The Fertility Transition in Munich:

First Results

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Abstract

The population registration system for Munich in the nineteenth and early twentieth century recorded not just the demographic information typical of most population registration systems, but data on internal migration, taxes paid, poor law receipts, and other social and economic information. The period 1860-1914 spans the fertility transition in Munich as well as in most of Bavaria, the German state that is Munich's home. We have collected a sample of 5000 couples from this period and are using this database to study the role of migration, religion, economics, and other forces in the fertility transition in Munich. This paper reports our first results from a portion of the full sample. These results demonstrate the power of the sample by showing important differences in the fertility of couples of different religions, socio-economic status, and birthplaces, findings that do not fit easily into received views of the European fertility transition.

In 1800, most areas of Germany were characterized by very high marital fertility, with women bearing six or more children in their lifetimes. Population growth rates were checked, if at all, only by the many who did not marry, by high mortality, or by significant out-migration. By 2000, few German women had even two children, and Germany's population size was maintained only by immigration. The process by which fertility fell from high levels to below-replacement levels remains a poorly-understood but critical part of human history. The fertility transition as it is called is now history in most parts of the world, but is an active process of great interest to policy-makers in other parts of the world. This paper is a first step in a long-term project that uses the German case, and more specifically the city of Munich and the surrounding state of Bavaria, to revisit earlier interpretations and to advance our understanding of the fertility transition. Our primary source is a 5000-couple sample drawn from the city of Munich's population registration system (the *Polizeimeldebögen*, or PMBs). This system collected demographic as well as economic and social information on virtually anyone born in or who moved to Munich in the period 1860-1914. Using this data is quite complex, and at this stage we can report only a preliminary round of analysis. These first results are, however, sufficient to suggest serious problems with received interpretations of the fertility transition, as well as to indicate the power of the PMBs for this purpose.

Our stress in this paper is on digging into the PMBs rather than historiography or theoretical models of fertility and its decline. Most research today on the fertility transition in western Europe is shaped by the results of the European Fertility Project (EFP) undertaken by the Office of Population Research at Princeton University in the 1960s and 1970s. The EFP produced several individual country monographs as well as many individual papers and a summary volume. The various contributions are rich and detailed, and differ in some respects from the conclusions advanced in the summary volume.

To understand the “Princeton view” it helps to use a distinction associated with Carlsson (1966). Carlsson divided explanations of the fertility transition in two groups — innovation/diffusion or adjustment. The first explanation states that the adoption of fertility control within a population represents a new behavior. The origins of this behavior may be new knowledge or changes in the moral acceptability of contraception. This view implies that high fertility prior to the transition reflects the population’s lack of ability to control fertility or unwillingness to do so on moral grounds. The adjustment explanation states that fertility control reflects couples' adaptation to changing economic and social circumstances. High, pretransition fertility is interpreted as couples' response to economic and social conditions just as falling fertility is believed to reflect their assessment of the changing costs and benefits of children.

The innovation/diffusion interpretation of fertility transitions differs from the adjustment interpretation in two empirically-testable ways. The innovation view implies that a fertility transition represents the diffusion of a *new* behavior. In addition, simultaneous fertility transitions in widely varying economic and social circumstances are consistent with the innovation/diffusion view, but not with the adjustment view. This is the real heart of the European Fertility Project stress on innovation and diffusion. One influential statement concluded that “Despite the great diversity of their socioeconomic characteristics, the countries of Europe had one striking factor in common when fertility declined: time itself … With the exception of the forerunner, France, and a few stragglers, such as Ireland and Albania, the dates of decline were remarkably concentrated” (Knodel and van de Walle 1986, p. 412). In their more general criticism of "demand theories" of the fertility transition, Cleland and Wilson concur: "clearly the simultaneity and speed of the European transition makes it

highly doubtful that any economic force could be found which was powerful enough to offer a reasonable explanation" (Cleland and Wilson 1987, p. 18).[1]

We cannot, in this paper, engage in the extensive discussion necessary to outline alternative views of the fertility transition and place them in context. One point is worth noting here, however. Many adherents of the Princeton view see the project's results as showing that economics had nothing to do with the fertility transition, as suggested in the statement of Cleland and Wilson. Even if we accepted the Princeton project's characterization of the empirical record — which we do not — this would be unfair both to economic interpretations and to the EFP. Demographers have tended to assert or assume that an innovation/diffusion process has nothing to do with economics. This is not true, of course; an innovation can itself be economic, and the diffusion process can be shaped by economic forces and economic change.

Our larger point amounts to four reservations about the common methodology underlying the European Fertility Project, reservations we simply list here but discuss at length in Brown and Guinnane (2001a) and demonstrate empirically for Bavaria as a whole in Brown and Guinnane (2002). First, the units of analysis in the EFP were too large and internally heterogenous. As we have shown in the most recent paper, the units Knodel used for Bavaria were so large that they masked considerable decline in fertility in the 1880s. We are working with the PMBs because we view individual-level data as critical to meaningful tests of the competing views of a fertility transition. Second, the definition of fertility control and the index chosen to detect the onset of fertility control are problematic. The Princeton studies defined the fertility transition as the point where the index of marital fertility Ig first fell by ten percent. Guinnane, Okun, and Trussell (1994) show, drawing on simulation results first reported in Okun's dissertation, that this ten-percent criterion is consistent with

[1] Alter (1992) provides a nice overview of competing explanations of the fertility transition.

fairly widespread, extensive control, and more generally Ig is too blunt an instrument to be a reliable indicator of the fertility transition. Okun constructed several plausible simulations in which large minorities of couples were practicing effective contraception without registering a ten-percent decline in Ig. Third, the explanatory variables used in most European Fertility Project studies were crudely defined, and do not support meaningful tests of the role of social and economic change in the fertility transition. Few of what the Princeton project calls an economic variable can be traced to economic reasoning about fertility and its decline. Most studies construct an estimate of the proportion of the labor force that works in agriculture and rely on that variable alone as an indicator of the potential role of economics in the fertility transition. Fourth, the statistical methods used in most European Fertility Project studies were not adequate to the task, and in many cases do an injustice to both the Princeton Project' interpretation and those it criticizes. This final objection is more pertinent to the use of aggregate data on fertility than to the couple-level data explored in this paper. Most of the Princeton studies confined themselves to aggregate data.

Our aim is to revisit the fertility transition in a way that is immune, so far as possible to these four reservations. In this paper we present some background on the city of Munich and the PMBs, discuss some empirical observations that would be at variance with the Princeton view, and then present some early results. The focus of our project is now the PMBs. Four earlier papers provide more background than can be detailed here. Guinnane (In press) is a general survey of German population history in the period 1800-1990, and sets the fertility transition in the larger context of population changes. Brown, Guinnane, and Lupprian (1993) describes the registration system and the value of the PMBs for historical reseach. Brown and Guinnane (2001a) is a critique of the methods used by the EFP. Our central point is that the EFP's conclusions are not necessarily incorrect so much as premature; the sources and methods used in that project cannot adequately distinguish between the

Princeton view and alternatives to that view. Brown and Guinnane (2002) used detailed district-level data for the German state of Bavaria (of which Munich was the capital) to study the fertility transition in Munich's hinterland in the period 1880-1910. This last paper also substantiates, for the Bavarian case, some of our methodological concerns about the EFP's approach.

1. Munich and the PMBs

As the capital of the Kingdom of Bavaria, Munich was representative of many of the other middle-sized cities of Germany that served primarily administrative and marketing functions through the middle of the nineteenth century. With the creation of the German customs union (*Zollverein*) in 1834, the southern region of Bavaria surrounding Munich known as Upper Bavaria began to benefit from the availability of markets for grain outside of the kingdom. The expansion of the railroad network in the 1850s to include north-south and east-west trunk lines lowered the cost of Bavarian grain and beer in neighboring regions of Germany, and Upper Bavaria prospered. A survey of earnings in agriculture from 1853 found that male day laborers earned about seventy percent more in Munich than in the surrounding districts of Upper Bavaria and female day laborers earned about 10 percent more.[2] Upper Bavaria, in turn, registered day wages that were 10 to 20 percent higher than elsewhere in the kingdom.

Along with purely administrative functions, the city supported the attendant court and cultural life expected of the *Residenzstadt* of the second-largest German kingdom as well as the high quality manufactures and highly skilled craftsmen to support the court life. Although census data are of limited

[2]"Der Anbau, Ertrag, Besitzverhältnisse, und Lohn der Landbauarbeiter in 1853,"*Beiträge zur Statistik Bayerns,* 1857, vol. 7, p. 6.

use in determining occupational breakdowns until the 1880s, Wiest (1991, Table 7.2) has used the city directories that were in turn based upon official city registration data to provide the outlines of employment. In the mid-1840s, the city of Munich included 15,000 households. Of these, over one-third were employed in the government , one-third were owners of businesses in either wholesale or retail trade or production, and one-tenth were in the liberal professions (see Table 1).

The 1850s marked the beginning of an upswing in Munich's economic fortunes that lasted through the late 1860s. Expansion of brewing and the establishment of two heavy machine-making firms, the Krauss and Maffei locomotive works, marked a period when the city's population grew by two percent a year.[3] By the time of the establishment of the German Empire in 1871, Munich's population of about 170,000 (and 180,000 within the boundaries of 1900) ranked fifth among all German cities. After a pause during the early 1870s, Munich's growth reasserted itself as it shared in the rapid expansion of German cities before the First World War. By 1910, its annual growth rate of over three percent had moved it into third place among large German cities. The city's population was 600,000 and it was the center of an urban agglomeration that ranked fifth after Berlin, Hamburg, Dresden, and the Ruhr industrial city of Essen.[4]

The sources of this growth were outside of the government sector that had dominated the Munich economy in the 1850s. Instead, the growth in employment was concentrated in machine-making, the hospitality industry, cleaning and personal hygiene, wholesale and retail trade and transportation. The share of government and the court in employment fell to about 20 percent.[5] In

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[3] The growth rates pertain to the area of Munich within the boundaries of 1900. See Fisch (1988, Table 3).

[4]Schott (1912), *Beilage* Tables 1 and 2.

[5]See Fisch, (1988, Tables 5a and 5b) and "Berufs- und Gewerbezählung"(1911, Table 2).

addition, the building sector declined in importance. The net result of this growth was an increase in jobs demanding high-skilled wage workers; by 1905, they and the salaried workers made up a third of household heads. Another measure of the expansion of the Munich economy is the upward pressure on the real wage paid a day laborer. The real wage of female and male day laborers rose by about 20-25 per cent between 1884 and 1910.

Two other features of Munich's urban growth during the period up to the First World War merit note. First, it shared with most other German cities a dramatic increase in the average population density. Schott (1912, Table 4) notes that from the early 1870s to 1910, population density in the "inner agglomeration" of Munich more than tripled. By 1910, only Hamburg, Leipzig, and Berlin, with its famous "rental barracks" tenements, had a denser urban core. How much this development influenced the cost of housing is difficult to chart. Fisch (1988, Table 14) draws upon data from housing censuses and assessments for tax purposes that suggest a notable shrinkage of the share of lowest-priced dwellings. The results of the housing censuses that were completed in conjunction with the population censuses offer some clues as well that have the merit of controlling for the size of the apartment. The median annual rent of a three-room apartment in the working class districts of the West End rose from about 300 Marks in 1890 to 432 Marks by 1905, or an increase in real terms of about 25 percent.[6] Fisch (1988, pp. 14-15) notes that one other sign of the relative scarcity of housing was the widespread practice of households renting either a room or simply a bed to a non-family member. From the 1880s through to almost the First World War, the share of these households remained at about one-quarter. Urban development and the active policy of the city administration also worked to remove one group of low-cost dwellings from the market, the *Herberge*. Rented or sold as

[6] See "Wohnungsstand und Mietpreise" (1906, p. 20) and "Bericht über die Ergebnisse der Volkszählung in München vom 1. Dezember" (1895, Appendix Tables). The adjustment for the cost of living uses the index found in Desai (1968).

individual units of larger, often ramshackle buildings, the *Herberge* offered low-income Munich residents an opportunity to buy a small dwelling at a price equivalent to two or three years' salary. The dwellings sold at such discounts because of their poor condition and primitive sanitation.[7]

The changes in Munich's economic structure also brought about an expansion in the employment opportunities offered to women. Shifting definitions and the difficulty of classifying those who were reported to be "without an occupation", but nonetheless in the labor force, makes a clear-cut comparison over longer periods of time difficult. Nonetheless, the data from the occupational census of 1882 suggest that already then, women made up about one-third of the Munich labor force. As Figure 1 suggests, labor force participation rates among married women were already at 5 to 10 percent. Growth in the sectors that disproportionately employed women boosted the employment of married women substantially. Although the share of women in the labor force dropped a bit below one-third, married women now made up more than a quarter of those employed.[8] The detailed data available for Munich in 1907 summarized in Table 2 suggest that about one-half of employed, married women worked outside the home. The remainder were divided evenly between those who worked in the home (primarily in the needle trades as seamstresses in the clothing industry or embroiderers) and those who owned their own shops, typically a small grocery or fruit and vegetable market.

Figure 1 shows that the trend towards greater employment of married women also affected women in their child-bearing years, particularly during the last surge of growth in the 25 years before

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[7] See Fisch (1988, pp. 8-9). Most of these were found in the primarily working class districts of Au, Haidhausen, and Giesing that had been annexed in the mid-1850s.

[8] "Berufs- und Gewerbezählung" (1911, Table 2). One problem with comparing German occupational censuses for the period before 1914 is a change in the practice of including family members working in the business of the head of the household (or another family member.) The 1907 census made a particular effort to count these "*mithelfende Familienangehörige*." The comparable detailed results that are available for 1895 suggest that change in this group accounts for a minuscule share of the increase. See the discussion in Ritter and Tenfelde (1992, pp. 212-213).

the First World War. The figure offers the age-specific labor force participation rate for married women in Munich for 1875 through 1907 for ages 20 and above. The rise in labor force participation of married women is unmistakable. By 1907,about one-quarter of married women was in the labor force.[9]

The brief summary of the key developments in Munich's economic development over the sixty years prior to the First World War provides a background to understanding the most notable features of Munich's demographic changes during this period. Figure 2 presents General Marital Fertility Rates for Munich and four other large German cities: Berlin, Frankfurt am Main, Breslau, and Essen.[10] These five cities were among the ten largest German cities from 1867 to 1913. Rates for all five cities register the affect of the Franco-Prussian War of 1870-1871 in a drop off in 1871 and a period of recovery thereafter. Although Munich's fertility rate in the mid-1870s was among the lowest of the four cities, the dramatic decline that set in at the turn of the century parallels the decline elsewhere. By 1880, marital fertility in Munich closely tracked the pattern for Berlin, with a significant departure most notable when fertility in Munich stabilized during the mid-to-late 1890s. To some extent, the divergence may actually result from shifts in the age distribution of the population of women of child-bearing years. An alternative that takes account of fertility rates of different age groups is the Princeton index of marital fertility, I_g. Laux (1983:Table 3) presents calculations of I_g that permit comparison of Munich with the 70 to 80 largest Prussian cities in 1880 and 1905. Laux

[9]A comparison with the labor force participation rates for married women found in Goldin (1990, Table 2.3) suggests that the Munich rates are twice those reported for married women in urban areas in 1920 for the United States.

[10] Brown and Guinnane (1991) extend this list of comparison cities to include Nuremburg and Dresden. Those additional cities also closely resemble Munich in their General Marital Fertility Rates.

classified the Prussian cities by their predominant industry. The decline of I_g in Munich was larger in absolute and percentage terms than the decline for all but the Prussian textile cities.

Two features of Munich's demographic patterns are typical of southern Germany, and thus set it apart from some other German cities. Bavaria has long been justifiably famous for both relatively high infant mortality rates and for high levels of illegitimacy. Infant mortality and illegitimacy were more common in Bavaria and Austria than in most other German-speaking regions at the turn of the twentieth century (Knodel, 1974: tables 2.1 and 4.6 and Marschalck, 1984, table 3.20). Munich's infant mortality declined significantly between 1871 and 1910 (from 417 deaths per 1000 to 166 per 1000) in response to improvements in public sanitation and other factors. The percentage of all births that were out of wedlock remained roughly constant over the same period. Historical demographers do not agree on the causes of south German illegitimacy patterns (Shorter, 1975).

Finally, one other feature of Munich's demographic development bears merits a closer look. Urban growth itself may influence urban fertility if migrants from rural areas had different fertility behavior. With a rate of natural increase that averaged about 1.1 percent, Munich's average annual growth of about 3 percent depended heavily upon in-migration. By 1900, a large majority of adults in Munich were not native to the city. Comparing Munich to seven other large German cities, we found that the share of young adults (those aged 16-30) born in the city as of 1900 was lowest in Munich (Brown and Guinnane,1991, Figure 6). Most of these migrants came from the less industrialized southern region of Bavaria.

2. The Polizeimeldebögen as a Source for Historical Demography

The PMBs have been available for use in the Munich City Archive since the early 1980s, but the overwhelming use has been by genealogists. There has thus been little reason to document the data

contained in the 1.2 million-odd records included in this collection or to examine their suitability as a micro-data source for historical demography. Organized alphabetically (last name, first name) and then by birth date, each PMB is actually a folder typically containing two different forms: one with more economic information, the other with more detail on family size and origins. While fifteen different forms were in use at various times during this period, the formats of the five forms that are used for most of the PMBs are quite similar. They include two to four sides with blanks provided for the name, birthdate, etc. and columns for information (e.g., taxes, births) that changes over the course of residency. Notations on the form provide the remaining data (see Lupprian,1992, Appendix). The records in the PMBs were kept on individual forms for all male heads of families (and their wives and/or children), single adult males and females, and minor children in the labor market residing in Munich. All demographic and tax data were continuously updated from the date the records were first set up (beginning in 1825) to the date the couple left Munich until about 1912.[11]

The PMBs cover nearly all of the core demographic data found in data sources from parish registries or population registers of the kind discussed in Alter (1988), Gutmann and van de Walle (1978), and Watkins and Gutmann (1983). (See Table 3.) These data include places and dates of birth of all family members upon entry. In addition, they generally *include* the migrant population excluded from sources such as INED or the *Ortssippenbucher* used by Knodel.[12] In contrast to the sparse

[11] For the period prior to 1825, it is apparent that recording of births and deaths was incomplete. For some of the records (the *Steuer-*, *Haupt-*, and *Quartierbögen*), an analysis of rates of infant mortality confirmed by examining the handwriting on the forms concluded that births were incompletely recorded prior to 1891. Fortunately, for most of the records in the sample, additional (and continuously updated) information is available from the records maintained by the police (the so-called *Fremden-*, *ECL III-*, *DCL II-*, and *Familienbögen*).

[12] For the period prior to the modernization of the laws of settlement that governed access to Poor Relief in 1868, the PMB system generally excluded include individuals who had not been granted the right of a legal domicile in Munich.

information on occupation and socio-economic standing of both alternative sources, many of the PMBs collected by this project have considerable detail on occupation, income and wealth taxes paid, business and property holdings, and receipt of poor law relief. For many of the longer-term residents of Munich, crucial data on family resources and occupation are available over the life cycle.

Along with the occupations of the father of the family head (and frequently of his father-in-law), the PMBs record the family head's occupations (more often than not written in chronological order). In a large minority of cases, taxes on earned income and income from financial assets, updated holdings and taxation of real property, and business holdings and taxation are also reported. All tax and business data specify whether they apply to the husband, wife, or jointly held property. The recording of data is quite good in comparison with other sources. 99 percent of records included the husband's date of birth and 94 percent included information on the wife's date of birth. Over two-thirds of records included the dates of birth of the married couple and the date of the marriage. Tax information was available for 54 percent of the subsample. These rates of completeness far exceed those reported for either INED data or the *Ortsippenbücher* (Knodel and Shorter,1976, 127-129).

The forms used for the PMBs that relate to marital fertility share one important characteristic: each was designed to record the vital events and movements in the city and in and out of the city of a husband, his wife, and his family. In the event of his death, the system continued to record information for his wife and her family on the same form until her remarriage or death. In the event of the death of his wife or divorce, the form records the information for the husband's new wife and children born to her as well as her surviving children prior to marriage. Thus, the form follows the entire family until the remarriage or death of the wife or the death of both husband and wife. Dates of in- and out-migration of the husband and/or wife are recorded as such. Frequently, the destination is also

included. In short, the form follows the family, not the household as is the case in other registration systems.

In brief, the PMBs provide in one set of documents a set of individual-level demographic and socio-economic data for which the bureaucratic system has already carried out the process of nominal linkage. The reason for this unusual circumstance is an historical accident. In Munich, *two separate* government agencies—state police and municipal authorities—kept parallel sets of records on Munich citizens.[13] The state police maintained the system of citizen registration (*Meldewesen*) common to all German cities. These records were scrupulous in keeping track of the residents as well as noting other information useful for keeping public order. The municipal authorities maintained voting and jurors' lists, required clear records of those holding the "right of domicile" in Munich (and hence eligible for welfare) and those simply living in the city, and registration of businesses. The city archive completed the monumental task of combining the two sets of records in the mid-1980s.

The sample used in this preliminary analysis is the first subsample of about 3,500 separate records from a projected random stratified sample of about 5,000 records in total. Of the 3,500, about 2,500 provide data that were suitable for the analysis of fertility. Those excluded from statistical analysis include records where the wife had reached age 50 before 1825 or after the beginning of the period when the record was being maintained. They also exclude records for which the date of marriage of the migrant is not available and other information on whether or not the migrant was married upon arrival in Munich is not present. Finally, some records (the *Personenstandsaufnahme* of 1919, for example) are excluded because the information on births and deaths were recorded only retrospectively and could be subject to under-reporting. As a practical matter, most of the observations

[13] See Sedlmayr (1899, p. 1). Lupprian (1992:42) reports a survey of fifteen other large German cities. Only one (Braunschweig) may have parallel sets of tax records, but these would not be incorporated with the police records as in the Munich case.

we lose from the original 5,000 couples are people who were in Munich a very brief time, and are thus captured by the registration system, but who would not be of much interest for fertility history anyway. A small number of the excluded records will be available for further analysis in future work if we can obtain the missing information from other sources.

Reliability and Coverage of the PMBs

As with any historical source of demographic data, the PMBs require a careful evaluation of their scope and reliability. Knodel and Shorter (1976) and Gutmann and van de Walle (1978) identify two potential weaknesses of population registers such as the Munich registration system: inaccurate coverage of in- or out-migration, and under-reporting of vital events. Unrecorded migration presents the problem of unobserved censoring: the likelihood of being registered at all (and appearing in the sample) may rise with the length of stay in the city. The sample may thus be selected on the duration of stay or on personal characteristics (high mobility, low economic status) correlated with both migration propensities and fertility intentions. Moreover, if in- and out-migration are not properly recorded, it may be more difficult to calculate the length of a woman's exposure to the risk of a (recorded) birth.

Such defects appear when individuals lack an incentive to register in the system and when the administration of the system functions poorly. Research into how the registration system functioned and analysis of a pilot sample developed for the project provide substantial confidence that in Munich, incentives for individuals and the administrative structure of the system kept these problems to a minimum. As elsewhere in Germany, new arrivals to Munich were bound by law to register their address and any subsequent changes of address (including out of Munich) with local police authorities within eight days of arrival. Registration laws placed a similar burden on landlords to report the arrival and departure of tenants. Fines for non-compliance were substantial and local German police

apparently devoted substantial resources to enforcing registration laws (Brown, Guinnane, and Lupprian, 1993, pp. 8-9). State police and city officials kept two parallel sets of records on all individuals living in the city. The Munich system also did a better job than many population registries of keeping track of Munich residents who departed, but might return by assigning each registrant a unique identification number. Upon return to Munich, the individual's record was simply reactivated. This system obviated the requirement for periodic "re-institutions," or error-prone transcriptions of names from one volume to another common in Belgian population registries, where re-institutions took place every 10-20 years. A contemporary report concluded that the Munich system was "more exhaustive" than, and "just as reliable" as systems found even in other German cities (Bastian (1906, p.1)).

Administration of the system involved handling thousands of pieces of information. By the mid-1880s, for example, Munich officials recorded about 280,000 changes of address annually in the PMBs (EWA, number14). Demographers have used two approaches to judging the effectiveness with which a registration system handled such flows of information: comparison of data found in the register with another source and examination of the consistency of information within the sample. For the purposes of this analysis, we used the first subsample. Our analysis of the PMB data using both approaches suggests that this source is of a quality comparable or better than sources based upon much smaller rural or village populations. This result is particularly remarkable given the high mobility of the Munich population.

Neumeier undertook a comparison of the PMBs with other sources as part of his social history of pre-World War I Munich. He first drew a sample of over two hundred forty wage workers from the employment records of a large Munich employer at the turn of the century that included workers with both short and long job durations. The PMB data on the name, occupation, and date of birth

agreed with the employment records for ninety-nine percent of the cases. Neumeier drew a second sample of about 300 house owners — primarily small businessmen, professionals, and skilled workers — from housing census manuscripts available for the early 1900s. Neumeier found that the small share of the PMBs from both samples that could not be found in the archive most likely resulted from damage to the collection from revolutionary strife in 1919. Most important, he found there was no obvious bias in which records were not found: "the registration system functioned equally well for all social groups" and "persons who were in Munich only a short period of time were as likely to be in the system as were persons who stayed longer or for their entire lives in the city."[14]

Evidence from the first wave of our sample led us to reach similar conclusions about the accuracy of the PMBs' recording of migration and vital events. We first looked at the consistency of sample information and information on births to detect problems with inaccurate recording of migration. We then looked at the migration records themselves to identify the degree to which moves went un-recorded and whether we could detect any systematic biases. Of the 2,816 couples use for analysis in the first wave, about one-seventh recorded one or more moves out of and back into Munich that interrupted the child-bearing years. Of the 5,000 births recorded for these couples, only about 80 were reported as occurring outside of Munich during period(s) when the PMBs recorded the couple as present in the city. Several of these were apparently cases of the mother remaining in the city of origin to await the birth after the husband had already completed the move to Munich. Several others were births to a couple where the father worked with the railroad and apparently commuted between Munich and nearby Augsburg, while the mother remained in Augsburg.

Procedures for recording births, deaths, and marriages in the PMBs provide particular confidence in the reliability of the demographic data. Records were updated using the official records

[14] Gerhard Neumeier, personal communication, dated January 1, 1992.

of the Bureau of Vital Statistics as well as separate registries maintained by the police (Bastian (1906, p.18); EWA [92]). Knodel and Shorter (1976) and Gutmann and van de Walle (1978) propose a battery of tests for detecting whether the system effectively carried out these transcription tasks. These tests compare sample results on the ratio of male to female births, the share of still births, and the share of neonatal deaths in all infant deaths with comparable published data available for Munich as a whole. The length of the birth interval after marriage is compared with results from Knodel and Wilson (1981). The more accurate a system was in recording of vital events, the less likely it would be to under-record female births, births of infants who died shortly after birth, and still births. Unusually lengthy birth intervals would imply that a large share of births was simply unrecorded in the PMBs.

The subsample suggests that PMBs pass virtually all of these checks, the results of which are reported in Table 4. The similarity of the sex ratios in the sample of PMBs and municipal registration date does not suggest an under-recording of female births. The distribution of infant deaths by age of the infant suggests that the system performed very well in recording live births and the deaths that occurred during the first year of life. The average length of the first birth interval within marriage in the Munich sample was virtually identical (or shorter) to the average reported for the *Ortsippenbücher* data.[15] The PMBs may tend to under-report still births, which may also occur because of the practice in Bavaria and in other Catholic parts of Germany of recording stillbirths as deaths of unnamed infants (Grassl 1904, pp. 283-284). In comparison, the *Ortsippenbücher* used by Knodel report a stillbirth share of 2.7 percent for the nineteenth century but only 0.6 percent for the twentieth. INED and English reconstitution studies generally record no stillbirths.

[15]The comparison is with couples who experienced three or more confinements and for whom the first birth occurred nine or more months after the date of marriage.

Finally, a comparison of some of the key characteristics of the sample to data available from independent, published sources allows us to ask whether the sampling scheme created a sample that is actually representative of Munich's population. The available comparisons show that our sample does capture key features of the Munich population. Table 5 reports some of these comparisons. The share Catholic is virtually identical with the results from the Census of 1880. The shares of men and women marrying in Munich who were also born in Munich are virtually identical with the actual shares over the period when these data are readily available (1876-1895). The subsample also comes close to replicating the pattern of migration into Munich. The age-adjusted distribution of places of birth for those in the sample who were alive at the census of the 1880 is virtually identical to the actual distribution of the population of Munich.

3. Using the PMBs

Demographers and others who use birth-histories, which are the core of the PMBs, have developed a keen appreciation for the complications of this kind of source, along with methods for overcoming some of their main pitfalls. In addition to the complications that arise with any birth-history, the PMBs present a number of special problems. We just list those here, as a caveat, but a central part of our research effort is finding ways to extract the rich information from this source despite these problems:

• *Migration*: Strictly speaking, events are only recorded if they take place in Munich. This means in theory that birth histories begin at the point a couple moves to Munich and registers. All living children were recorded at that time, but if a child had been born and then died outside of Munich, we do not necessarily know of that child's existence. The same applies to

children who are born and then die during a brief absence from Munich. As a practical matter, children who are born outside Munich and then die are often included in the demographic information, but we cannot count on it. Thus for people who did not spend all their time after marriage in Munich, the birth histories may not be complete. This problem does not apply at all to the many couples who married in Munich and remained there throughout their lives.

• *Non-marital fertility*: In most of our period in south Germany large fractions of births were to unwed parents. In the 1880s in Munich, for example, about 20 percent of all children are illegitimate at birth. This is both a research problem and a research question. The problem is that if so many couples have sexual relations outside marriage, we cannot accurately compute standard birth rates because we do not really know the period of exposure to the risk of a birth; put differently, marital duration-specific fertility measures may not make much sense. Largely for this reason in results reported below we rely on age-specific fertility measures, which are less informative but in this instance probably more robust. We can also emply slightly modified methods. For example, this problem affects the first birth interval more than later birth intervals. Non-marital fertility is also a research question for us because of a longstanding debate about the causes and nature of this south German practice. Some have argued that couples lived together and had children in what amounted to functional but unsanctioned marriages, while others have claimed that non-marital fertility in south Germany reflected a greater degree of sexual license.[16] One implication of the former view is that couples who

[16] Brown and Guinnane (2001b) discuss the issue at greater length. Many have noted the possible effects of laws that restricted the right to marry. These had been repealed, by and large, by the late nineteenth century, but it is possible that patterns created by these laws outlived their direct

eventually married would convince the Roman Catholic Church to legitimize their children. One implication of the latter view is that a woman might bear several children with different men. We can test both claims using the PMBs, and in fact our source will shed great light on many issues concerning the way marriages and households were formed.

• *Infant and child mortality*: Infant and child mortality play a central role in most studies of fertility and its decline. They are especially important in our study because infant and child mortality was very high in Bavaria (and especially Munich) in the mid-nineteenth century, but declined dramatically by the early twentieth century. Infant and child mortality are related to fertility in several distinct ways. First, most models of fertility presume that couples have some goals about the final size of their brood. Children who died in infancy might be "replaced," leading to possibility that mortality that is high for exogenous reasons might elevate fertility, and that the decline of mortality would drive a fertility decline. Second, infant mortality especially might be endogenous to fertility. If couples have preferences about the final size of their family, these preferences could be expressed both through deliberate fertility control and through variations in their efforts to preserve their children's health and safety. That is, a couple who want a smaller family could use contraception or devote fewer health-enhancing resources to their children. There is no suggestion of infanticide here; rather, Bavarian folk sources call the practice "allowing a child to go up to heaven," or dealing with a too-large brood through neglect. This connection between fertility and mortality is likely to be important during a fertility transition, because economic and social changes drive subtle changes in the relative merits of fertility control versus neglect. A good example for Munich is

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impact.

> increases in the market value of women's time, which would increase the cost of breastfeeding, a key component of infant health in our period. Third, there are other, biological ties between fertility and infant mortality. For example, breast-feeding is a mild contraceptive, and the death of a child who is breastfeeding may increase the chance that the mother becomes pregnant again.

None of these problems are lethal. In many cases we can compute all straightforward demographic measures for a large sub-set of our sample. This observation applies to couples who marry and remain in Munich. In other cases we can use econometric methods to detect and if need be impute missing children. This type of approach requires greater structure and a bit of faith, but has been widely used with apparently satisfactory results. In this paper we simply rely on measures that are, while somewhat less informative, robust to the type of problems noted above.

Some questions

Our results address at a descriptive level several questions that have been raised in connection with other European populations. Carlsson's distinction between innovation/diffusion and adjustment is most properly addressed using individual-level data, but understanding how to use this data requires careful thought. Several of the Princeton studies stress apparent commonalities in fertility experience within linguistic boundaries; fertility fell earlier in French-speaking Belgium than in the Flemish areas. Some of the migrants to Munich in our sample were born in Italy, and many would have an accent that would mark them as non-natives to the city, but our population does not have the linguistic differentiation that would allow us to examine the role of language in the fertility transition. We do have religious differentiation. Munich was overwhelmingly Catholic, but there was a large Protestant

and small Jewish minority. Most studies find that Catholics adopted fertility control later than Protestants or Jews, but lack the fine-grained data necessary to understand whether this is really an independent role of Catholicism or just religion acting as a marker for some other trait (such as social class; Protestants in Munich were of higher social class than were Catholics). Finally, recent studies stress the importance of location and local norms to the fertility transition. A migrant to Munich from Lower Franconia, for example, might behave differently in Munich than one from Lower Bavaria, even once we have controlled over possible influences. The PMBs tell us the birthplace of every individual in the sample, allowing us to see whether these local effects operated in Munich.

Few historical studies have the empirical raw materials to study in any detailed the roles of occupation, social class, wealth, and related socio-economic effects. This gap is one reason we think the EFP's conclusions were premature. They did not find strong economic effects in part because they couldn't. The PMBs have rich detail on several variables that can be used to remedy this problem. The most universal is simply occupation. We face two problems in using the occupation data, one less serious than the other. The original sources list a large and bewildering array of occupational titles. To make the information useful we have distilled it to a small number of categories, basing our classification scheme on that used by several German social historians. A second problem is that many individuals list several occupations, with no hint of when the individual changed jobs. In most cases the differences between jobs are not significant (for example, "worker" versus "railroad worker"). The best we can do is to assess the sensitivity of our results to varying definitions of occupation. In the results presented below, we re-compute all findings using both the lowest-status and the highest-status occupation the individual reports, without important changes to our results.[17] The other group of

[17] Few wives report an occupation in the PMBs. Another sensitivity rest, which we will undertake at a later point, will assess whether variations in occupations reported for wives affect our results.

variables included in the PMBs report the taxes people paid. The previous section discusses the various taxes and how they applied to different sub-sections of the population. Eventually we will use the data on income tax and the wealth and business taxes to construct estimates of permanent income. In our results below we simply use each tax directly, for those who paid them.

4. Some results

Table 6 presents estimates of age-specific marital fertility rates from the sample. These age-specific fertility rates are robust ways to examine fertility in general, and declines at the upper ages are often taken by demographers as the clearest evidence of intentional fertility control.[18] Couples represented in Table 6 are limited to those who moved into or out of Munich at most once. We divide the sample into those married before and after 1860 because that is the approximate median year of marriage, and forms a reasonable divide for the late nineteenth century. For now we divide couples into those in which the husband was Catholic, and those for whom this was not true. Most non-Catholics were Lutherans; Munich had a small Jewish minority as well as some other smaller Protestant denominations. Our data contain a few couples with spouses were of different religions, but for now we do not attempt to follow up how this might matter. The table displays two important regularities. Prior to 1860, Catholic fertility was very similar to that of non-Catholics. This is not surprising, given findings from other studies in European fertility history. The other regularity is more important. Fertility for the second marriage cohort is much lower, and the decline is somewhat sharper for non-Catholics than for Catholics, but fertility does decline for both groups. This second

[18] That is, many demographers believe that "stopping" behavior, where women cease bearing children at some point, is a more reliable indicator of intentional control than apparent "spacing," where fertility rates are lower at all ages. We do not accept the demographer's general point, but in this paper will rely on stopping measures because they are most readily available at this stage in our project. See Brown and Guinnane (2001a) for more on this issue.

pattern is also not terribly surprising, but it does show that Catholicism is not a bar to fertility reductions in our context.

Table 7 present a second important regularity. The classification here is by income, but the table is not based directly on reported incomes. Rather, we use reported occupations to allocate occupations to an income group. This is clearly a rough procedure that we will refine by using direct reports on taxes paid (from which we can back-out incomes) as well as the details of the occupation reports themselves. The patterns in Table 7 are so striking that they can hardly be the result of problems in our allocation scheme. At a general level the table shows a strong relationship between income and the propensity to reduce fertility. The decline is strongest in the wealthiest group, for both age groups represented here. Viewed differently, among the younger women (35-39) only the poor do not experience a fertility decline in the after-1860 group. This seems like a simple, almost obvious result, but patterns of this sort are implicitly denied by Princeton-style interpretations of the fertility transition, and in fact data with details on income or occupation are quite rare.

One can wonder about how these and other effects just reflect the composition of variables sub-populations. For example, virtually all of the couples in the lowest income group were Catholics, and we already knew that Catholics were less likely to control fertility. With relatively small samples digging further into these matters requires a multivariate approach. Table 8 reports an OLS regression on the wife's age at the birth of her last child, and, as a check, the same specification as a median regression. As noted earlier, age at last birth is a measure of fertility control if we assume that the predominant strategy for family-building is stopping, or that couples have all the children they intend to have and then cease entirely. We cannot include a measure of the wife's age at marriage in this model because at this point this measure has too much error to be reliable. That can be improved in later work. We find a strong, negative time trend. This again is not surprising. Attempts to interact

this with a dummy for Catholic show that the trend is essentially the same for the to religious groups. The trend was not stronger for non-Catholics. The income class variables show that the findings from the previous table are not an artefact of sample composition; the decline was strongest among the wealthier groups. Home ownership, which might be another proxy for permanent income, also reduces age at last birth. An alternative interpretation of this result would stress home ownership as an alternative to child-rearing in a household budget constraint. The result for Catholics is most surprising, as it suggests that once we have controlled for other effects, Catholic women were more likely to control fertility.

The dummy for wife born in Munich shows that immigrants to the city were less likely to control fertility. The relatively higher fertility of rural-urban immigrants is a common finding in historical studies and in accounts of developing-country cities today. We can expand upon this result; in additional specifications not reported, we used the characteristics of the places where immigrants were born (that is, the characteristics of the Bavarian district of their birth) and show that the type of place a person is born in strongly affects their fertility behavior in Munich. Women born in rural, high-fertility areas of Bavaria had larger families than women born in lower-fertility regions of Bavaria.

The regression is open to many criticisms. Perhaps the most general is that it focuses only on age at last birth. The result for Catholics, for example, could mean that when they controlled fertility Catholics did so by "stopping," while others were more likely to reduce fertility earlier in marriage. This is just one example of a broader array of empirical and modeling issues that face us in future work.

5. Conclusions

The Munich city registration system (the PMBs) offers a rare source for the study of the fertility transition of the late nineteenth century. We have compiled a large sample from this source, and are now busy trying to do it justice. Our first stage results lend us great confidence that all this work will pay off. Munich was unusual in a few, relevant ways, but in most respects its fertility history was typical enough to offer some broad lessons. And the PMBs thus far suggest that some of the central conclusions drawn by earlier studies were the product of not having, or using, data that was sufficiently general to draw appropriate conclusions.

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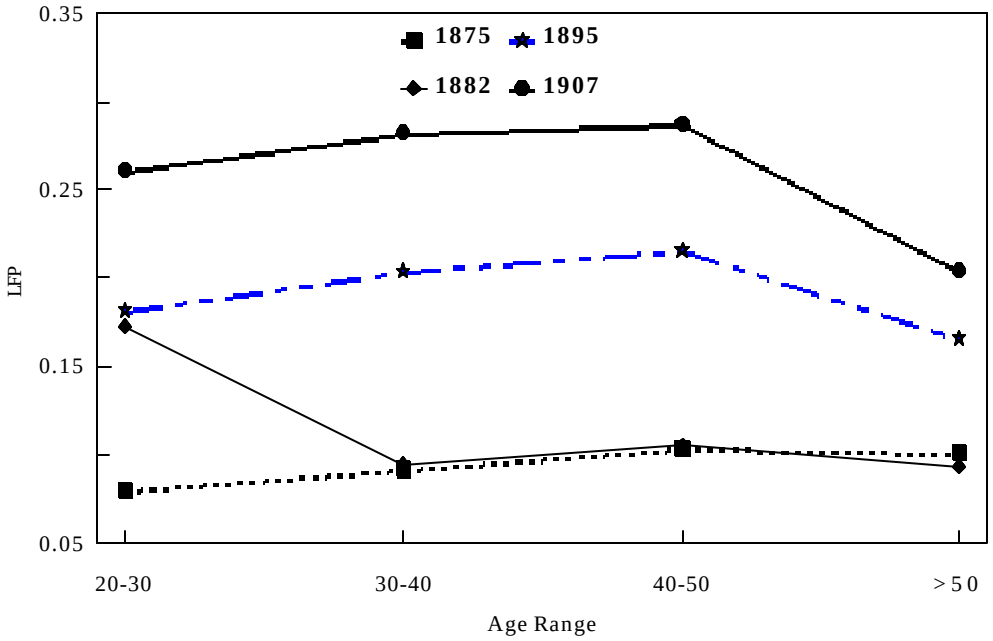
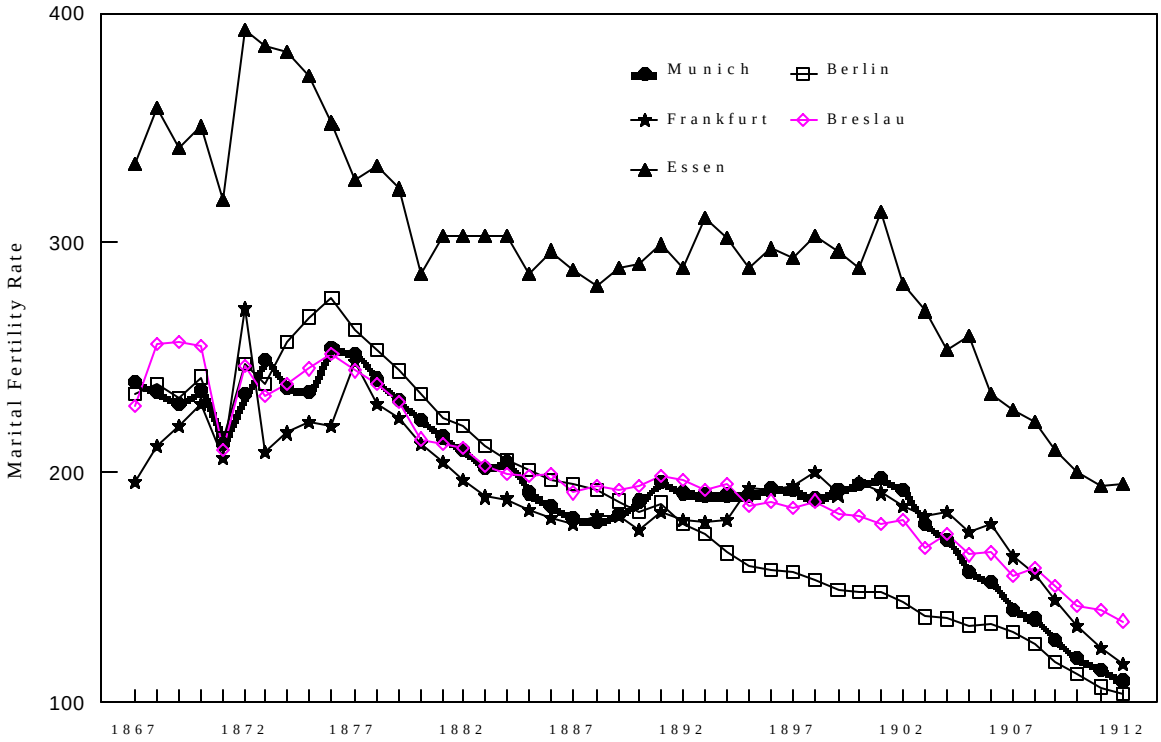
Figure 1:
The Labor Force Participation Rate for Married Women in Munich



Source: "Ergebnisse der Volkszählung vom 1. Dezember 1875," (1877, Table 8);"Ergebnisse der berufsstatistischen Erhebung bom 5. Juni 1882 in München," (1884, pp. 207-208); "Berufs- und Gewerbezählung vom 14. Juni 1895," (1896, Table 5);"Berufs- und Gewerbezählung vom 12. Juni 1907," *Mitteilungen des Statistischen Amtes der Stadt München* (1911, Table 2).

Notes: For a discussion of the method calculation, please see the text. Note that the census of 1875 did not include *mithelfende Familieangehörigen*, or family members living at home working in the employ of another family member. Subsequent censuses did.

Figure 2:
The General Marital Fertility Rate for Munich and Four Other German Cities



Source: *Statistisches Jahrbuch deutscher Städte* (1888-1912).

Note: The general marital fertility rate is the number of births divided by the number of married women aged 15 to 50 multiplied by 100.

Table 1

The Distribution of Employment of Household Heads in Munich: 1845-1905

Year	Total	Share of Each Occupational Group (In percent)					
	Population	Independent Business and Liberal Professions	Small Business	Skilled Workers	Unskilled Workers	Salaried	Government, Church, Court
1845	84,000	41.1	10.1	5.1	3.0	3.8	36.9
1872	191,000	43.1	3.0	8.9	6.8	6.1	32.2
1905	525,000	27.7	4.4	20.0	13.0	14.4	20.4

Source: Wiest (1991, Table 7.1).

Notes: The distribution is based upon an examination of city directories.

Table 2

The Distribution of Employment of Married Munich Women Ages 16-40 in 1907

Sector	Percent
Wholesale and Retail Trade	24.9
Clothing	14.3
Household Service and Day Labor	14.3
Lodging, Taverns, and Restaurants	11.4
Foods	7.3
Cleaning	7.6
Printing	4.2
Other	16.0
Type of Occupation	
Owner of Business	24.0
Working the business of the husband	3.50
Domestic trades (sewing, needlework)	20.0
Other work	52.50

Source: “Ergebnisse der Volkszählung vom 1. Dezember, 1875"(1879, Table 8); “Ergebnisse der berufstatistischen Erhebung bom 5. Juni, 1882 in München”(1884, pp. 206-208); “Berufs und Gewerbezählung vom 14. Juni 1895”(1896., Table 5); and “Berufs- und Gewerbezählung”(1911, Table 2).

Notes: The distributions have not been adjusted for the inclusion of married women working in the business of the husband (*mithelfende Familienangehörige*).

Table 3
The *Polizeimeldebögen* Compared with Other Micro Sources of Demographic Data

PMBs in Munich	OSB[a]/INED	Register[b]
Coverage		
Before 1868: official domicile in locality After 1868: all adult residents, children in the labor force	Marriage and death in locality	Official domicile in locality
Demographic		
At entry: Name, place and date of birth, legitimacy and religion of all living family members	Yes	Yes
Births: Name, date, legitimacy, and religion	Yes	Yes
Marriage/ Divorce/ Separation: Date and place	Yes	No
Deaths: Date and place for all with right of domicile; only date if in Munich for all others	Yes	No
Socio-cultural background		
Religion of husband, wife, children	Yes	Yes
Occupation of father of both husband and wife	Some	No
When granted right of domicile or citizenship	No	No
Incarcerations and expulsions; stays in local mental hospitals.	No	No
Occupations, Income, and Wealth		
Occupations of family head; occasionally of wife	Yes	Yes
Taxes on income	No	Top 10%
Purchase, sale, and ownership of real property	No	No
Taxes paid on financial assets, real property, and businesses	No	No
Businesses: description, period operated, ownership	No	No
Bankruptcy (period); welfare received: period, purpose	No	No
Migration History		
Date of husband's arrival in Munich, last residence(often), legal domicile	NA	Yes
Dates of subsequent departures (often with destinations) and returns to locality with notation if husband, wife, or children	NA	No (Depart only)
Dates and addresses of moves within Munich	NA	Some

[a] *Ortssippenbücher* (Knodel and Shorter ,1976)
[b] Belgian population registries (Alter, 1988)

Table 4
Evaluating the Quality of Recording of Births

Description of Check	PMB Subsample	Municipal Registration Data[a]
Sex Ratio at Birth	1.067 (N = 4,990)	1.062
Share of Stillbirths in All Births	0.4%	3.0%
Share of Deaths 0-1 month	31.5	28.0
Share of Deaths 2-3 months	24.2	24.5
Share of Deaths 3-6 months	18.0	22.8
Mean Length of Interval between First and Second Confinement (Legitimate Births Only; Women with at Least Three Legitimate Confinements)		
1825-1849 Marriage Cohort	21.9 (N=80)	23.0
1840-1874 Marriage Cohort	23.1 (N=101)	22.8
1875-1899 Marriage Cohort	21.4 (N=72)	21.3

[a] Comparison of birth intervals uses data from *Ortsippenbücher*.

Source: PMB subsample and *Mitteilungen des Statistischen Amts der Stadt München*, various years and Knodel and Wilson (1981, Table 9).

Notes: The comparison with the reproductive histories of the couples in the *Ortsippenbücher* village histories data set is for couples for whom the first birth occurred at least nine months after the date of marriage.

Table 5

Summary Characteristics of the PMB Subsample Compared with Available Published Data

Characteristic	PMB Subsample	Munich
Share Catholic in 1880	86.6	85.7
Share Married in Munich also born in Munich (1876-1895)	19.5(men) 19.8(women)	20.0 22.9
Distribution of Population by Birthplace for Men Ages 16 and Above: 1880		
Munich	23	27
Province of Upper Bavaria	23	22
Neighboring Provinces	38	35
Other places in Bavaria	16	16
Share Homeowners: 1890	24.6	5.8

Sources: PMB subsample and "Bericht über die Ergebnisse der Volkszählung vom 1. Dezember 1880", (1881, Table 20); "Münchener Jahresübersichten für 1895" (1896, Table 24); "Bericht über die Ergebnisse der Volkszählung in München vom 1. Dezember, 1890 und der Wohnungszählung daselbst vom 1. November, 1890" (1895, Appendix).

Notes: The characteristics from the PMB subsample refer to the 2,531 husbands used in the statistical analysis.

Table 6: Religion and Fertility Decline in Munich

Age-Specific (Annual) Marital Fertility Rates

Wife's Age	Husband is Catholic		Husband is not Catholic	
	Married before 1860	Married after 1860	Married before 1860	Married after 1860
20-24	.43 (168)	.36 (92)	.36 (13)	.36 (13)
25-29	.40 (330)	.32 (693)	.42 (29)	.21 (142)
30-34	.31 (471)	.24 (832)	.32 (36)	.16 (181)
35-39	.23 (515)	.16 (855)	.18 (41)	.16 (173)
40-44	.11 (520)	.08 (808)	.09 (40)	.05 (140)

Source: PMB sub-sample

Table 7: Income and Fertility Decline in Munich

Age-Specific (Annual) Marital Fertility Rates

Income Class	Wife's Age 35-39		Wife's Age 40-44	
	Married before 1860	Married after 1860	Married before 1860	Married after 1860
1 (Lowest)	.20 (76)	.17 (182)	.15 (84)	.07 (164)
2	.24 (243)	.16 (402)	.10 (237)	.09 (377)
3	.19 (75)	.16 (158)	.11 (72)	.04 (131)
4 (Highest)	.23 (59)	.09 (159)	.10 (57)	.03 (145)

Notes: Source is the PMB sample. Figure in table is mean, with number of observations are in parenthesis.

Source: PMB sub-sample

Table 8: The determinants of age at last birth

Covariate	OLS		Quantile (median) regression		
	Estimate	T-ratio	Estimate	T-ratio	Mean of variable
Birth cohort of husband (years since 1790)	-0.03	-2.23	-0.03	-1.25	63.7
Income class 2	-0.45	-0.68	-1.30	-1.13	0.51
Income class 3	-2.79	-3.07	-3.46	-2.39	0.16
Income class 4	-1.08	-1.29	-1.48	-0.97	0.14
Wife born in Munich	-1.65	-3.24	-1.84	-2	0.33
Husband Catholic	-1.23	-1.29	-1.72	-1.14	1.08
Home owners	-1.69	-3.25	-2.34	-2.6	0.42

Note: Sample restricted to couples observed until the wife was at least 45, and for whom the wife is the husband's first spouse. The mean of the dependent variable is 38.5, and its median is 39.6. The lowest income class is the excluded variable. R-square in the OLS model is 0.11