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# WOMEN'S STATURE AND MARRIAGE MARKETS IN PREINDUSTRIAL BAVARIA

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*The authors investigate marital patterns among Bavarian women born 1819 to 1886. In particular, Becker's hypothesis concerning heights and probability of marriage, namely, that likes tend to marry likes, is considered. The authors find to the contrary that the shortest women were at a distinct disadvantage in the marriage market. Other characteristics that lowered the probability of ever marrying included birth in northern Bavaria, lower class status, and illegitimate birth. It is concluded that the height-marital status relationship sheds light on the wage premium paid to married workers: The premium probably reflects greater productivity that (1) existed prior to marriage and (2) increased the likelihood of marriage.*

Relationships in the past between demographic phenomena and anthropometric measures have been little studied. We consider the potential effect of women's height on the decision to marry in a preindustrial German society. The fruitfulness of an anthropometric approach to historical demography is suggested by the work of economic historians to associate height and weight data with standard-of-living variables such as wages or national incomes. Here, we examine height as a cause of nuptiality rather than as an effect of living standards.

Patterns in nuptiality may provide a key to understanding subsequent demographic changes that were mediated by trends in nuptiality. Demographers since Malthus have acknowledged that marriage occupied a "central position . . . in the long-term fluctuations of population within the pre-industrial European demographic regime."[1] Marriage tended to be late in western Europe and celibacy common, as Hajnal found.[2] As a beneficial result, the lack of universal and early marriage may provide sufficient variation in nuptiality to allow for statistical hypothesis testing.

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Study of the anthropometric-nuptiality relationship in the past has been hampered by the lack of suitable data. Most samples of heights or weights consist of people such as soldiers or students, most of whom were too young at the time of measurement to have been married. Studies of European nuptiality commonly use parish registers, which have yielded a wealth of data on age at marriage, family structure, and literacy but which lack anthropometric data. A recent review issued a call for historical demographers to consider data sources other than parish registers.[3] The present study uses data compiled from prison records to examine whether height played a role in female marriage opportunities in the past. Although the sample is far from random, it is representative of a large class of poor and working class women and yields insights into the marriage decision not available from other sources.

Anthropometric data express the health and nutrition of people in a variety of places and times. Relationships in the past between stature and per capita income, stature and real wages, and stature and nutritional availability have all been demonstrated, although not without some scholarly contention.[4] Relationships with demographic variables have been suggested as well. Komlos found a positive relationship between height and fertility in eighteenth-century central Europe.[5] Costa and more recently Murray independently confirmed a complex, nonlinear relationship between body-mass index (BMI) and mortality that had been proposed by Fogel for past populations, based on extrapolation from present-day studies such as those of Waaler.[6] Whaples detected a positive relationship between BMI and nuptiality among Slovak men who had immigrated to America in about 1900.[7] Whether such relationships were typical in Europe, and among women, has not been studied.

## DATA

Our article examines the anthropometric-nuptiality relationship among a sample of women who were imprisoned at Wasserburg, Bavaria, about 45 km east of Munich. Although there were three women's prisons in Bavaria at that time, it appears that only the Wasserburg records have survived. The data set initially consisted of 3,178 women who were incarcerated between 1860 and 1906. We included in the subsample of prisoners whose heights were analyzed only those women twenty to forty-nine years of age so as to eliminate those in middle age and older who had begun to lose stature. The subsequent sample used for analysis numbered 2,496. Birth cohorts of women in the sample began in 1819 and continued to 1886. The present data set records continuities that extend from just after the Napoleonic and Revolutionary Wars (1815) through the absorption of Bavaria into the German Empire (1871) to the initiation of Bismarck's social insurance programs (1884). Thus, it offers a picture of marriage patterns of Bavarian women during a period of relative quiet, between two eras of great social change.

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The sample of prisoners from Wasserburg has many characteristics found in other samples of criminals that have proven useful for historical analysis. On incarceration, the prisoner's name, birth year, birthplace, marital status, crime, sentence, and legitimacy at birth were recorded.[8] The manuscript volume also contains a short description of the woman's own occupation if she had never been married and of her husband's occupation if she was married or widowed. Finally, the prisoner's height was also recorded, presumably for identification purposes, because some "wanted" circulars from the era survived that list a suspect or escapee's height. We may thus specify several characteristics of our subjects that may have influenced their marriage prospects.

The quality of height measurement appears to have been good. Heights recorded before 1871 were measured to twelfths of inches; later measurements were in full centimeters. There was no evidence of strong age or height "heaping," in which reported values center disproportionately on a few numbers, such as those ending in 0 or 5. The universe of adult heights is known to be distributed as a normal random variable. Testing for normality with the Shapiro-Wilk test showed each decade-long birth cohort except that of the 1860s to have been distributed normally.[9] Normal distribution of heights suggests that the Wasserburg sample has some characteristics of a sample representative of all Bavarian women, but we do not believe that the Wasserburg sample is truly representative in any meaningful way. We simply note that for most of the birth cohorts, the data in this sample behave in ways typical of other samples of heights used in historical analysis.[10]

Use of prison data invites comment on the representativeness of the sample. In concert with scholars of Anglophone prisoners and historians of German criminality, we believe that our sample consists not of members of a permanent criminal underclass but of relatively poor and young workers and peasants who occasionally stole out of economic necessity. There may have been a professional criminal element in Bavaria at this time, but we excluded prisoners who had previously been convicted of a felony (*schwerverbrechen*) from our sample specifically to circumvent this problem, as well as to eliminate any possibility of double counting. Far and away the most common crime was theft. Combined with fraud and possession of stolen goods, theft broadly defined led 71.6 percent of our sample into prison.

The age structure of the women (that is, females older than the age of twenty) in our sample and of all Bavarian women of the late nineteenth century, according to the 1882 Bavarian census, differed substantially.[11] Given that the women in our sample were much younger than average, it was to be expected that the proportion of Wasserburg women who had ever been married was much less than the proportion married among all Bavarian women. Two-thirds of the Wasserburg women were younger than the age of forty, whereas only about half of all Bavarian women were younger than forty years of age. The low proportion of wives and widows followed from the age structure: Two-thirds of the prisoners twenty to fifty years of age were single, but only one-third of all Bavarian women of that age had never been married (see also Table 1).

According to occupational data listed in the logbook, those occupations that afforded greater opportunities for theft were overrepresented. The categories of farmhand, clothes maker and cleaner, domestic servant, and food processor accounted for more than two-thirds of the women in our sample. Studies of German criminals in the past suggest that women were much more likely to commit theft-related crimes

Table 1
Proportions Ever Married by Age and Decade of Birth

| Decade of Birth | Age Group | | | |
|---|---|---|---|---|
| | 20-24 | 25-29 | 30-39 | 40-49 |
| 1819-1829 | | | .20 | .38 |
| 1830-1839 | | .23 | .26 | .61 |
| 1840-1849 | .06 | .13 | .49 | .81 |
| 1850-1859 | .13 | .29 | .55 | .72 |
| 1860-1869 | .09 | .32 | .49 | .56 |
| 1870-1886 | .03 | .17 | .35 | |
| Total | .08 | .19 | .37 | .58 |

Source: State Archive Munich, JVA Wasserburg, Eingangsbuch I-III, 1860-1906.

than violent crimes, both in absolute terms and relative to men, and that women's theft rates were very sensitive to economic difficulties.[12] Age and occupational biases may actually enhance the usefulness of the sample. Overrepresentation of women who were younger, and thus more evenly divided between the married and single, adds power to statistical tests of human capital and marriage. Similarly, if height and marriage prospects were related positively, overrepresentation of women who were servants and farm workers—jobs that required physical strength and hence should have provided an attractive wage premium to larger people—should enable us to tease out evidence of such a relationship, if it existed.

## THEORIES OF MARRIAGE

We approach the study of nuptiality through the metaphor of the *marriage market*. According to such models, couples match through a process in which each prospective spouse evaluates various characteristics of the other. Although some of these factors are not of great economic interest—such as hair or eye color—others are heavily influenced by parental decisions to invest in nutrition, health, or education early in a person's life. For some of these characteristics, likes are hypothesized to marry likes, and for others, couples are hypothesized to differ. Gary Becker has hypothesized that height is among the attributes that attract likes to likes.[13] Although Becker supposed that height is determined primarily by genetic factors, average final adult stature is more commonly thought to be heavily dependent on environmental conditions.

Average height in a large sample represents the residual of quality and quantity of nutrition, after deductions for fighting illness, work intensity and duration, and basal metabolism. Hence, height is often said to reflect *net nutrition*. Nutritional intake, disease, and workload in turn often depend on nutritional, medical, and sanitation expenditures, which may be considered as investments in human capital that lead to improved net nutrition and thus greater stature. Variation in present-day heights is not as useful as variation in past heights for understanding differences in net nutritional experience during the growing years, since present-day Westerners experience almost uniformly healthful net nutritional conditions in their growing years. Thus, to examine the relation between net nutritional status and marriage prospects, we look to the past for suitable data.

The language of the marriage market has been used by narrative historians in studies of marriage decisions of nineteenth-century German women. Jacobi-Dittrich's analysis of several middle- and upper-class women's autobiographies discusses "searching for and selecting a husband," with those women of poorer circumstances forgoing the search altogether due to their low probability of success.[14] Meyer's biographical sketch of a middle-class woman describes the subject's "marketing" efforts "to catch a husband whose nobility and wealth were sufficient to make him worthy of marriage."[15] Even among the lower classes, the metaphor held. Schulte noted that in Bavaria, farmers' maids, who constituted 44 percent of the Wasserburg sample, oriented their lives toward their future marriage. Even among the poorest such women, potential husbands would carefully consider the ability of their future wives to contribute financially to the family's well-being. Indeed, of particular value was the knowledge held by the husband of the wife's potential ability to work hard, a characteristic for which stature would serve as a suitable proxy.[16]

Potentially, analysis of nuptiality can shed insight into wage premiums paid to married workers—a common finding in present day labor markets. Whaples has marshaled an impressive set of evidence to propose that a marriage premium paid to nineteenth-century American men was much smaller, if in fact it existed at all, in the past than in the present.[17] Married women in his collection of samples were paid more than the unmarried, with the largest premium accruing to women who held jobs that could be expected to reward physical strength—a reasonable proxy for which is stature. Because Whaples focused on unmarried males, no further analysis of the women was conducted. In our analysis, we make an implicit assumption that a marriage premium was available to women as well as men. To the extent that this height-wage relationship was caused by the ability of larger men and women alike to perform more strenuous physical labor, this relationship should have been stronger in the past, when more jobs involved physical labor—for example, working on a farm, as noted above.

Theoretical explanations of marriage premiums can be grouped into two categories by direction of causation. In rough terms, by one hypothesis the marriage caused the wage premium, and by the other the wage premium caused the marriage. The first theory proposes that the act of marriage causes a man (typically the discussion proceeds in terms of men, who are more likely to be household heads than women, but the discussion could proceed in terms of women) to work harder. The incentive for greater productivity could be positive (for example, the nutritional and emotional support provided by his wife) or negative (for example, the fear that his unemployment would harm his newly founded family). Thus, the act of marriage would cause greater productivity, which would then be rewarded with higher wages.

Alternatively, men with greater productive capacities may be more likely to enter marriage if women are more attracted to more productive men than they are to less productive men. Of course, women may find taller men more physically attractive as well, but that is still consistent with this hypothesis. That is, men with certain characteristics that are rewarded in the labor market also happen to find that these same characteristics are rewarded in the marriage market. An example of such a characteristic could well have been height. We have strong reason to believe that stature is positively associated with wages. In a sample of rural Filipino families, Bouis and Haddad found that among women and men alike, greater stature was associated with a higher daily wage. Among women, this held true both in low-wage tasks such as

weeding and high-wage tasks such as harvesting.[18] Similarly, Margo and Steckel found in a sample of American slaves that an additional inch of height raised the value of a slave by 5 percent.[19] Height thus acts as a signal of high earnings potential on the part of the prospective husband, in addition to whatever physical attractiveness being tall may confer on him. In this case, the wage premium awarded to larger men, due to their greater productivity, increases the probability of marriage.

Distinguishing between these two theories requires that a prospective spouse be able to estimate his or her potential partner's human capital attainment before marriage, if this were to play a role in the marriage decision. While it is true that many societies have associated height with physical beauty, it is also the case that height reflects human capital accumulation, that is, the net effects of those nutrition and health care efforts that were expended during the growing years. While numerous difficulties attend attempts to measure quality of nutrition, the burden of disease, and the costs of dealing with illness, final adult height can be easily observed. To an important extent, it is the result of investments in good (that is, expensive) nutrition and health care. And, critically, unlike the husband's productivity according to the first hypothesis described above, height of spouses who marry after the cessation of growth will not change as a result of the marriage. Assuming that the above arguments pass through for women as well as men, which seems reasonable, a greater probability of marriage for taller women than for shorter women would support the theory that the wage premium, associated with greater height, raises the probability of marriage rather than vice versa.

## EMPIRICAL DATA
## ON BAVARIAN NUPTIALITY

We use data from the prison at Wasserburg to examine patterns in the tendencies of nineteenth-century rural, lower-class Bavarian women to marry. Especially in the later nineteenth century, these women were given more autonomy in choice of marriage partner than had previously been the case.[20] We examine how they exercised that autonomy.

Table 1 shows the proportion of the sample that was ever married (that is, either married or widowed at incarceration) by age and birth cohort. If greater wealth induces earlier marriage, the origins of many of the Wasserburg criminals in the peasantry would naturally lead to the relatively low proportions of women who were not married at the time of their incarceration. By comparison, a study of contemporary factory workers in nearby Württemberg showed an average age at first marriage for agricultural women of twenty-nine years, and a study of Bavaria as a whole estimated it at twenty-six years of age.[21] Because the average age of all women in the Wasserburg sample was thirty-one, and less than a third of the sample had ever been married, the average age at first marriage among the Wasserburg women must have been much higher than that of the Württemberg women.

Mean values of the independent variables can be seen in Table 2. Thirty percent of the women in the sample had ever been married. Ninety-five percent of the women were from rural areas or the smaller cities; only 5 percent were from Munich. Women in the Wasserburg sample were mostly from the lower and working classes; we judged from their occupational descriptions that just 9 percent could have been described as middle class.[22] A third of the women in our sample had been born illegitimately, a high

## Table 2
### Nuptiality Index by Category

| Variable | Share of Total | $I_m{}^*$ |
|---|---|---|
| Middle class | .09 | .658 |
| Lower class | .91 | .226 |
| Legitimately born | .67 | .417 |
| Illegitimately born | .33 | .196 |
| Born in northern Bavaria | .09 | .192 |
| Born in southern Bavaria | .91 | .258 |
| Height < 150 cm | .12 | .173 |
| 150 cm ≤ height ≤ 165 cm | .82 | .262 |
| Height > 165 cm | .06 | .279 |
| Born before 1850 | .61 | .218 |
| Born 1850-1859 | .18 | .347 |
| Born after 1860 | .21 | .302 |
| Entire sample | 1.00[a] | .251 |

Source: State Archive Munich, JVA Wasserburg, Eingangsbuch I-III, 1860-1906.
Note: $I_m{}^*$ = nuptuality index.
a. N = 2496.

proportion even by the standards of the day; other estimates of Bavarian illegitimacy suggested peak rates of less than one-fourth around midcentury.[23] The average height of 156.2 cm placed the average woman in this sample in only the seventh centile of modern German standards, suggesting relatively poor net nutritional conditions for these women throughout their childhood.[24]

From Table 1, the gradual increase of proportion married with later age was as expected. Variation by decade of birth in Table 2 was only somewhat consistent with Bavarian demographic history. Inspired by Malthusian theories, Bavarian authorities raised property and age requirements for marriage in the hopes of inducing lower birth rates among the poor and thus ultimately diminishing the number of poor themselves. The result instead was a soaring rate of illegitimacy among those not owning any property.[25] With the relaxation of such property requirements, marriage rates increased in the later part of the century. Among the Wasserburg sample, however, Tables 1 and 2 show a decline in marriage rates among those women born after 1860.

Given the skewed age distribution of the Wasserburg sample, average age at first marriage is not as useful a statistic as it would be with a more representative age distribution. An alternative is the index of proportion married, $I_m$, as described by Knodel in his work on German fertility at this time. Here,

$$I_m = (\Sigma m_i F_i)/(\Sigma w_i F_i),$$

where $w_i$ is the number of women in the $i$th five-year age interval from 20 to 49; $F_i$ is the fertility of married Hutterite women in each age interval, thought to be the greatest sustained schedule of fertility on record; and $m_i$ is the number of married women in each five-year age interval.[26] In this case, rather than simply divide the number of married women by the number of all women, the numerator and denominator of this index are themselves each a weighted average, that is, weighted by Hutterite fertility rates at each age group. The index, then, is weighted so as to give greater importance to the proportion of women married who are in their most fertile years.

Although $I_m$ is a reasonably intuitive measure of the proportion of women married, it is more sensitive to the age distribution of women than we would like. Calculation of the nuptiality index $I_{m*}$ can be expected to be more useful than the index $I_m$.[27] This index is defined, using the symbols used above, as

$$I_{m*} = (\Sigma F_i[m_i/w_i])/(\Sigma w_i F_i).$$

If the age distribution of women is rectangular (that is, if there are equal numbers of women in each age group), then the two indexes are identical. The greater usefulness of $I_{m*}$ follows from the fact that it is insensitive to variations in age distribution. Knodel found, using German data from the late nineteenth and early twentieth centuries, that the two indexes are highly correlated. These data can be used for comparisons with the Wasserburg sample. The overall Wasserburg $I_{m*}$ was .251, which is relatively low. By comparison, $I_{m*}$ for all Bavaria rose from .410 in 1867 to .516 between 1867 and 1910.[28] Some segments of the Wasserburg sample, however, appear to have had nuptiality patterns similar to those in the general population. For example, the legitimately born had an $I_{m*}$ of .417, which is roughly within the range of the overall population.

Variations in nuptiality according to several characteristics of the women in the Wasserburg sample can also be seen in Table 2. Clearly, marriage was much more common among the middle-class women than among the lower-class women. Also, women born to married parents were much more likely to have been married than were the illegitimately born. Geographically, Knodel found a marriage gradient within Bavaria as of 1900, with the southernmost regions (Niederbayern, Oberbayern, and Schwaben) having the lowest proportions married ($I_m$). We were able to identify the small proportion of women born in northern Bavaria in this sample, but they had even lower proportions married than did the southerners. Here, possibly, the sampling process involving prisoners has created a bias in our sample. Within the entire Bavarian sample, the height-marriage relationship was evident. The correlation coefficient between average height and $I_{m*}$ among the seven regions with at least fifty observations (Bayerischer Wald, Donau Ost, Donau West, Franken, Oberbayern Süd, Oberpfalz Nord, and Schwaben Süd) was .60. Finally, there was a visible gradient of married status across height categories, with $I_{m*}$ increasing across the three height groups. The greater nuptiality of average and tall women as compared to the shorter women is especially noticeable.

To examine the effect of height on marriage while holding other compositional factors constant, we conducted logistic regression analyses (Table 3). Logistics is a type of regression analysis especially adapted to study binary dependent variables such as marital status. Because we were interested in the effects of height on the probability of a woman ever having been married, we set the dependent variable equal to 1 for a woman who was married or widowed and set it to 0 for one who was single.[29] Thirty percent of the women in the sample had ever been married. The parameter estimates in a logistic regression represent the effect of an independent variable on the dependent variable, holding the other independent variables constant. The magnitude of the effect, however, is not clearly given by the parameter estimate. For that, a transformation is necessary that requires evaluation of the variables at their means and that leads to the column headed $\partial P/\partial X$, a symbol denoting the effect of the variable on the probability of ever having been married.[30] Because the independent variables are all binary

*Table 3*
Logit Regression: Influences on Probability of Ever Having Been Married

| Variable | Parameter Estimate | SE | $\partial P/\partial X$ | p |
|---|---|---|---|---|
| Constant | −2.73 | 0.27 | | .0001 |
| Age 25-29 | 1.14 | 0.19 | .21 | .0001 |
| Age 30-34 | 2.08 | 0.20 | .39 | .0001 |
| Age 35-39 | 2.89 | 0.21 | .54 | .0001 |
| Age 40-44 | 3.31 | 0.23 | .62 | .0001 |
| Age 45-49 | 3.87 | 0.25 | .72 | .0001 |
| Born 1819-1829 | −1.79 | 0.23 | −.33 | .0001 |
| Born 1830-1839 | −1.15 | 0.18 | −.22 | .0001 |
| Born 1840-1849 | −0.29 | 0.16 | −.05 | .07 |
| Born 1860-1869 | −0.25 | 0.21 | −.05 | .22 |
| Born 1870-1886 | −0.59 | 0.22 | −.11 | .01 |
| Middle class | 1.62 | 0.18 | .30 | .0001 |
| Height < 150 cm | −0.40 | 0.17 | −.08 | .02 |
| Height > 165 cm | −0.04 | 0.22 | −.01 | .86 |
| Born southern Bavaria | 0.59 | 0.20 | .11 | .003 |
| Illegitimate | −0.63 | 0.11 | −.12 | .0001 |

*Source*: State Archive Munich, JVA Wasserburg, Eingangsbuch I-III, 1860-1906.
*Note*: Omitted categories: age 20 to 24; born 1850 to 1859; lower class; height between 150 cm and 165 cm; born in northern Bavaria (i.e., Franken); legitimately born. $\partial P/\partial X$ = effect of the variable on the probability of ever having been married.

themselves, the $\delta P/\delta X$ column gives the difference in probabilities of ever marrying between the variable named in that row of the first column and the omitted category of that variable. Thus, for example, relative to those women in their early twenties, women in the Wasserburg sample twenty-five to twenty-nine years of age were 21 percent more likely ever to have been married; women thirty to thirty-four were 39 percent more likely ever to have been married; women thirty-five to thirty-nine were 54 percent more likely, and so on.

Probability of ever having been married was influenced by several other factors. Because the omitted birth cohort was that of the 1850s, the negative coefficients on the other cohort variables indicate that marriage probability increased to midcentury, because women born in the 1820s were about a third less likely ever to have married than those born in the 1850s. Marriage probability then went into a slow decline, with those born in the 1870s and 1880s about a tenth less likely ever to have married, holding age constant. Probability of ever having been married was 30 percent higher for women of the middle class than for women of the lower classes, and this result was statistically significant. Bastard status continued to haunt Bavarian women into their adulthood. For two young women born in the 1850s, identical except for the marital status of their parents, the one who had been born illegitimately was 12 percent less likely ever to have been married. These findings were all consistent with the $I_{m*}$ estimates for the currently married only in Table 2.

The effect of height on nuptiality differed slightly from the $I_{m*}$ estimations in Table 2. Shorter women were 8 percent less likely to have been married than the omitted group, that is, women of average height. This result was statistically significant at the .02 level. Evaluation of the derivative at the means suggested an 8 percent lower probability of marriage for shorter women, holding other characteristics constant. How-

ever, unlike in Table 2, taller women were no more or less likely than were women of average height ever to have been married, as indicated by the insignificance of the coefficient for tall women, which was also small in magnitude.

Thus, we find that shorter women were at a disadvantage in the marriage market in general, and that this disadvantage existed even after controlling for other age, cohort, and social factors. However, the slightly higher $I_{m*}$ for taller women seems to have been an artifact of these compositional factors, leaving us with partial confirmation of the height-marriage relationship. These results were robust to other specifications of the height variables.

## CONCLUSION

Our findings indicate a positive relationship between women's height and marriage prospects. We find weak evidence, based on the nuptiality index $I_{m*}$, that taller women were favored in the marriage markets of nineteenth-century Bavaria. We find strong evidence that stands up to controls for age, cohort, and social factors that shorter women were about 8 percent less likely to marry than women of average height. These findings inform our understanding of economic causes and consequences of marriage. Reasoning by analogy from studies of men, taller women must have been better able to perform physically demanding jobs than could shorter women. Hence, we might expect that taller women would earn a higher wage in the labor market. Because height was established before marriage and not subject to change after marriage, we hypothesize that stature may have acted as a signal of earning capacity. Thus, one attraction to men of a taller woman was the higher income that she could bring into the family when employed. Thus, this study supports the claim that wage premiums paid to married workers derive from characteristics of the worker and not from behavioral changes induced by the act of marriage.

These results carry implications for theories of the demographic transition. Because there is evidence elsewhere of a positive height-fertility relationship, a positive height-nuptiality relationship opens the possibility that height cycles played a role in the decline of European fertility. In particular, if the women most likely to marry were taller and hence more fertile, the decline of fertility suggests an important role for contraception within marriage, as distinguished from trends in age at first marriage. Although this statement is speculative, it is consistent with data from anthropometric-demographic studies and may indicate fruitful areas of future research.

## ACKNOWLEDGMENTS

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17. R. Whaples, "The Marriage Premium in Historical Perspective," mimeo, Wake Forest University, North Carolina, 1991.

18. L. J. Haddad and H. Bouis, "The Impact of Nutritional Status on Agricultural Productivity: Wage Evidence from the Philippines," *Oxford Bulletin of Economics and Statistics* 53 (1991): 45-68.

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20. W. Kaschuba, "Peasants and Others: The Historical Contours of Village Class Society," in Evans and Lee's *German Peasantry*, 235-64.

21. H. Schomerus, "The Family Life-Cycle: A Study of Factory Workers in Nineteenth-Century Württemberg," in *The German Family: Essays on the Social History of the Family in Nineteenth and Twentieth Century Germany*, ed. R. J. Evans and W. R. Lee (London: Croon Helm, 1981), 175-93; W. R. Lee, "Germany," in *European Demography and Economic Growth*, ed. W. R. Lee (New York: St. Martin's, 1979), 179.

22. A certain amount of arbitrariness attends any attempt to divine class status from an occupational description. We associated occupations such as *dienstmagd* (servant maid) or *tagelöhnerin* (day-wage worker) with lower-class status and others such as *bahnaufsehersfrau* (wife of railroad inspector) and *bauersehefrau* (wife of yeoman farmer) with middle-class status.

23. W. R. Lee, "Bastardy and the Socioeconomic Structure of South Germany," *Journal of Interdisciplinary History* 7 (1977): 404-06.

24. P. B. Eveleth and J. M. Tanner, *Worldwide Variation in Human Growth* (Cambridge, UK: Cambridge University Press, 1990), 228.

25. J. Knodel, "Law, Marriage, and Illegitimacy in Nineteenth Century Germany," *Population Studies* 20 (1967): 279-94; Lee, "Bastardy and the Socioeconomic Structure," 403-25; E. Shorter, "Bastardy in South Germany: A Comment," *Journal of Interdisciplinary History* 8 (1978): 459-69; J. Baten and J. E. Murray, "Bastardy in South Germany Revisited: An Anthropometric Approach," *Journal of Interdisciplinary History* 32 (1997): 47-56.

26. J. Knodel, *The Decline of Fertility in Germany* (Princeton, NJ: Princeton University Press, 1974), 33-36. Knodel provides the following estimates for $F_i$ in terms of births per married woman per year in each age group: age twenty to twenty-four, .550; age twenty-five to twenty-nine, .502; age thirty to thirty-four, .447; age thirty-five to thirty-nine, .406; age forty to forty-four, .222; age forty-five to forty-nine, .061.

27. Knodel, *Decline of Fertility*; the original sources for these indexes is A. J. Coale, "The Decline of Fertility in Europe from the French Revolution to World War II," in *Fertility and Family Planning*, ed. S. J. Behrman, L. Corsa, and R. Freedman (Ann Arbor: University of Michigan Press, 1969), 3-24.

28. Knodel, *Decline of Fertility*, appendix table 2.1. See also J. Knodel, *Demographic Behavior in the Past: A Study of Fourteen German Village Populations in the Eighteenth and Nineteenth Centuries* (Cambridge, UK: Cambridge University Press, 1988), 126, which shows a decline in age at first marriage in the Bavarian villages from about thirty-four in the 1840s to about twenty-eight in the 1890s.

29. In common with other studies, $I_{m*}$ was estimated above only for women who were currently married at the time of their imprisonment. The results we find were robust to specifications using either "presently married" or "ever married" as the nuptiality variable.

30. See G. S. Maddala, *Introduction to Econometrics* (New York: Macmillan, 1988), 277.