonly-used alternative to OLS for such count data is to assume that the counts follow a parametric (conditional) distribution and estimate the model by maximum likelihood (ML).[6] The distribution used most often is Poisson distribution which, however, has the unfortunate feature that its (conditional) mean is equal to its (conditional) variance. This assumption amounts to a strong restriction on the data. Like most other historical data on family size, our data suffer from *overdispersion*: the variance is substantially higher than the mean. For Irish-born married women under the age of 55 in the 1910 IPUMS data, the mean of the number of children ever born is 3.8 while the variance is 9. Researchers have taken several approaches to contend with overdispersion. One is to use an alternative distribution that allows for more flexibility. The negative binomial distribution is popular in part because the Poisson model is nested within it. For the negative binomial distribution, the relationship between the mean and variance is a function of a parameter that itself is estimated:

$$E(CEB) = \mu$$

$$Var(CEB) = \mu + \alpha\mu^2$$

When α is equal to zero, the negative binomial simply collapses to the Poisson distribution. Testing whether α equals zero is, therefore, a straightforward test of the assumption that the data are distributed according to the Poisson distribution.

[6]See Cameron and Trivedi (1998) for a discussion of count models. These models are consistent with duration analysis, which is more widespread in the demography literature. Corresponding to any distribution of counts is a distribution describing the waiting-times between births. The key difference is a loss of information: the hazard rate might have been higher or lower in the first interval than in the second. The count models assume, implicitly, that the hazard rate was the same (for a given duration) across all intervals.

A standard interpretation of the negative binomial model is that it allows for unobserved heterogeneity within a population. Mathematically, this is represented by the conditional mean function having a random intercept term that enters multiplicatively:

$$\theta_i = \exp(\beta_0 + x_i'\beta_1 + \varepsilon_i) = e^{(\beta_0 + x_i'\beta_1)} e^{\varepsilon_i} = \mu_i \upsilon_i$$

In our context, this amounts to saying that, even after conditioning on observable characteristics, the number of children ever-born varies within the population. Such heterogeneity could reflect biological factors. The fecundity of a couple depends on genes as well as the general health status of the husband and wife. But it could also reflect variation in the 'taste' for children in a population. Even after conditioning on other characteristics, some couples may prefer more children than others.

Overdispersion in most applications, fertility data included, is due to excess zeros. Returning to the sample of Irish-born women, if we ignore couples with zero children the mean number of children born is about 4.5 and the variance is 7.9. These figures still violate the assumptions of the Poisson model, but the violation is less severe. The econometrics literature has developed two, parallel approaches to contending with excess zeros: the hurdle model and the splitting model. The two models view the source of the overdispersion differently. The hurdle model assumes that the excess zeros arise because there is some fixed cost associated with the activity that is counted. The splitting regime model assumes that the data are drawn from two different regimes. In one regime the outcome is always zero and cannot be otherwise. In the other regime it may or may not be zero.

The splitting model is more appropriate for fertility decisions. For biological reasons, some couples will not be able to have children and will therefore be in the 'always-zero' regime. Just what fraction of couples fall into this category is an issue of debate. A standard approach to estimating sterility rates is to calculate the proportion of women who have a birth after a given age in a population thought to be exhibiting no fertility control. For instance, if in a non-controlling population, 95 percent of married women have a birth after the age of 25, this suggests that at most 5 percent were sterile at age 25. Estimates constructed in this way suggest that the sterility rate is only 5 percent or less among women in their 20s, rise slightly to about 10 percent for women in their early 30s, and then jump to approximately 20 percent for women aged 35 to 39 (Menken and Larson 1986, 153-154).

We cannot identify on an individual basis which couples are sterile, but with some structure we can estimate the probability that a couple is in the always-zero regime. Once we have the probability that a couple is not in the always-zero regime we can estimate the probability that they have *k* children following a distribution such as the negative binomial. We estimate models that assume that there is a process that determines whether a couple must always have zero children, and another process that determines, for those not in the always-zero regime, how many children. It is important to note that some couples not in the always-zero regime will have zero children. This model is fully consistent with some of the childlessness during this period being voluntary (Morgan 1991; Tolnay and Guest 1982). There are two types of childless couples in this model: those that cannot have children for biological reasons and those who choose not to have children. Identification of the two types of childless couples arises from functional form assumptions, choice of covariates, or both. In the census data, the only variable that provides information on the likely sterility of a couple is the wife's age at marriage. Based on the estimated sterility rates discussed above, the variable we use to identify possibly sterile couples is whether the wife was 35 or older at marriage.

These two corrections for overdispersion – the negative binomial model and the splitting model – can be used in combination or separately. Which correction or corrections are required to fit the data can actually tell us something about the underlying behavior of the population of interest. Both approaches model overdispersion as the result of unobserved heterogeneity, but they model that unobserved heterogeneity in different ways. The splitting model assumes that this heterogeneity stems from the fact that some fraction of the population is sterile. The need to invoke this assumption implies that the number of couples with zero children cannot be explained in the context of the same distribution that explains the variation in the number of children among those who had children. The negative binomial model assumes a more general form of unobserved heterogeneity, allowing for both heterogeneity between those with and without children and within the population with children. It reveals variation that must be interpreted as variation in fecundity or preferences for children that remains even after controlling for observable characteristics.

Endogeneity

Several of our regressors are likely endogenous, but the one of most concern is the measure of child mortality. Preston and Haines (1991) documented the high infant and child mortality rates in the U.S. in the early twentieth century. Table 2 presents data on the mortality experiences of the women whose fertility experiences were illustrated in Figure 1. A substantial fraction of these women had experienced at least one child death. Almost 70 percent of first-generation Irish immigrants had lost at least one child. Twenty-nine percent of children born to these women died by the census date. The second-generation Irish and native-born also had high child mortality, but not as high as the first-generation Irish. For emigrants from rural Ireland, these high child mortality rates were one of the new conditions they encountered in America. Child mortality in the Irish countryside was low by the standards of the time. However, child mortality in urban Ireland was very similar to that experienced by Irish immigrants in urban America.[7]

Child mortality is expected to influence fertility decisions in a variety of ways. Perhaps most important is the so-called ‘replacement effect’. If couples have a desired family size, we would expect them to ‘replace’ a deceased child with another birth. Testing for the replacement effect, therefore, is a test of fertility control. Variations in this effect would also be evidence of differences in contraceptive intensity. For example if the Irish had a weaker replacement effect than the native population, this is evidence, independent of implied family sizes, of less fertility control among the Irish.

Estimating the replacement effect, however, requires dealing with the likely endogeneity of child mortality. This is more difficult than usual for two reasons. First, there is the mathematical relationship between the number of births and the number of deaths: the number of deaths can never exceed the

[7]See Preston, Ewbank, and Hereward (1994) for further discussion of differences in infant and child mortality by ethnicity and race in 1910.

number of births, thereby inducing a positive correlation between these two variables. One method for dealing with this issue is to convert the mortality variable into the proportion of children who have died and to look at how this is related to the number of births. This is the basic strategy we pursue below. But this does not eliminate the potential endogeneity problem. Parents have some control over the survival chances of their children. Parents who find it difficult to control births (for whatever reason) may choose to invest less in protecting the health of their offspring, in effect using mortality to reduce family size. This link does not require active infanticide; rather, parents may simply not provide as many health-enhancing resources (such as breastfeeding or supervision, both of which require parental time) if they are concerned about having too large a family.

The usual strategy for dealing with an endogenous variable is an instrumental-variables approach. The challenge for fertility studies is that most variables that affect mortality can also plausibly affect fertility. The few fertility studies that have addressed the endogeneity problem have used as instruments variables capturing differences across space in climate and public infrastructure (see Okojie 1991; Benefo and Schultz 1996). Here we experiment with similar instruments: summer temperatures, miles of public water mains per 100,000 persons, and the interactions of these variables. Hotter temperatures, even today, tend to lead to more hostile disease environments, but this was especially true a century ago when the icebox was the most effective means of food refrigeration that was available and many cities were still building their sewer systems. Some of the biggest killers of infants and children in this period were gastro-intestinal diseases. Hot summer temperatures hastened food spoilage and the fermentation of refuse promoting the spread and intensity of these diseases. The U.S. Climate Division dataset provides data back to 1895 on average monthly temperatures and precipitation totals for the 344 climate divisions of the 48 contiguous states.[8] We converted these to county-level data using ArcView software to place each county in the climate division which contains its geographic center. We then calculated the mean summer temperature for the period 1895 to 1909. Water main mileage per capita captures variation across

[8]These data are publicly available at the National Climatic Data Center website: http://lwf.ncdc.noaa.gov/oa/climate/onlineprod/drought/ftppage.html.

cities in the quality of water delivery systems. Troesken (2002) has shown that cities with more dense water delivery systems had lower incidence of waterborne diseases. We use data on water main mileage in 1903 published by the Census Bureau in its report, "Statistics of Cities Having Populations of Over 25,000, 1902 and 1903." These data have two limitations. First, they pertain only to cities with populations of 25,000 or more, requiring that we limit the analysis to couples living in such cities. Second, the report contains data on water main mileage only for cities with public waterworks. 49 out of the 175 cities included in the report had private waterworks. Therefore, we use two variables to capture differences in waterworks across cities: miles of public water mains per 100,000 population and an indicator variable for having a private waterworks. We also use as instruments interactions of the waterworks variables and the mean summer temperature. Safer water delivery systems may have mitigated the effects of adverse climate conditions.

This instrument strategy suffers from a number of shortcomings. It is based on the premise that the exogenous mortality risk faced by a couple is determined by its place of residence. This is problematic for a number of reasons. Although couples cannot control the weather, they do, within their economic constraints, choose where to live. In that sense, climate and public infrastructure are not exogenous to household decisions. Also, conditional on weather patterns, our strategy assumes that mortality risk in a given city was constant over time. In the decades around the turn of the century, however, cities were investing in public health measures and infrastructure that lowered mortality risk. A woman married in 1880 in Philadelphia was likely exposed to a very different mortality regime in the early days of her marriage than a woman married in Philadelphia in 1905. More troubling though is the application of this strategy to the census data. We only know where a couple lived on the census date. A couple which married in Boston in 1900 and moved to Chicago in 1909 will be assigned the same mortality risk as a couple who spent the entire decade in Chicago.[9]

[9]The census recorded the state or country of birth of all individuals enumerated in the census. Therefore, we can identify couples who migrated across national and state borders by looking at the birthplaces of their children who were still at home on the census date. To make this an effective test, we need to look at couples who have all their surviving children at home. So for this exercise, we focus on the sub-sample of couples married fewer than 15 years who had all of their surviving children still at home. About 18 percent of such couples in the urban, non-South had children born outside their current

Following Windmeijer and Santos Silva (1997), we use a two-stage procedure to implement our instrumenting strategy. The number of children ever born to a couple (CEB_i) is modeled as depending on a latent endogenous variable (M_i*) representing an index measure of the general health of the couple's potential offspring where higher values indicate poorer health or a higher probability of mortality. For example, if CEB_i is assumed to follow a Poisson distribution, the model would be specified as follows:

$$CEB_i = exp(\alpha M_i^* + x_{1i}'\beta) + u_{1i}$$

$$M_i^* = x_{2i}'\delta + u_{2i}$$

$$Cov(u_{1i}, u_{2i}) \neq 0$$

This system cannot be estimated directly because M_i* is not observed. But by assuming that the proportion of a couple's children who are dead is a censored measure of M_i*, we use a tobit model to obtain a consistent estimate of δ.[10] We then construct $x_{2i}'\delta$, substitute it for M_i*, and then estimate the model for CEB_i by maximum likelihood. Implementing this procedure requires two adjustments. First, the estimated intercept term for the CEB_i model must be adjusted by $ln(E[exp(\alpha u_{2i})])$. Second, the standard errors of this model must be corrected to take into account the use of an estimated regressor. We do so by bootstrapping the standard errors.[11]

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state of residence. This must be viewed as a lower bound on the degree of mobility of married couples during this era since it fails to capture movements within states. These data also reveal that geographic mobility varied by ethnicity. The Irish had fairly low mobility rates: only 5 percent of Irish-born women had children born outside the U.S. and 7 percent had children born in a state in the U.S. other than the state of residence. In contrast, 15 percent of native-born whites of native parentage had children born in a state other than their state of residence.

[10] For the tobit model, we weight the data by the number of children ever born to deal with the likely heteroskedasticity of the dependent variable.

[11] Windmeijer and Santos Silva (1997) derive the asymptotic standard errors for a similar model in which the first stage is estimated by a logit model. But in our model, we also need to take into account the clustering of standard errors due to our use of city-level instruments. The bootstrapping procedure takes this clustering into account by constructing bootstrap samples by randomly sampling cities and taking all of the household observations for those cities rather than by randomly sampling individual households.

Results

We examine the fertility outcomes of three groups: native-born white women of native parentage, and first- and second-generation Irish immigrants. For this analysis, we use the most inclusive definition of the second-generation: women whose father *or* mother was born in Ireland. The basic sample is women under the age of 55, in their first marriage, who had been married at least one year on the census date.[12] Given the constraints imposed by some of our instrumental variables, we limit the sample to women living in cities of 25,000 or more. We further exclude women living in the South, since few Irish immigrants lived there and fertility rates among the native-born were much higher there than in the rest of the country.

Table 3 presents the descriptive statistics of the variables used in the analysis. Consistent with standard fertility models, we allow fertility behavior to vary with mortality experience, ages at marriage, marital duration, social class, and place of residence. Marital duration is entered as a third-order polynomial to allow fertility behavior to vary over time within marriage . We include husband's occupational class and home ownership as proxies for social class. We also include indicators of the illiteracy of the wife and husband. The place of residence variables include an indicator for living in a large city (population 500,000 or more) and indicators for census region.

In addition to these standard covariates, we include others intended to probe deeper into the role of nativity and assimilation in fertility decisions. We include the nativity of the husband. Spengler (1931) was bemused to find that "in mixed marriages the attitude of the father appears to have been at least as important as that of the mother in deciding the size of the family" (p. 483). For the second generation Irish, we include parental nativity to see how being the offspring of a mixed marriage affected fertility. We also include indicators for whether the wife or husband immigrated as a child (younger than age 13) to see whether spending part of one's formative years in the U.S. affected fertility choices. The percent Irish-born in the county of residence in 1910 is meant to capture the extent to which Irish

[12]The estimated effects of marital duration are sensitive to the inclusion of marriages of less than a year duration due in part to the issue of pre-marital conceptions.

immigrants were concentrated in a particular area and had established communities that reinforced cultural norms. The percent Catholic in the county, calculated as described above, is included to test whether fertility was higher in more Catholic areas.

Table 3 displays the significant socioeconomic gap between the first-generation Irish and the native-born white population. The Irish were much less likely to have husbands in white-collar occupations; they lived in more Catholic counties, and were concentrated in the large cities of the Northeast. The characteristics of the second-generation Irish were much closer to those of the natives, but they too were still more likely to be found in the very large cities of the Northeast. One of the questions addressed below is to what extent can these differences in other observable characteristics explain the differences in fertility?

Which model best fits the data?

The first question to address is: can the data for these three groups be described by the same model? The answer is "no." The pooled model which allows only for different intercept terms for the three groups was rejected at a significance level of 0.05 percent. The fertility differences between these groups were not just level effects; they also reflected differences in the effects of variables such as marital duration and husband's occupation.

The next step is to determine which count model best fits the data for each group. As noted above, the Poisson model is nested in the negative binomial model and the test of whether the Poisson model fits the data is whether $\alpha = 0$. The splitting model and its non-splitting counterpart are not nested. But we can test between them using a Vuong (1989) test which compares models based on their distance from the (unknown) true data generating process.[13] In addition to these test statistics, it is useful to construct the fitted frequency distributions derived from the different models and compare them to the distribution observed in the data. These comparisons will illustrate which parts of the distribution are well-captured by the different models, and which are not. To construct the fitted frequency distribution

[13]Cameron and Trivedi (1998, 184) describe and discuss this test.

for a model, we first calculate the predicted probabilities of being at particular parities for each observation in the dataset. Averaging these predicted probabilities over all observations produces the fitted frequency distribution (Cameron and Trivedi 1998, 155-6).

Table 4 presents the actual and fitted distributions together with the model test statistics for all three samples.[14] For all three samples, the basic Poisson model fails to capture key features of the parity distribution. The failings of this model are most apparent for the Irish data. The Poisson model underpredicts the percent of couples with zero children and overpredicts the percents of couples with 1, 2 or 3 births. The corrections that need to be made to the model to fit the data, however, vary across the samples. In the last column, the results are presented for the model which incorporates both corrections: the splitting (or zero-inflated) negative binomial model. The test statistics indicate that only for the second generation Irish are both corrections appropriate: the estimated α is statistically greater than zero and the Vuong test rejects the model that does not allow for splitting at a significance level of 5 percent. For the native sample, α is statistically greater than zero – indicating that a negative binomial model is required – but the Vuong test fails to reject the no-splitting model. The fitted frequencies for the negative binomial and splitting negative binomial models are indeed almost identical, reinforcing that after allowing for unobserved heterogeneity with the negative binomial model, the splitting model correction is not necessary. For the Irish, the opposite is true: α is not statistically different from zero, but the Vuong test rejects the no-splitting model. For this group, the splitting Poisson model best fits the data.

What do these results tell us about differences in the fertility patterns of these three groups? They tell us first, that childlessness must be interpreted differently in these populations, and second, that after conditioning on the characteristics we can observe, the remaining variation in fertility patterns differs across these populations. In splitting models, the assumption is that there are some couples that are biologically constrained to have zero children; that is, they are sterile. The fact that this model correction is required for the Irish but not the natives, however, does not imply that the Irish were more likely to be

[14]The results presented in Table 4 and discussed here pertain to the models estimated without taking into account the endogeneity of child mortality. The results from the two-stage models, however, produce the same conclusions.

sterile. Note that the percent childless was, in fact, smaller for the Irish than the native-born. Rather, it implies that only for the Irish could the model estimate the probability of sterility. Relatively small fractions of Irish couples had one or two children. In this population, having small families was relatively rare, so observing a couple with zero children is a relatively good indicator that the couple was sterile. In contrast, families of one or two children were common among the native-born population. For this population, we cannot identify the childless by choice from the childless by constraint, and hence, cannot estimate the probability of sterility. This in itself is evidence of differences in the use of fertility control between the Irish-born and the native-born populations. For many native-born, the objective was to have two or fewer births, requiring fairly diligent fertility control starting early in marriage. But such an objective, and hence such fertility control, was rare among Irish-born women.

The fact that the native-born and second-generation Irish samples require the negative binomial distribution, while the Irish-born sample does not, reveals differences in the heterogeneity of fertility decisions within each of these populations. For the Irish, after incorporating the splitting model correction, the variation in the number of children ever-born can be explained by the variation in observed characteristics. For the natives and the second-generation Irish, in contrast, the observable characteristics still leave a significant degree of variation unexplained. For these two groups, allowing for unobserved heterogeneity as incorporated in the negative binomial model, better fits the data. To some extent, these findings make intuitive sense. The Irish-born were a much more homogeneous population – both in terms of genetic background and cultural heritage -- than either the native-born and the second-generation Irish.

Ethnic-Specific Models

Tables 5-7 present the model results for the three groups. For each group, the count model presented is that found to best fit the data as described in the preceding section. Each table presents the estimated marginal effects for two count models: one in which no account is made for the likely endogeneity of child mortality and the other which implements the two-stage procedure described above. The marginal effects represent the derivatives with respect to the regressors of the expected number of children ever-born evaluated at the sample means. For indicator variables such as husband's occupational category, the reported effect represents the change in the expected number of children ever-born due to the discrete change from 0 to 1. The standard errors reported are those of the marginal effects estimates. Alongside these marginal effects estimates are the results of the tobit models for the proportion of children deceased, the first stage of the two-stage procedure. Since the instruments are city-level variables, both the standard errors for the tobits and the marginal effects from the two-stage models have been corrected for clustering of the error terms by city.[15]

In order to examine the power of the instruments, let us begin by considering the tobit models for the proportion of children dead. The instruments do have some explanatory power, at least for the native-born population and first generation Irish immigrants. The chi-square statistic for the joint test of the instruments is 16.11 (p-value=0.0065) for the Irish-born and 22.27 (p-value=0.0005) for the native-born. Both groups had higher mortality in places with higher mean summer temperatures. For the Irish, the coefficient on the indicator of living in a city where the waterworks were run by a private company was positive and statistically significant. However, the interaction of this variable and mean summer temperature was negative. At the sample mean of mean summer temperature, the interaction effect offsets the positive coefficient on the indicator variable, indicating that at temperatures above the mean, having a private city waterworks company lowered child mortality. But disappointingly, miles of public water mains per capita had no statistically significant effect on the proportion of children dead for either group. Even more disappointing is the fact that none of the instruments has any explanatory power for the child mortality experiences of the second-generation Irish. The chi-squared statistic for the joint test of the instruments for this group is 5.33 (p-value=0.3330). This is a somewhat puzzling result. It is difficult to square with our finding that the mortality of the native-born and first-generation Irish was sensitive to summer temperatures.

The differing power of the instruments for the three groups leads to differing findings from the two-stage procedure. For the native-born and first-generation Irish, for whom the instruments have

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[15] The standard errors for the marginal effects estimated from the two-stage procedure were constructed by bootstrapping to take into account the use of a predicted regressor.

explanatory power, the use of the two-stage procedure has a significant impact only on the estimated marginal effect of the child mortality variable. For both groups, instrumenting leads to a blowing up of the standard error of this estimate. For the natives, however, the estimated marginal effect remains statistically different from zero and indicates that couples with children in poorer health had more births. This suggests that the fertility decisions of native couples were based in part on notions of desired completed family size. In contrast, the estimated marginal effect of the mortality index for the Irish is not statistically significant. Irish couples' fertility choices were not apparently affected by the potential mortality of their offspring.

For both groups, the estimated effects of the other variables are fairly similar in the no-instrument and the two-stage models. The small differences between models suggest that the bias due to the endogeneity of child mortality may be small. In contrast, the two-stage procedure produces unexpected results for the second-generation Irish. The effect of the proportion of children dead becomes negative although the standard error estimate also becomes quite large. In addition, the estimated effects of other variables and their standard errors also differ from the no-instrument model. These results are consistent with a problem of weak instrument bias. The fact that the instruments have little power in the first stage means that the effect of the endogenous variable is not identified in the second stage. Note that the variables for which the marginal effects change the most between the no-instrument and two-stage models (e.g., the illiteracy of the husband and wife and the husband having no reported occupation) are those which have the strongest effects in the first stage model for the proportion of the children dead.

These results expose the problems with our instruments. While data on summer temperatures and city waterworks can explain the variation in aggregate child mortality across places, they are less useful for explaining variation in the number of children a given couple would have lost. Due to these problems, the discussion that follows will focus on the results of the no-instrument models. The silver lining here is that the results for the native-born and first generation Irish suggest that the endogeneity of child mortality may not bias the estimates of the effects of other variables in the models.

The basic conclusion that emerges from Tables 5-7 is that the determinants of fertility patterns for the Irish differed in significant ways from both the native-born and the second-generation Irish. The contrasts with the native-born are the starkest. One notable, if expected, difference is in how the number of children ever born rose with marriage duration. Figure 2 plots the predicted number of children ever-born by years of marriage for the three groups. For the Irish, the number of births rose quickly during the early years of marriage and leveled off only after over twenty years of marriage. By contrast, for natives the rise was fairly gradual and the leveling off much less prominent. At every marital duration below 20 years, the slope of the Irish duration curve exceeded that of the native duration curve, indicating that an Irishwoman's propensity to have another birth was greater than that of a native-born woman married the same number of years. Some caution is, however, in order here. These duration effects were measured from a cross-section so they reflect cohort as well as any true duration effects. Nonetheless, Figure 2 indicates that at every marital duration, Irishwomen had on average more children ever-born then their native-born counterparts.

More striking, perhaps, are the differences in the effects of the socioeconomic variables. The native-born fertility patterns exhibited a clear class gradient: white collar families had fewer births than blue collar families, holding all else equal. In contrast, the fertility of the Irish did not vary with occupational class. The families of professional workers were no smaller than the families of unskilled workers. But there were economic differences in Irish fertility patterns: owning a home increased Irish fertility. If one interprets home ownership as a measure of wealth, this indicates that for the Irish, fertility was increasing with wealth.

The estimated fertility models clearly differ between the Irish and the native-born, but to what extent did these differences contribute to the observed differences in fertility patterns? Part of the difference in family size between the Irish and the natives was due to differences in population characteristics and part was due to the differences in the effects of these characteristics on fertility. We want to determine the relative sizes of those two parts. Our approach is to construct counterfactuals asking: What would native fertility have been had natives had the same population characteristics as the Irish and vice versa?

Figure 3 plots the predicted cumulative distributions of children ever-born for first-generation Irish couples and native couples using both the Irish and native models. These distributions are calculated from the fitted frequencies constructed as described above.[16] The solid lines plot the predicted cumulative distributions for the factual populations: the native model was applied to the native data and the Irish model to the Irish data. The dashed lines plot the predicted cumulative distributions for the counterfactual populations: the native model was applied to the Irish data and the Irish model to the native data. Note how the distribution for the counterfactual population generated by the Irish model applied to the native-born data lies only slightly above the distribution for the factual Irish population, implying that giving the Irish the same population characteristics as the native population would have had little effect on the size distribution of Irish families. Likewise, the distribution for the counterfactual population generated by the native model applied to the Irish data lies only slightly below the distribution for the factual native population, implying that giving natives the same population characteristics as the Irish would have had little effect on the size distribution of native families.

To quantify these results, we construct dissimilarity indices for the various pairs of distributions. The dissimilarity index we use is defined as follows:

$$D = \frac{\sum_{j=1}^{J} \left| x_j - y_j \right|}{2}$$

where x_j is the proportion of population X in cell j and y_j is the proportion of population Y in cell j. The value of this index can be interpreted at the proportion of a given population which would have to change cells so that the distributions of the two populations would be the same.

The dissimilarity indices for all the pairings of the three population groups are presented in Table 8. The dissimilarity index for the native-born and Irish-born predicted parity distributions is 0.35, indicating that 35 percent of the native-born would have had to change their number of children ever-born to bring the two parity distributions in line with each other. The contribution to this overall difference generated by differences in other population characteristics can be assessed by constructing a dissimilarity indices for the parity distributions produced by applying a given model to the two sets of population data.

[16]To focus on the effects of variables other than nativity, the effects of husband's nativity and the age of immigration were set to zero for both models.

That is, by comparing the Irish data-Irish model distribution to the Native data-Irish model distribution, or the Irish data-Native model distribution to the Native data-Native model distribution. The dissimilarity indices so constructed are only 0.08 and 0.07. This just confirms what was shown in Figure 1: differences in other population characteristics alone can account for very little of the overall difference in the two parity distributions. In contrast, the dissimilarity indices produced by the two models applied to the same data – hence the model contribution to the overall degree of divergence – are 0.29 and 0.27.[17]

First generation Irish immigrants clearly did not adopt the fertility patterns of the native-born population in the U.S. What about second-generation Irish immigrants? The model describing them could in some ways be described as a hybrid of those for the native-born of native parentage and for first generation. Controlling for all other factors, the number of children ever-born rose more rapidly with marital duration for the second-generation Irish than for the native-born, but not quite as rapidly as it did for the Irish-born. The second-generation, however, like the native born, exhibited clear class differences in fertility with the families of white collar workers being smaller than those of blue collar workers. But as for the Irish-born, fertility was higher for home-owners.

Despite some of the similarities in the models for the first- and second-generation Irish, these models do indicate differences in behavior. The overall dissimilarity index for the first- and second-generation Irish is 0.16. Only about a third of this difference can be explained by differences in other observable population characteristics. Being raised in the U.S. seems to have led to different fertility choices. But these choices were still different from those made by the native-born of native parentage. The dissimilarity index for the second-generation Irish and the native-born is 0.20 and very little of the divergence can be explained by differences in the distributions of other population characteristics alone.

The overall picture that emerges from Tables 5-8 is of persistence of cultural differences in fertility. But there is also evidence of adaptation and change. The strongest evidence, of course, is the difference in fertility patterns of the first- and second-generation. But additional evidence comes out of

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[17]Since the dissimilarity index is not additive, the dissimilarity indices for the population characteristic and model components will not necessarily sum to the overall dissimilarity index.

the variation in fertility outcomes within those populations as well. For instance, Irish-born women who immigrated as children had lower fertility than those who had immigrated as adults. The estimated effect is sizable: immigrating as a child reduced the number of children ever-born by 0.68. Spending part of one's formative years and perhaps attending school in the U.S. led to fewer births. This effect, however, only works through the wife, however. The husband having immigrated as a child had no effect on fertility.

But husband's nativity did affect fertility outcomes, confirming the observation of Spengler (1931). For both generations of Irish, being married to a native-born man lowered fertility, and for the first-generation, so too did being married to a man of any other foreign stock. It is unclear, however, whether such effects reflect selection or an adaptation of behavior. Irish women who married native-born men may have done so in part because they desired fewer children. The results for the second-generation suggest that being the product of a mixed marriage also affected a woman's fertility, but perhaps not as strongly as might have been expected. Having a native-born mother lowered a women's number of children ever born by 0.3.

We find no effect, however, that living in an area with a greater concentration of Irish or a greater concentration of Catholics influenced the fertility behavior of the Irish. This may be due to the fact that the county is too large of a geographic area to look for such an effect. Interestingly, though, the fertility of the native-born population was positively related to the percent Catholic in the county and negatively related to the percent Irish. However, these effects were relatively small. For instance, a one-standard-deviation increase in the percent Irish reduced native children ever-born by 0.19 children.

Was the persistence of fertility patterns unique to the Irish?

Irish-American fertility patterns were persistently different from those of the native-born white population even to the second-generation which was born in the U.S. Were the Irish unique in this persistence? This gets back to the question of whether the cultural constraints on fertility behavior were much stronger among the Irish than other groups, particularly other western European populations. To answer this question we want to compare the Irish to other immigrant groups. But to make these comparisons meaningful, we want to choose other groups that immigrated to the U.S. also in large numbers and had a long enough history of immigration to have a sizable second generation by 1910. Based on these criteria, the natural comparison group is the Germans. Like the Irish, the Germans had been immigrating to the U.S. for generations and had had the opportunity to establish communities and institutions which maintained the cultural traditions of their homeland. Males and females came in roughly equal numbers and stayed, and most were single at the time of immigration. Moreover, a substantial fraction of German immigrants were Catholic.

To make comparisons of German and Irish fertility patterns, we estimated models for the number of children ever born for first- and second-generation Germans, limiting the sample as above to women ages 55 or younger living in cities of population 25,000 or more outside of the South.[18] We then used these models to construct predicted parity distributions for factual and counterfactual populations and calculated dissimilarity indices to quantify the divergence in these distributions. These dissimilarity indices are presented in Table 8.

The overall gap between the parity distribution of the native and first-generation Germans is as large as that between natives and the first-generation Irish. But to a much larger extent than for the Irish, the German divergence can be explained by differences in the distributions of other population characteristics. The overall dissimilarity index for the parity distributions is 0.37; that generated by differences in population characteristics alone is 0.15 or 0.13, depending on the model used. More notably, the divergence between the first- and second-generation was much larger for the Germans. The overall dissimilarity index is 0.28. Even more telling, the overall dissimilarity index for the second-generation Germans and the native population is only 0.11. This contrasts with an index of 0.20 for the second-generation Irish and the native population. By the second-generation, German fertility patterns were very close to the those of native-born whites of native parentage.

[18] Just as for the Irish, the first step was to determine which formulations of the count models best fit the two sets of data. For the first-generation Germans, the splitting negative binomial model was required, while for the second-generation, the negative binomial model was appropriate.

The degree of persistence observed in the fertility patterns of Irish immigrants, therefore, was not a general immigrant pattern. The immigrant group closest to the Irish in terms of the scale and duration of immigration to the U.S., the Germans, did not exhibit such persistence.

Conclusions

A standard explanation of the Ireland's late entry into the fertility transition is that the Irish were "just Irish." Their stubbornly high marital fertility was a cultural rather than economic phenomenon. This is often backed up by the claim that the Irish in the U.S. behaved the same way. We find that this is not the case. Irish immigrants in the U.S. had lower fertility, at least when measured in terms of completed family size, than women in either urban or rural Ireland. This lower fertility may reflect the self-selection of immigrants from the Irish population or else the adaptation of fertility patterns to the economic and social conditions of the U.S. We cannot determine which force was at work given data currently available. But either way, these results raise doubts about the "just Irish" argument. The self-selection story implies that there was more heterogeneity in preferences for children among the Irish than the traditional view allows. The adaptation story implies that the Irish did respond to changing economic and social conditions. Further evidence against the "just Irish" story is the fact that the second-generation of Irish immigrants, those born in the U.S., had much lower fertility than women in Ireland.

However, our findings also reinforce the notion that cultural factors are an important influence on fertility and are slow to change. Irish immigrants to the U.S. did not simply adapt the fertility patterns of the native-born white population. Their fertility remained much higher. The gap cannot be explained by differences in other observable characteristics. Conditional on such characteristics, Irish immigrants had larger families. Even the behavior of the second generation reflects some cultural persistence. Even though the gap was much smaller, the second generation also had larger families than the native born even after conditioning on observable characteristics.

This was not a general immigrant pattern. While the fertility of first-generation German immigrants was also higher than that of native-born whites, much more of the gap between the two could be explained by differences in the distributions of other population characteristics than in the case of the

Irish and the native-born. Moreover, the second generation of German immigrants had fertility outcomes very similar to those of the native-born population. There appears, therefore, to have been an "Irish" component to the fertility patterns of the Irish in America.

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Table 1.—Marital Fertility by Place of Residence and Wife's Nativity
Women Age 45 and Younger, Married 10 to 19 Years

	N	Percent with: zero children	2 or fewer children	6 or more children	Mean children ever born
1911 Ireland[a]					
All Ireland	123,113	8.3%	18.9%	45.3%	5.04
County Boroughs	31,872	9.3	22.2	40.2	4.71
Rural Ireland	91,241	7.9	17.7	47.0	5.15
1910 U.S. Census					
All U.S.					
Native whites of native parentage	7,534	7.6	35.4	23.5	3.76
Irish-1st generation	306	7.8	22.5	33.3	4.54
2nd generation[b]	416	9.4	33.9	25.5	3.86
Urban, non-South					
Native whites of native parentage	1,975	12.8	53.7	9.8	2.69
Irish- 1st generation	270	8.1	21.5	35.6	4.62
2nd generation	315	10.2	34.9	23.8	3.70
1900 U.S. Census					
Rhode Island					
Native whites of native parentage	6,133	17.5	58.7	9.2	2.46
Irish- 1st generation	2,551	7.6	20.6	42.1	4.81
2nd generation	1,990	10.3	29.0	32.0	4.23
Cleveland					
Native whites of native parentage	3,104	15.2	59.7	6.3	2.36
Irish- 1st generation	1,019	8.6	20.2	40.9	4.82
2nd generation	839	8.8	31.1	28.1	3.94
Ohio --rural counties					
Native whites of native parentage	2,808	5.7	37.0	16.8	3.43
Irish- 1st generation	497	5.0	21.9	37.4	4.64
2nd generation	1,291	6.4	30.9	25.2	3.89
Minneapolis					
Native whites of native parentage	2,469	12.7	57.1	5.9	2.44
Irish- 1st generation	272	5.9	22.8	35.7	4.55
2nd generation	575	8.0	30.8	23.1	3.88
Minnesota--rural counties					
Native whites of native parentage	1,439	5.1	37.9	14.9	3.36
Irish- 1st generation	153	7.2	22.2	39.2	4.73
2nd generation	788	4.8	16.0	41.1	4.93

[a]The Irish Census provided tabulations by 5-year age at marriage intervals and 5-year marital duration intervals. The data reported here pertain to women married 10 to 14 years who married before age 35 and women married 15 to 19 years who married before age 30.
[b]Second generation defined as women with both parents born in specified country.
Sources: Census of Ireland, 1911; 1910 IPUMS sample; U.S. Immigration Commission, 1911.

Table 2.—Infant and Child Mortality by Place of Residence and Mother's Nativity, 1910/1911
Wife's Age at Marriage 20 to 29, Marital Duration 25 to 34 Years

	U.S.: urban, non-South			Ireland	
	Natives	Irish	Irish-2nd gen.[a]	Urban	Rural
Mean children ever born	3.47	5.62	5.00	6.59	7.30
Mean number of children dead	0.74	1.65	1.08	1.89	1.30
Proportion of children dead[b]	0.21	0.29	0.22	0.29	0.18
Percent with any dead children	41.4%	69.3%	55.1%		
Number of observations	597	101	107	9,814	42,678

[a]Second generation Irish defined here as women with both parents born in Ireland.
[b]Calculated as the total number of child deaths divided by the total number of births to women in the cohort.

Source: 1910 IPUMS sample; Census of Ireland, 1911.

Table 3.—Descriptive Statistics of Variables Used in Fertility Models

	Natives		Irish		Irish-2nd generation	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Children ever born	2.078	2.128	3.894	3.144	2.973	2.634
Proportion children dead	0.099	0.220	0.171	0.247	0.136	0.242
Wife's age at marriage	22.067	4.523	23.771	4.698	23.190	4.772
Husband's age at marriage	26.097	5.941	27.179	5.837	26.982	5.792
Marital duration	12.282	8.839	14.625	8.768	13.211	8.670
Husband's occupation:						
Professional	0.247	0.431	0.090	0.286	0.202	0.402
Clerical	0.219	0.413	0.082	0.274	0.178	0.382
Skilled	0.239	0.427	0.245	0.431	0.260	0.439
Unskilled	0.275	0.447	0.542	0.499	0.342	0.475
Agricultural	0.009	0.094	0.027	0.163	0.007	0.082
None Reported	0.012	0.107	0.014	0.119	0.011	0.103
Home ownership	0.314	0.464	0.263	0.441	0.297	0.457
Wife illiterate	0.004	0.065	0.026	0.158	0.006	0.076
Husband illiterate	0.003	0.055	0.021	0.143	0.007	0.082
Nativity of wife's parents						
Mother native					0.134	0.340
Mother other foreign stock					0.051	0.220
Father native					0.061	0.240
Father other foreign stock					0.071	0.257
Husband's nativity						
Native	0.671	0.470	0.056	0.230	0.239	0.427
Irish	0.007	0.085	0.643	0.480	0.095	0.293
Irish-2nd generation	0.058	0.235	0.125	0.331	0.376	0.485
Other foreign stock	0.263	0.440	0.176	0.381	0.291	0.454
Wife's age of immigration < 13			0.194	0.396		
Husband's age of imm. < 13	0.032	0.175	0.109	0.312	0.073	0.261
Percent Irish-born in county	0.028	0.022	0.051	0.022	0.041	0.022
Percent Catholic in county	0.191	0.101	0.275	0.080	0.243	0.090
Large city (500,000+)	0.311	0.463	0.611	0.488	0.471	0.499
Northeast	0.493	0.500	0.806	0.396	0.665	0.472
Midwest	0.394	0.489	0.154	0.361	0.254	0.435
West	0.113	0.317	0.040	0.196	0.081	0.273
Wife age at marriage ≥ 35	0.020	0.139	0.030	0.172	0.020	0.142
Mean summer temperature	69.204	2.922	69.050	2.058	69.014	2.584
City waterworks –private co.[a]	0.146	0.354	0.087	0.281	0.110	0.313
Miles of public water mains per 100,000 persons in city[a]	116.003	86.910	98.169	64.508	106.958	69.934
Number of Observations	3,271		624		1,025	

[a]Waterworks data pertains to 1903. Water main mileage only available for cities with public waterworks.
Notes: Sample drawn from 1910 IPUMS. Sample restricted to women under the age of 55, in their first marriage, married at least one year, and living with their husbands in cities with populations 25,000 or more outside of the South.

Table 4.—Actual and Fitted Frequency Distributions and Model Test Statistics

		Actual	Poisson	Splitting Poisson	Negative binomial	Splitting Negative binomial
				Native		
Parity:	0	0.228	0.218	0.233	0.245	0.245
	1	0.263	0.252	0.240	0.251	0.250
	2	0.204	0.198	0.193	0.185	0.185
	3	0.123	0.135	0.134	0.122	0.123
	4	0.069	0.085	0.086	0.077	0.077
	5	0.040	0.050	0.051	0.047	0.048
	6	0.027	0.028	0.029	0.029	0.029
	7	0.016	0.015	0.016	0.017	0.017
	8	0.013	0.008	0.008	0.010	0.010
	>8	0.018	0.009	0.009	0.016	0.016
Alpha					0.127 (0.014)	0.126 (0.014)
Vuong test				1.99 (p-value=0.023)		0.83 (p-value=0.203)
				Irish		
Parity:	0	0.154	0.104	0.153	0.116	0.153
	1	0.120	0.142	0.119	0.149	0.121
	2	0.128	0.140	0.122	0.143	0.124
	3	0.099	0.130	0.118	0.128	0.118
	4	0.114	0.117	0.110	0.110	0.109
	5	0.085	0.100	0.099	0.091	0.097
	6	0.093	0.081	0.083	0.073	0.081
	7	0.075	0.061	0.065	0.055	0.063
	8	0.053	0.044	0.047	0.041	0.046
	>8	0.079	0.080	0.085	0.094	0.088
Alpha					0.070 (0.019)	0.013 (0.014)
Vuong test				3.17 (p-value=0.001)		2.82 (p-value=0.002)
				Irish-2nd generation		
Parity:	0	0.176	0.139	0.179	0.160	0.180
	1	0.184	0.187	0.165	0.195	0.175
	2	0.151	0.176	0.159	0.172	0.162
	3	0.147	0.148	0.138	0.137	0.135
	4	0.108	0.116	0.113	0.103	0.107
	5	0.062	0.086	0.087	0.075	0.080
	6	0.060	0.059	0.062	0.053	0.057
	7	0.038	0.038	0.041	0.036	0.039
	8	0.031	0.023	0.026	0.024	0.026
	>8	0.043	0.029	0.032	0.044	0.040
Alpha					0.115 (0.021)	0.058 (0.019)
Vuong test				3.06 (p-value=0.001)		1.76 (p-value=0.039)

Notes: Reported results are for no-instrument models.

Table 5.—Fertility and Child Mortality Models, Native Sample

	Negative binomial models for children ever-born				Tobit model for proportion children dead	
	No instruments		Two-stage procedure			
	dy/dx	std. err.	dy/dx	std. err.[a]	coef.	std. err
Proportion children dead	1.349	0.099				
Child mortality index			1.256	0.538		
Wife's age at marriage	-0.052	0.007	-0.051	0.008	-0.003	0.003
Husband's age at marr.	-0.016	0.005	-0.020	0.005	0.003	0.003
Marital duration	0.365	0.025	0.341	0.031	0.035	0.012
Marital duration- sqr./10	-0.148	0.016	-0.142	0.017	-0.010	0.007
Marital duration- cbd./100	0.021	0.003	0.020	0.003	0.001	0.001
Husband's occupation:						
(excluded cat., Unskilled)						
Professional	-0.374	0.062	-0.332	0.083	-0.074	0.028
Clerical	-0.359	0.064	-0.303	0.084	-0.084	0.033
Skilled	-0.075	0.063	-0.060	0.071	-0.026	0.026
Agricultural	0.234	0.245	0.293	0.181	-0.111	0.080
None Reported	-0.429	0.168	-0.371	0.206	-0.092	0.091
Home ownership	-0.014	0.054	0.015	0.061	-0.020	0.026
Wife illiterate	-0.267	0.295	-0.400	0.380	0.382	0.151
Husband illiterate	-0.189	0.348	-0.106	3.886	-0.084	0.165
Husband's nativity:						
(excluded cat., Native)						
Irish	-0.292	0.243	-0.280	0.259	-0.049	0.103
Irish-2nd generation	0.524	0.123	0.525	0.118	0.030	0.036
Other foreign stock	0.134	0.061	0.097	0.061	0.031	0.026
Husband's age of imm.< 13	0.056	0.151	0.018	0.126	0.076	0.063
Percent Irish-born in county	-9.509	1.914	-9.228	2.584	-0.288	0.816
Percent Catholic in county	0.786	0.336	0.782	0.398	0.084	0.184
Large city (500,000+)	0.056	0.062	-0.013	0.081	0.024	0.026
Midwest	-0.244	0.063	-0.225	0.073	-0.039	0.027
West	-0.132	0.083	-0.081	0.097	0.011	0.046
Mean summer temperature					0.027	0.010
City waterworks –private co.					1.111	0.794
Miles of public water mains					0.007	0.005
(City ww priv.)*(summer temp.)					-0.018	0.012
(Miles of mains)*(summer temp.)					-1.0E-4	7.3E-5
Constant					-2.148	0.714
Sigma					0.437	0.015

[a]Standard errors for the two-stage model were calculated by bootstrapping to take into account the use of an estimated regressor. Due to the use of city-level instruments in the first-stage, the bootstrap samples were constructed by sampling cities and using all observations from the sampled cities.

Notes: For the tobit model for the proportion of children dead, observations were weighted by number of children ever-born. Standard error estimates for the tobit model are corrected for clustering by city.

Table 6.—Fertility and Child Mortality Models, Irish Sample

	Splitting Poisson models for children ever-born				Tobit model for proportion children dead	
	No instruments		Two-stage procedure[a]			
	dy/dx	std. err.	dy/dx	std. err.	coef.	std. err
Proportion children dead	1.758	0.261				
Child mortality index			1.315	1.376		
Wife's age at marriage	-0.114	0.021	-0.112	0.026	0.003	0.005
Husband's age at marr.	-0.025	0.016	-0.030	0.020	0.005	0.003
Marital duration	0.781	0.086	0.755	0.113	0.066	0.019
Marital duration- sqr./10	-0.310	0.051	-0.300	0.058	-0.025	0.010
Marital duration- cbd./100	0.039	0.009	0.038	0.010	0.004	0.002
Husband's occupation:						
(excluded cat., Unskilled)						
Professional	-0.147	0.236	-0.123	0.357	-0.008	0.050
Clerical	0.187	0.257	0.229	0.321	0.083	0.053
Skilled	0.095	0.169	0.097	0.234	0.007	0.027
Agricultural	-0.100	0.349	-0.122	0.545	0.078	0.103
None Reported	-0.796	0.534	-0.673	6.472	-0.293	0.175
Home ownership	0.354	0.164	0.352	0.233	-0.015	0.039
Wife illiterate	0.830	0.453	0.841	0.447	0.071	0.073
Husband illiterate	-0.755	0.374	-0.801	0.580	0.035	0.106
Husband's nativity:						
(excluded cat., Irish)						
Native	-0.683	0.293	-0.691	0.341	0.052	0.121
Irish-2nd generation	-0.144	0.215	-0.146	0.241	-0.022	0.066
Other foreign stock	-0.784	0.166	-0.803	0.186	0.049	0.055
Wife's age of immigration <13	-0.543	0.173	-0.469	0.279	-0.114	0.044
Husband's age of imm.< 13	-0.044	0.216	-0.111	0.250	0.089	0.047
Percent Irish-born in county	0.503	4.765	-0.250	6.505	2.196	1.191
Percent Catholic in county	1.233	1.096	1.337	1.199	0.092	0.262
Large city (500,000+)	-0.136	0.150	-0.103	0.237	-0.055	0.057
Midwest	-0.023	0.232	-0.036	0.278	0.069	0.055
West	-0.294	0.357	-0.177	4.966	-0.311	0.081
Wife age at marriage ≥ 35	-1.171	0.524	-1.253	0.529		
Mean summer temperature					0.061	0.028
City waterworks –private co.					6.390	2.364
Miles of public water mains					0.016	0.014
(City ww priv.)*(summer temp.)					-0.094	0.034
(Miles of mains)*(summer temp.)					-2.4E-4	2.0E-4
Constant					-4.874	1.984
Sigma					0.325	0.016

[a]As in Table 5.

Table 7.—Fertility and Child Mortality Models, Irish-2nd Generation Sample

	Splitting negative binomial models for children ever-born				Tobit model for proportion children dead	
	No instruments		Two-stage procedure[a]			
	dy/dx	std. err.	dy/dx	std. err.	coef.	std. err
Proportion children dead	1.069	0.210				
Child mortality index			-1.094	1.917		
Wife's age at marriage	-0.056	0.016	-0.052	0.020	4.7E-4	5.0E-3
Husband's age at marr.	-0.035	0.013	-0.041	0.016	-0.004	0.004
Marital duration	0.514	0.063	0.651	0.183	0.085	0.019
Marital duration- sqr./10	-0.180	0.039	-0.240	0.089	-0.037	0.011
Marital duration- cbd./100	0.019	0.007	0.029	0.014	0.006	0.002
Husband's occupation:						
(excluded cat., Unskilled)						
Professional	-0.308	0.136	-0.381	0.181	-0.057	0.053
Clerical	-0.424	0.143	-0.547	0.169	-0.077	0.048
Skilled	-0.110	0.128	-0.259	0.218	-0.082	0.038
Agricultural	-0.700	0.459	-0.650	9.860	-0.003	0.112
None Reported	-1.266	0.296	-1.627	18.583	-0.579	0.260
Home ownership	0.325	0.125	0.311	0.149	0.001	0.042
Wife illiterate	0.349	0.738	1.433	1.460	0.325	0.145
Husband illiterate	-0.181	0.529	-0.661	4.180	-0.316	0.096
Nativity of wife's parents:						
(excluded cat., both Irish)						
Mother native	-0.289	0.156	-0.409	0.231	-0.070	0.069
Mother other foreign stock	-0.083	0.268	-0.168	0.319	-0.033	0.071
Father native	-0.233	0.199	-0.147	0.302	0.065	0.046
Father other foreign stock	-0.178	0.191	-0.291	0.308	-0.089	0.058
Husband's nativity:						
(excluded cat., Irish- 2nd gen.)						
Native	-0.404	0.133	-0.315	0.179	0.051	0.034
Irish	0.298	0.202	0.444	0.264	0.085	0.052
Other foreign stock	-0.086	0.129	-0.118	0.132	-0.011	0.039
Husband's age of imm.< 13	0.089	0.218	0.133	0.271	-0.020	0.066
Percent Irish-born in county	1.922	3.914	2.030	5.734	0.759	1.243
Percent Catholic in county	-0.020	0.730	0.715	1.364	0.379	0.211
Large city (500,000+)	0.041	0.115	0.133	0.209	-0.002	0.043
Midwest	-0.027	0.161	-0.174	0.254	-0.073	0.045
West	-0.131	0.213	-0.018	0.303	0.064	0.061
Wife age at marriage ≥ 35	-0.123	0.431	-0.180	0.301		
Mean summer temperature					-1.6E-3	1.9E-2
City waterworks –private co.					-0.559	1.646
Miles of public water mains					-2.1E-3	8.5E-3
(City ww priv.)*(summer temp.)					0.007	0.024
(Miles of mains)*(summer temp.)					2.2E-5	1.2E-4
Constant					-0.321	1.347
Sigma					0.367	0.016

[a]As in Table 5.

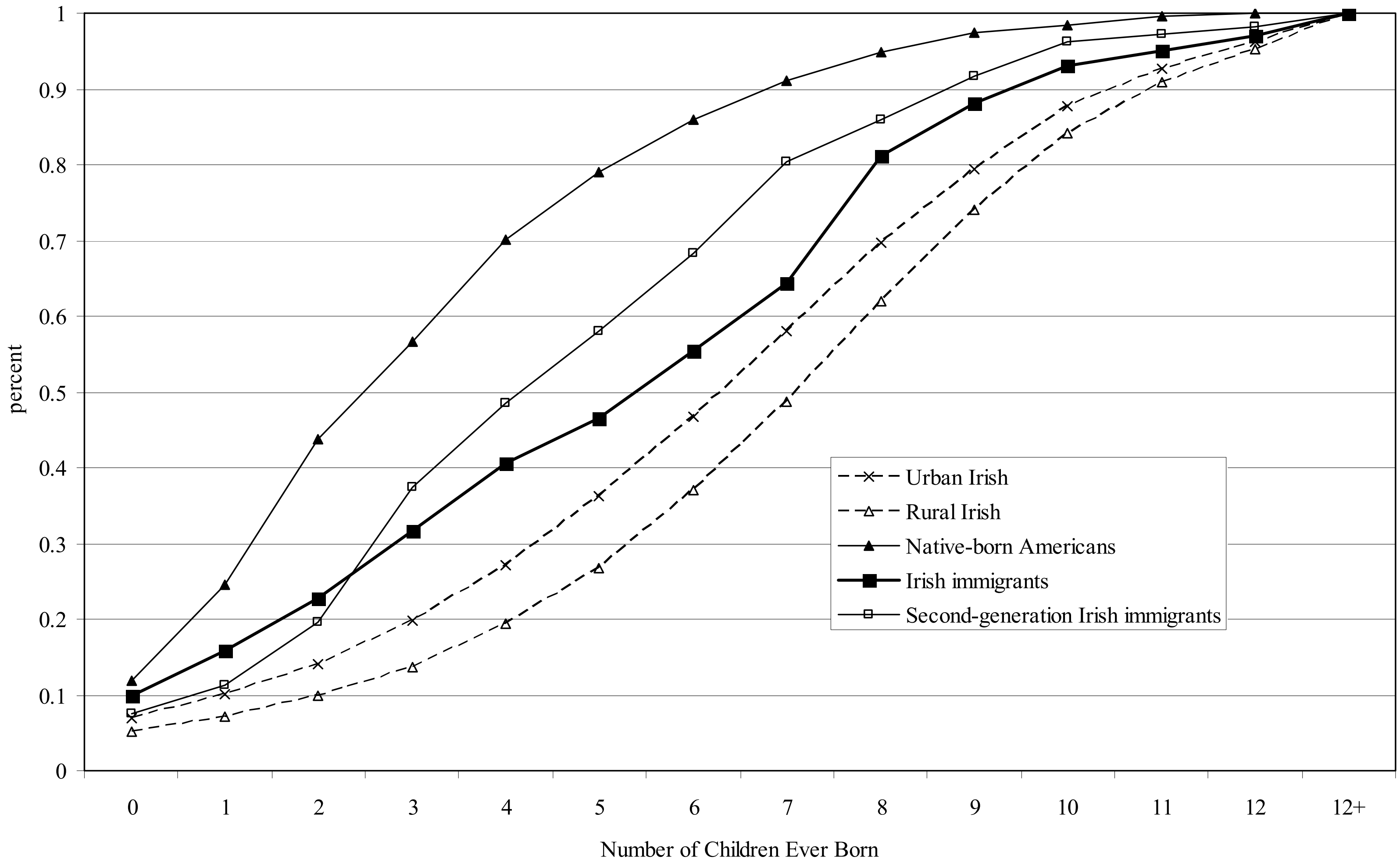
Table 8.—Dissimilarity Indices for Predicted Parity Distributions

		Dissimilarity due to differences in: Other characteristics		Models	
Irish vs. Natives	0.35	0.08	(Irish model)	0.29	(Irish data)
		0.07	(Native model)	0.27	(Native data)
Irish 2nd gen. vs. Natives	0.20	0.04	(Irish 2^{nd} model)	0.18	(Irish 2^{nd} data)
		0.03	(Native model)	0.16	(Native data)
Irish vs. Irish 2nd gen.	0.16	0.05	(Irish model)	0.11	(Irish data)
		0.06	(Irish 2^{nd} model)	0.12	(Irish 2^{nd} data)
Germans vs. Natives	0.37	0.15	(German model)	0.27	(German data)
		0.13	(Native model)	0.23	(Native data)
Germans 2nd gen. vs. Natives	0.11	0.06	(German 2^{nd} model)	0.09	(German 2^{nd} data)
		0.02	(Native model)	0.05	(Native data)
Germans vs. Germans 2nd gen.	0.28	0.13	(German model)	0.18	(German data)
		0.12	(German 2^{nd} model)	0.16	(German 2^{nd} data)

Note: See text for definition of dissimilarity index. In order to focus on the effects of non-nativity variables, predicted parity distributions were calculated after setting the effects of parents' and husbands' nativities and ages of immigration to zero.

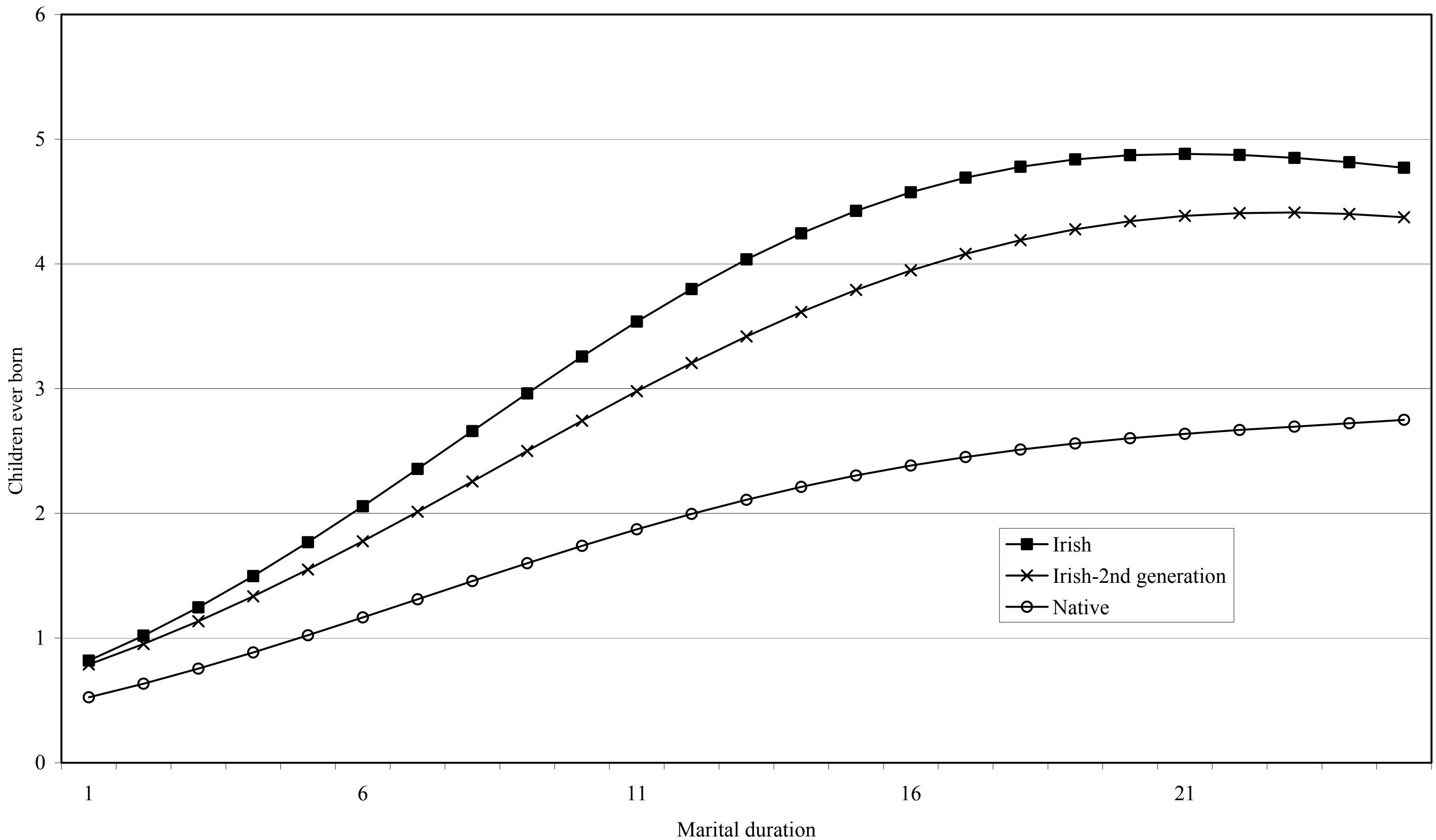
Figure 1.—Fertility in Ireland and the U.S. 1910/1911

Cumulative Distribution of Children Ever-Born
Wife's Age at Marriage 20 to 29, Marital Duration 25 to 34 Years



Notes: U.S. data pertain to women living in urban areas outside the South.

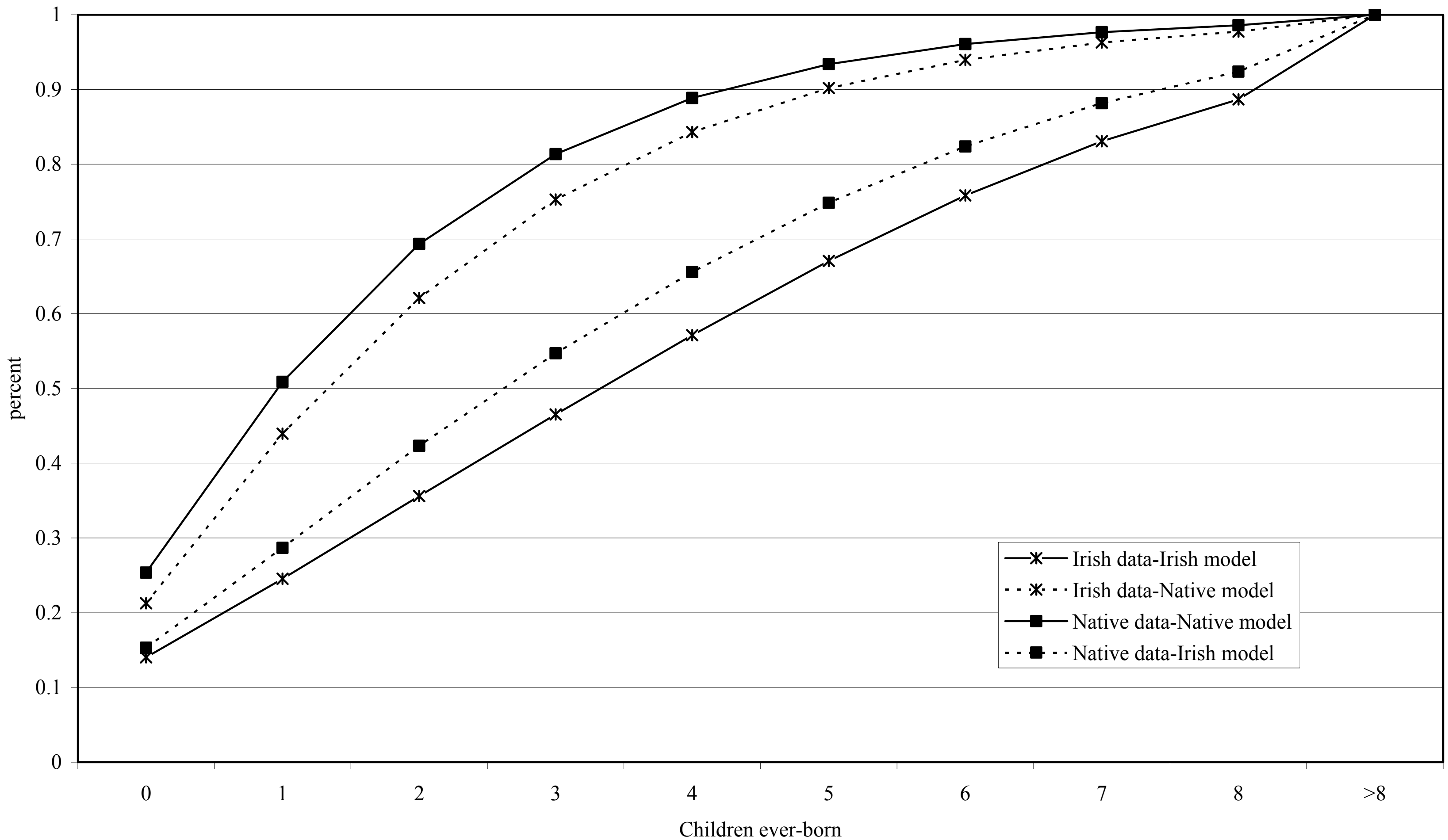
Figure 2.—Ethnic Differences in Duration Effects
Predictions from Count Models



Notes: For all groups, the predicted number of children ever-born was calculated for a baseline couple in which the wife's age of marriage was 23, the husband's age of marriage was 27, the husband had an unskilled occupation, and which lived in a small city (population 25,000 to 499,999).

Figure 3.—Native vs. Irish Fertility: Predictions from Count Models

Cumulative Distribution of Children Ever-born



Notes: Predictions calculated using results from no-instrument models. The effects of husband's nativity and the age of immigration were set to zero to focus on the effects of the non-nativity variables.