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Exhibit P-323



details of the inheritance system provide an important perspective on marriage: the fact that a son was willing to wait a long time to marry, running the risk of never marrying at all, attests to the decline of the institution's importance in rural Ireland. The inheritance system was not an independent influence on marriage, but part of a system in which marriage mattered less than it might otherwise.

Emigration is a second important theme in Irish economic and social history. Irish couples produced more children than the economy could absorb, resulting in an emigrant flow which took over half of many nineteenth-century birth cohorts. Few emigrants were married: young adults had to compare life abroad to a life in Ireland which might or might not entail marriage. Thinking about the relationship between migration and marriage requires an explicit life-cycle framework. Young adults could learn about their opportunities in Ireland only by waiting there; men had to wait to learn whether they would be favored as heirs, women had to wait to see if they would find husbands. Investigating these and other opportunities in Ireland was costly, since every year spent at home was a year foregone in foreign labor and marriage markets. Viewing migration as a question of not just *whether* an individual migrates, but of *when* in his or her life-cycle both explains an important empirical regularity and highlights the role of age dependence in migration and marriage decisions. Women's opportunities in Ireland closed off relatively faster as they aged, since they were valued primarily as bearers of children; women knew their opportunities in Ireland earlier than men, so female emigrants were younger. More than a few young adults probably remained in Ireland by "mistake." They made commitments to life in Ireland counting on opportunities, including marriage, which never materialized. Their willingness to run that risk, however, once again attests to the relative unimportance of marriage.

The dissertation provides new explanations for several features of late nineteenth-century Irish household behavior. An interpretative framework which ties decisions about marriage to the details of the economic and institutional environment portrays the Irish as less an anomalous population than a population facing anomalous circumstances. These results provide a firmer foundation for understanding the contribution of household behavior to Ireland's overall economic performance. In challenging the neo-Malthusian model which underlies most work on marriage and household formation in western societies, the dissertation suggests the need to rethink the relationship between population and the economic environment in other historical contexts.

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Schooling and Occupational Choice in Nineteenth-Century America

Scholarly and popular interest in nineteenth-century immigration to America has always run high.¹ Comparisons between native and immigrant economic performance have been the major focus, especially since Stephan Thernstrom's *Poverty and Progress* (Cambridge, MA, 1964). Those studies utilize manuscript census data as well as city directories to analyze, among other things, intragenerational and intergenerational occupational mobility. The latter involves comparison of fathers' and sons' occupations, the finding being that sons of native parentage occupy a broader range of occupations than immigrants' sons, and that the sons of immigrants seem to follow their

¹ This dissertation was completed in 1987 at the Economics Department of The University of Chicago under the supervision of David Galenson.

fathers' occupations with greater frequency. A primary explanation for these results is given as "noneconomic barriers"—discrimination—a result that was thought to call into question the traditional view of America as the "land of opportunity" for those of all native backgrounds. Another interesting finding, noted, among others, by Lee Soltow and Edward Stevens in *The Rise of Literacy and the Common School in the United States* (Chicago, 1981), is that German parents appear to have sent their children to school at a lower rate than either the Irish or the natives. They explain this result by an appeal to peculiar preferences on the part of people of German birth.

This thesis places these findings in a broader context, and thereby provides an explanation that does not rely either on discrimination or preferences. Specifically, it will be argued that the two sets of results cited above are part of the same structure.

The empirical focus is Philadelphia in 1880. Two large and distinct immigrant groups, the Irish and the Germans, participated in Philadelphia's thriving urban labor market.

The key question addressed is whether, in observing the intergenerational occupational patterns of Irish, German, and native whites, a coherent explanation of those patterns can be supported that does not rely on nativity. The economic theory brought to bear is the human capital investment model as applied to the family. Parents are assumed to maximize an intergenerational utility function, the arguments of which are parents' own consumption and the future utility of their children. To give the latter observable content, let parents care only about the future incomes of their children, which are influenced by investments in the childrens' human capital made today. Clearly this model assumes parental altruism. At this point the model is quite generic, and must be adapted to historical reality. In this regard the first thing to note is a focus on sons, since the labor-force participation rate of women in 1880 America was very low.

A more important modification of the basic framework is to note that nineteenth-century parents had two basic means of investing in their sons' human capital—schooling or some form of apprenticeship. The issue is to what extent and in what ways these two differed in relative cost. In this analysis an occupation was considered apprentice-based if reference to apprentices could be found in the census data being used. Since this period was one of transition with regard to training for occupations of many types, some apprentice-based occupations had begun to disappear in their traditional form. It was therefore decided that in addition to consulting secondary sources about the nature of occupations, the data would be permitted to speak for themselves.

Turning back to the schooling rates, if one examines those for the Irish, Germans, and natives, the rate for German sons is significantly below that for the Irish or natives. As mentioned earlier, this occurs despite the Germans' significantly higher incomes as compared to the Irish. Interestingly, the schooling rate for German daughters is insignificantly different from that of the Irish. Resolution of this apparent anomaly can be found in a careful consideration of the family investment process.

Consider two types of families—in one the father has a craftsman occupation, in the other a "white collar" job. Consider now the relative costs to each family of investing in the two forms of training—schooling and apprenticeship. There is much evidence to support the notion that, all other things being equal, the craftsman will find the relative cost of apprenticeship for his son to be lower than the relative cost of apprenticeship for the son of a white-collar father. Consider finally a third occupation—unskilled worker. Again, the relative cost of apprenticeship will be lower for the craftsman's son—implying that sons in unskilled families should in fact have higher schooling rates than the sons of craftsmen, other things equal.

Note that in the argument thus far, no mention is made of nativity. In nineteenth-century America, Irish, Germans, and natives possessed markedly different occupational distributions. The Irish in Philadelphia were over 50 percent unskilled, the

Germans were almost 50 percent craftsmen, and the natives were distributed fairly widely. The relative-costs-of-training argument implies that an appropriate stratification of families is not by nativity, but by father's skill type. Furthermore, what matters is not the level of the skill type but rather the degree to which apprenticeship plays a role in the training for the occupation.

Following this discussion I offer three main hypotheses which must find mutual support for the relative-costs argument to hold. First, the schooling rate of sons must be negatively related to craftsman status of the father. Second, the intergenerational match rate of fathers' and sons' occupations must be significantly higher for craftsman occupations. (Note that it is critical that the son be observed in his first mature job, not at an age comparable to his father's. The point is to observe occupational transference from father to son.) And third, the schooling rate for daughters must be insignificantly related to craftsman status of the father.

To highlight the importance of the joint support of all hypotheses, consider, for example, if only the first held. Then a conclusion that craftsmen have a distaste for schooling could not be ruled out. If only the second held, then the inference might be drawn that craftsmen simply follow tradition. If both of these hypotheses hold, as well as the third, the overall story of constraints as the operative force in occupational patterns is more credible.

Finally, the implication is that when skill type is correctly controlled for, the schooling rate should be less significantly, or insignificantly affected by nativity. Note that this structure does not rule out the possibility that nativity might continue to exert independent effects on schooling and occupational matching, it simply allows such an observation to be distinguished from the effects of correlated variables such as skill type. Thus discrimination, or preferences, are viewed as residual to the analysis.

Turning to the results, all three hypotheses were supported by the data. Examining schooling rates of sons and daughters by nativity alone, German rates exhibited the pattern mentioned above. When broken down by age, the drop-off in German rates was even more apparent for apprentice-aged boys (15 to 19). When the breakdown included father's skill type, the differences by nativity virtually disappeared. Finally, in regressions of the schooling rate of sons on several independent variables, the strong significance of a negative German dummy variable disappeared when skill type of the father was entered. In fact, the German variable turned insignificantly positive. The skilled crafts variable was strongly negative, and was of greater magnitude when the regressions were performed on apprentice-aged boys alone. When these same regressions were performed on daughters, there was no significant impact on the already insignificant German variable when skill was entered, and the latter was itself insignificant. Furthermore, the explanatory power of the daughters' regressions were roughly half that for sons.

In the occupational match analysis (father and son having the same occupation was considered a match), the overall German rate was significantly higher than for either of the other two. However, that result was the product of the high concentration of Germans in the skilled trades. When broken down by skill type, the German rates were substantially the same as for the Irish and the natives. Finally, the matching rate for craftsman fathers for all three nativities was much above those for any of the remaining six occupational categories. Carrying the argument to regression analysis, matching was strongly related to craftsman status of the father, and the omission of craftsman status caused a German dummy variable to be significantly positive.

The following conclusions emerge. Anomalies in German immigrant schooling behavior can be explained by the disproportionate weight of craftsmen in the German occupational distribution. Families appear to have made systematic choices concerning their sons' training that were partially a function of relative prices. One can view coherently the persistent "unbalanced" intergenerational occupational distributions for

immigrants by relying on relative costs, not tastes or discrimination. (Another way to say this is that initial conditions mattered.) And finally, it is clear that to observe fathers and sons outside the family context prevents a full appreciation of the causal mechanisms involved.

In summary, it appears that when faced with occupational choices and schooling decisions, an important factor to families of varied nativities in nineteenth-century urban America was the type of skill possessed by the father, not simply the country of origin.

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Movements in Aggregate Price Uncertainty in the United States: 1884–1981

Aggregate price uncertainty is an unusual variable to place at the focal point of macroeconomic analysis, which more often deals with measuring and explaining changes in real output growth, unemployment, the price level, or interest rates.¹ However, aggregate price uncertainty, which refers to the lack of confidence a typical hypothetical individual may have had in his or her forecast of the aggregate price level for the next year, is also an important variable to examine since estimating it allows evaluation of the dramatic change in monetary regime which many argue occurred after the creation of the Federal Reserve.

The traditional view of commodity money standards, such as the gold standard in the late nineteenth-century United States, is that they will provide stability in both the exchange rate and the aggregate price level. But the years from the 1879 resumption of the gold standard until the establishment of the Federal Reserve in 1914 were not characterized by price-level stability; the price level was generally falling until 1896 and generally rising thereafter. The gold-standard years may have been characterized by price-level predictability, however, especially when compared to the period after World War II. Thus, the benefits usually claimed for commodity money may have been present in nineteenth-century America even though the price level was unstable; this possibility is investigated by estimating measures of aggregate price uncertainty.

A number of different measures of price uncertainty, six series in all, are estimated. Two reasons make several uncertainty measures necessary. First, it is unclear which implicit model of the price level would best parallel that of a typical forecaster. Each of the measures proposes a different macroeconomic model, which summarizes, hypothetically, the way in which forecasts were made. Second, the measure of uncertainty is computed as the variance of the forecast error; its computation depends on the assumed statistical properties of the model which is estimated. There are three measures of uncertainty common in the literature: one derived from a moving regression approach to estimation, a second from the ARCH measure and a third from the Multi-State Kalman Filter (MSKF). Since there is no general agreement on which is the best method of forecasting or of computing uncertainty, each is estimated.

Two of the uncertainty statistics, the moving regression series and the MSKF series, are *ex ante* measures of uncertainty. In these estimates only information dated before the year of the forecast is used in computing parameter estimates. This is an important feature of an uncertainty measure since it closely parallels the situation a hypothetical

¹ This dissertation was completed in 1987 at the Economics Department of the University of North Carolina at Chapel Hill under the direction of Roger N. Waud and Robert E. Gallman.