# *Proto-industrialization and Demographic Change: The Canton of Zürich Revisited* *

**Ulrich Pfister**
University of Zürich

## Introduction

The relationships between rural industry and demographic change have received much attention from scholars engaged in research on proto-industrialization and the hypotheses derived from this concept. In fact, Mendels[1] considers the interest in demographic corollaries of rural industry to be one of the main features distinguishing the concept of proto-industrialization from earlier research on rural industry.

The theoretical interpretations of the relationships between demographic forces and the expansion of cottage industry are usually rooted in the strong functional relationships that linked the two[2]: On the one hand, since proto-industrial production proceeds with few technological innovations and only limited fixed capital formation, its expansion requires a parallel increase of

* Helpful suggestions and comments by Rudolf Braun, Markus Mattmüller, Thomas Meier, Hans-Ulrich Pfister, Urs-Peter Schelbert and Christian Suter are gratefully acknowledged. Responsibility for errors and omissions remains, of course with the author.

[1] Franklin Mendels, *Des industries rurales à la proto-industrialisation: historique d'un changement de perspective* (Annales, E.S.C. 39, 1984, p. 985).

[2] See notably Peter Kriedte, Hans Medick and Jürgen Schlumbohm, *Industrialization before Industrialization; Rural Industry and the Genesis of Capitalism*, Cambridge/Paris 1981, chapter 3. Also important are the theoretical contributions in the work of Rudolf Braun, *Industrialisierung und Volksleben; Die Veränderungen der Lebensformen in einem ländlichen Industriegebiet vor 1800 (Zürcher Oberland)*, Erlenbach/Zürich 1960 (2nd printing Göttingen 1979) and idem, Proto-industrialization *and Demographic Changes in the Canton Zürich* (in Charles Tilly (ed.), *Historical Studies of Changing Fertility*, Princeton 1978, pp. 289-334); Franklin Mendels, *Proto-industrialization: The First Phase of the Industrialization Process* (Journal of Economic History 32, 1972, pp. 241-261); Wolfram Fischer, *Rural Industry and Population Change* (Comparative Studies in Society and History 15, 1973, pp. 158-170).

labour inputs. On the other hand, handicraft industries provide means of subsistence to people who could otherwise not be absorbed by agriculture.

Both of these arguments suggest that proto-industrialization was associated with substantial population growth. Marriage rates and ages are usually considered as mediating between proto-industrial business cycles and population growth; hence, an expansion of cottage industry, by providing new opportunities to found households with a non-existent or limited agricultural base, provoked an increase of marriage rates and, through a corresponding rise of fertility, an expansion of population size.[3] On the other hand, a short-term contraction of proto-industry was not necessarily followed by lower marriage rates due to the specific conditions of production and reproduction within the proto-industrial family economy. Since the proto-industrial household — due to its roots in the traditional subsistence economy — was a maximizer of production (not of profits) and since maximal production was reached only when large number of children of an age that enabled them to contribute to the family economy was present, marriages remained attractive even during a time of crisis. This second mechanism, it is argued, accentuated population growth in the long run and also the spread of pauperism.

There is a considerable body of literature supporting this kind of 'classical' model of proto-industrial population growth.[4] However, recent research has revealed cases where some or all of the above hypotheses do not hold.[5]

[3] At this point the discussion on proto-industrialization intersects with the debate on the origins and the early stages of the demographic transition. Authors committed to the proto-industrialization tradition implicitly claim that the demographic transition began with a rise in fertility whereas many demographers (especially in the 1960s and earlier) asserted that it began with a decline in mortality; see esp. the contributions by HABAKKUK and MCKEOWN/BROWN in DAVID V. GLASS and D.E.C. EVERSLEY (eds.), *Population in History*, London 1965, and the conclusive discussion in EDWARD A. WRIGLEY and ROGER S. SCHOFIELD, *The Population History of England, 1541-1871*, London 1981.

[4] Apart from the references cited in footnote 2 see ERIC L. ALMQUIST, *Pre-famine Ireland and the Theory of European Proto-industrialization: Evidence from the 1841 Census* (Journal of Economic History 39, 1979, pp. 699-718); J. D. CHAMBERS, *The Vale of Trent* (Economic History Review, Supplement 3, 1957); DAVID LEVINE, *Family Formation in an Age of Nascent Capitalism*, New York 1977; FRANKLIN MENDELS, *Industrialization and Population Pressure in Eighteenth-Century Flanders*, New York 1981; JOAN THIRSK, 'Industries in the Countryside' (in F. J. FISHER (ed.), *Essays in the Economic and Social History of Tudor and Stuart England in Honour of R. H. Tawney*, Cambridge 1961, pp. 70-88); see also the numerous references cited in KRIEDTE et al., *Industrialization Before Industrialization* (note 2), ch. 3.

[5] GERD HOHORST, *Wirtschaftswachstum un Bevölkerungsentwicklung in Preussen 1816-1914*, New York 1977, pp. 208-227; MYRON P. GUTMANN and RENÉ LEBOUTTE, *Rethinking Proto-industrialization and the Family* (Journal of Interdisciplinary History 14, 1984, pp. 587-607); FRANKLIN MENDELS, *Des industries rurales...* (note 1), appendix. For Switzerland in particular see MARKUS MATTMÜLLER, *Das Einsetzen der Be-*

Perhaps the most comprehensive and systematic qualifications have been put forward by Gullickson in her studies on the Pays de Caux in northern France.[6] In the case of the Pays de Caux putting-out industries develop in an area of commercial agriculture with the effect of helping poor people to stay on the land and to serve as agricultural workers during seasonal labour peaks; cottage industry provides an additional income mainly by employing women. This means that proto-industrialization does not produce a new class of people with little or no agricultural base and entirely dependent on industrial employment; rather, it supports a given agricultural structure. As a consequence, the pattern of low and/or falling marriage ages does not occur in the Pays de Caux. Results like these suggest that the demographic corollaries of proto-industrialization may vary according to the precise nature of the relationships between rural industry and agricultural structures in a particular area, and that, therefore, the classical pattern may not be of universal validity.

On the background of this state of diverging evidence it may be instructive to have a look at demographic processes in the Canton of Zürich (Switzerland) in the eighteenth century. Although the earlier studies of Rudolf Braun played an important part in the formulation of the classical model, little empirical demographic research has been carried out in this area so far.[7] Hence, one may ask whether the elements of the model outlined above are really present in the different parts of the Canton which were penetrated by rural industry, in particular, whether cottage industry was always accompanied by rising marriage and fertility rates, and how these were related to proto-industrial growth. Such a more detailed investigation may provide additional material for a discussion of the validity of the classical model as well as of the relevance of possible qualifications.

Our analysis takes the form of a cross-sectional comparison of crude birth, marriage and death rates in 41 parishes of the Canton of Zürich during the eighteenth century. Since these parishes represent several different contexts which bear on the interpretation of the results it is necessary to begin with a short account of the historical development and the spatial structure of proto-industry in the area under investigation.

*völkerungswelle in der Schweiz* (Vierteljahrschrift für Wirtschafts- und Sozialgeschichte 63, 1976, pp. 390-405 and idem, *Die Landwirtschaft der schweizerischen Heimarbeiter im 18. Jahrhundert* (Zeitschrift für Agrargeschichte und Agrarsoziologie 31, 1983, pp. 41-56); Mattmüller sees declining mortality as the main force behind population growth in Swiss proto-industrial areas.

[6] Gay L. Gullickson, *Proto-industrialization, Demographic Behavior and the Sexual Division of Labor in Auffay, France* (Peasant Studies 9, 1982, pp. 105-118); eadem, *Agriculture and Cottage Industry: Redefining the Causes of Proto-industrialization* (Journal of Economy History 43, 1983, pp. 831-850).

[7] Rudolf Braun, *Proto-industrialization...* (note 2), p. 323, states that "our present statistical data are in many regards insufficient and very scanty".

## Proto-industrialization in the Canton of Zürich: A Short Overview

Early textile production in Zürich[8] benefited a great deal from protestant refugees. From 1555 onwards refugees from Locarno (southern Switzerland) began to arrive in the town. Because they were barred from carrying on their traditional handicrafts by the town guilds they turned to textile manufacturing which was subject to only modest regulations. As innovative merchants they introduced the putting-out system as well as new textile products, basically in the domains of wool and silk production. Although few of these immigrants were allowed to establish themselves definitely in Zürich their example was followed by burghers. This led to a rapid development of textile production for export, particularly in the first decades of the seventeenth century. Later on, the industry faltered because of slackening demand during the Thirty-years War and due to higher import duties for woollen products of Swiss origin in France since the 1660s.

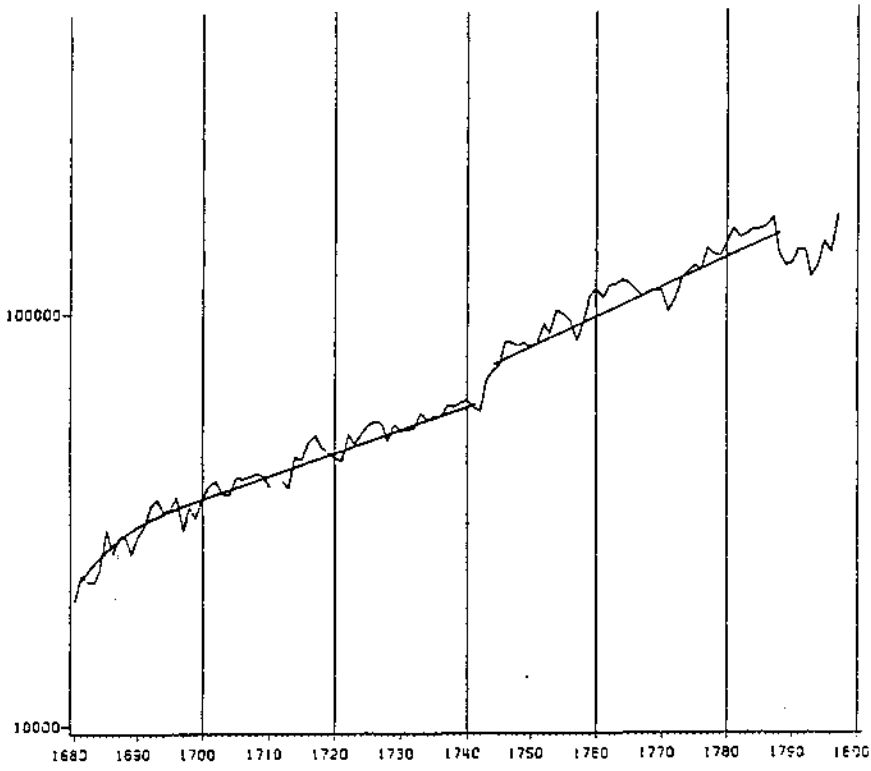
A new stimulus was provided in the 1680s and 1690s by French refugees who left their country after the Revocation of the Edict of Nantes in 1685. On the one hand, they introduced new cotton products (particularly of fine cloths, i.e., muslin and *mouchoirs*) and thereby laid the base for the great boom of the cotton industry in the eighteenth century. On the other hand, they also brought several innovations to the silk industry.

However, after an initial push in the late decades of the seventeenth century the long-term growth rate of exports declined somewhat and remained on that reduced level until the 1740s; this is visible from Figure 1 which shows the total amount of export duties (mainly on textiles), the so-called *Pfundzölle*, on a semi-logarithmic scale.[9] This was due probably to the continuing decline of the wool industry which had shrunk to very modest proportions by the middle of the eighteenth century; hence, the rapid expansion of the cotton industry substituted in part for the declining wool production during this time. Nevertheless, the upturn of the long-term growth rate of exports which is visible in the 1740s (see Figure 1) was substantially supported by the expansion of mechanical printing of cotton cloth, particularly

[8] Where not indicated otherwise the material presented in this section is based on Walter Bodmer, *Die Entwicklung der schweizerischen Textilindustrie im Rahmen der übrigen Industrien*, Zürich 1960.

[9] Source: StAZ (State Archive of Zürich) F III 32. Unfortunately, total amounts are not broken down according to different groups of products, which were taxed differently. Several changes in the definition of the tax took place previous to 1680; therefore, the information previous to that year has not been included in Figure 1. For the legal background of the tax, see Otto Sigg, *Die Entwicklung des Finanzwesens und der Verwaltung Zürichs im ausgehenden 16. und im 17. Jahrhundert*, Berne 1971, pp. 49-58.

Figure 1
EXPORT DUTIES IN ZÜRICH, 1680-1797 (lb., semi-logarithmic scale)




of *indiennes*, around the middle of the century. This increase in the pace of proto-industrial development was also marked by an expansion of weaving activities which led to shortages of yarn, a corresponding rise of spinners' wages in the late 1740s and the expansion of cotton spinning far beyond the area of the Canton of Zürich. Interrupted by several crises (particularly the one around 1770) high average growth rates persisted until the late 1780s when the introduction of mechanical spinning in England began to impair the competitive position of many continental areas (cf. Figure 1).

The strong expansion of cotton production brought difficulties for the silk industry. Due to the high wages it had to pay to spinners in order to prevent them from turning to cotton spinning its products became progressively less competitive. The ensuing partial supercession of silk production meant that, in the second half of the eighteenth century, cotton spinning and weaving was the main proto-industrial activity in the countryside of the Canton. In 1787 the cotton industry counted 32730 spinners (some 20 percent of the total population in 1792) and 6472 weaving looms. Hence, our subsequent

analysis will be concerned mainly with the demographic corollaries of cotton manufacture.

These phases of proto-industrial development in Zürich and their structure are reflected in the spatial distribution of cottage industry on the countryside of the Canton.[10] The silk industry, because of the high value of raw materials and the skills it required, was organized by the city merchants themselves and carried out under their relatively close supervision. Hence, silk manufacture was always confined to areas relatively close to the town. On the other hand, work in the wool and cotton sectors were carried out in areas farther away; it appears that, at the end of the seventeenth century, all parts of the Canton were touched by these two branches of textile production, except for the north-eastern Wineland where a commercialized wine production was firmly rooted (cf. the map in Figure 2).[11] Nevertheless, some final work processes were also carried out in the capital; this is especially true for the printing of cotton cloth which was done in centrally located proto-factories.

The concentration of the final work processes in the cotton industry and of the silk industry as a whole in the areas around the capital led to the emergence of a para-urban agglomeration in the villages in the immediate vicinity of the town: In the second half of the eighteenth century one finds there a relatively wealthy class of qualified workers and clerks (often working in town) who raised the productivity of their own small plots of land to very high levels, "often rivalling with the lords in this respect".[12]

Around 1700 an important bifurcation began to emerge among the proto-industrial areas which were situated farther away from Zürich. On the one

[10] In this paragraph the information provided by Bodmer, *Schweizerische Textilindustrie...* (note 8) is supplemented by the study of THOMAS MEIER, *Nichtagrarische Tätigkeiten und Erwerbsformen in einem traditionellen Ackerbaugebiet des 18. Jahrhunderts*, Zürich 1986, on the Lowland and the information on the occupations of the rural poor in 1692 in StAZ A 61.5.

[11] Wine production generally seems to preclude an expansion of cottage industry in the same area because its labour requirements are less concentrated seasonally and because its labour intensity is higher than in the case of cereals; for this argument and some French examples, see FRANKLIN MENDELS, *Seasons and Regions in Agriculture and Industry During the Process of Industrialization* (in SIDNEY POLLARD (ed.), *Region und Industrialisierung* (= Kritische Studien zur Geschichtswissenschaft 42), Göttingen 1980, p. 184f).

[12] JOHANN KASPAR HIRZEL, *Beantwortung der Frage: Ist die Handelschaft, wie solche bey uns beschaffen, unserem Lande schädlich oder nützlich, in Absicht auf den Feldbau und die Sitten des Volkes?* (Magazin für die Naturkunde Helvetiens 3, 1788, p. 60). For a general discussion of the significance of proto-industrial para-urban agglomerations, see also PIERRE DEYON, *Fécondité et limites du modèle protoindustriel: premier bilan* (Annales, E.S.C. 39, 1984, p. 870).

hand, the region of Knonau, on both sides of the lake and in the hilly Highland quickly adapted to the large-scale production of cotton textiles (in some parishes substantial numbers of cotton spinners are already present in 1692).

On the other hand, the Lowland did not adapt to this change and, with the decline of the wool industry, faced a process of de-industrialization in the subsequent decades. In the second half of the century this area was mostly dominated by subsistence agriculture where occasional agricultural surpluses were sold on the market.[13] It is not easy to account for this bifurcation; a possible explanation may be developed by considering the fact that the wool and the cotton industries were organized differently. Cotton spinning and weaving always developed in partial independence from urban merchants. Already in the sixteenth century small rural putting-out merchants or clothiers (*Tüchler*) can be documented, and they appear as important partners of the French refugees in the stimulation of cotton production during the late sevententh century. Despite repeated efforts by the authorities they could never be brought entirely under the control of the merchants of the capital. These rural putters out are to be found mainly in the lake and Highland areas; it may be supposed that this kind of non-agricultual or proto-industrial upper class emerged in these areas mainly because of their less rigid communal order.[14]

Among the areas which turned to the production of cotton textiles since the late seventeenth century the lake area and some parishes around the

[13] See MEIER, *Nichtagrarische Tätigkeiten...* (note 10), ch. 3.2. Perhaps as a consequence of de-industrialization the Lowland became interspersed with small areas dominated by non-agricultural trades of regional importance, such as straw-hat production or hosiery knitting (which was not organized in a putting-out system and sold only within the Canton by pedlars). The fact that the Lowland was an area of subsistence agriculture during most of the eighteenth century implies that the Canton of Zürich does not correspond to a proto-industrial region as defined by MENDELS, *Seasons and Regions...* (note 11). Mendels, in following the bifurcation thesis of ERIC L. JONES, *Agricultural Origins of Industry* (Past and Present 40, 1968, pp. 58-71) states that a typical region is made up of two principal sub-regions dominated by proto-industry and commercial agriculture, respectively, and interlocked in a regional division of labour. In the case of Zürich, the nearest area of commercial agriculture was southern Swabia which traditionally was an important provider of grain for many Swiss regions and which, therefore, was the main source of grain sold on the market of Zürich during the eighteenth century; see PETER GIGER, *Zürcher Kornmarktpolitik im 18. Jahrhundert* unpublished master's thesis, University of Zürich 1985. At the same time, Swabia was a target for seasonal migration of Swiss agricultural labour (labour exchanges being mentioned by Mendels as one form of interaction between the two main sub-regions of a regional unit); the institution of migration to Swabia for agricultural work was called *Schwabengängerei*.

[14] For the role of the communal order in the process of proto-industrialization of Zürich see the work of Braun cited above (note 2) and the discussion below.

Phannenstil hill specialized in weaving, although they usually contained important segments of spinners, too (see Figure 2). The main reason for this spatial pattern probably was the relative closeness of these areas to the town and their easy accessibility.

On the background of this short account of the spatial development of proto-industry in the Canton of Zürich, the 41 parishes for which a demographic analysis is possible (for the criteria, see next section) and which will form our data base can be aggregated into the following six groups each of which has its distinct characteristics[15] (see also the map in Figure 2):

*I The Highland:* Apart from several parishes of the upper Töss valley (Bäretswil, Bauma, Fischenthal, Sternenberg, Wila, Wildberg and Zell) two parishes closer to the lake (Grüningen and Oetwil) are also part of this group. It is characterized by a very strong presence of cotton spinners (48.8 percent of the estimated population in 1787).[16]

*II The north-western border area of the Highland:* Towards the north and the north-west the Highland passes over to the relatively flat Wineland. Several parishes in this border area record moderate levels of proto-industrialization (the share of spinners ranges between 10 and 20 percent; for the group as a whole the figure is 17.4 percent). The parishes in this group are Elgg, Elsau, Embrach,[17] Seen and Wiesendangen.

*III Pfannenstil:* This group is made up of those five parishes of our sample which are located around the Pfannenstil hill and whose main proto-industrial activity is not cotton spinning. The larger ones (Egg, Maur and Uetikon) are predominantly engaged in cotton weaving, the two smaller parishes which are located nearer to the town (Erlenbach and Zollikon) are predominantly engaged in silk production.

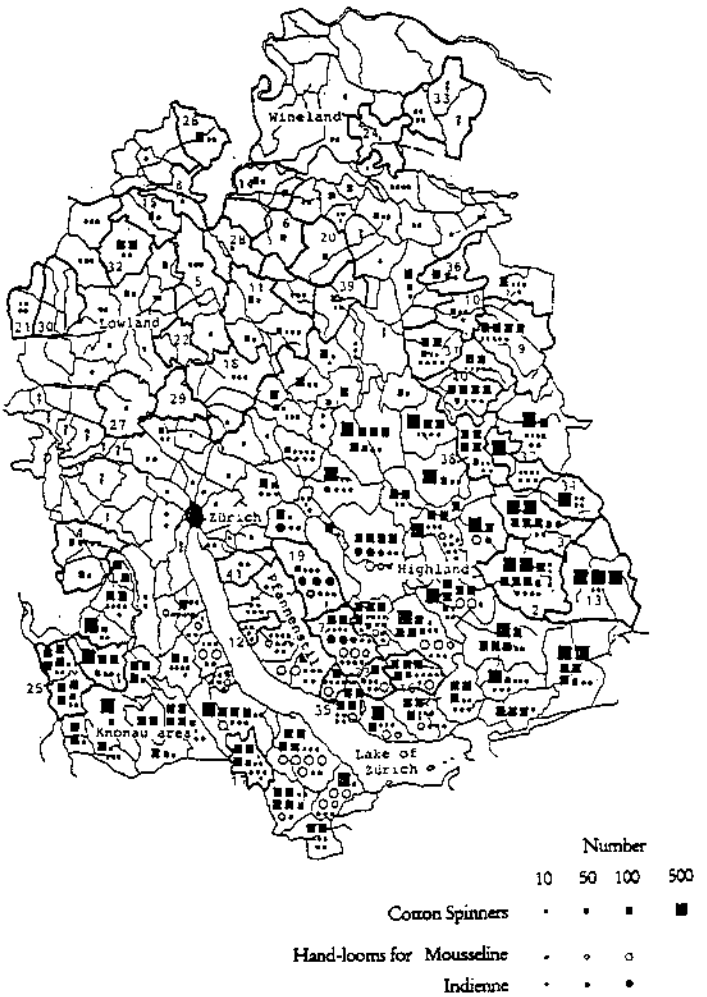
*IV Left of the Lake:* Four parishes in different areas on the left side of the lake and the Limmat river form this group: Affoltern and Ottenbach are part of the Knonau area, Birmensdorf belongs to the outer part of the para-urban agglomeration around Zürich, and Hirzel lies in the hilly parts of the

[15] The later analysis implicitly assumes that these groups are relatively homogenous with respect to demographic patterns. In order to test this assumption cluster analyses (Ward's method and relocate) were performed on time series of eleven-year-averages of birth and death rates. Three major clusters emerged incorporating roughly the Highland (group I) and the parishes on the left of the lake (IV), the Wineland and its southern border area (II and V), and the Lowland (VI), respectively. The parishes in group III are outliers and were incorporated into differing clusters (see also note 65 below). Hence, except for group III, the assumption of a certain homogeneity of demographic patterns within groups is warranted.

[16] The figures for the number of spinners are taken from the map in Figure 2; the method used in estimating population size is explained in the subsequent section.

[17] Embrach was included in this group mainly because its demographic behaviour resembles that of the other parishes further to the east.

Figure 2
THE COTTON INDUSTRY IN THE CANTON OF ZÜRICH IN 1787




*Source:* Kläui, Paul and Eduard Imhof, *Atlas zur Geschichte des Kantons Zürich* Zürich 1951, chart 35; their source is StAZ A 76.
*Villages analyzed:* 1 Affoltern, 2 Bäretswil, 3 Bauma, 4 Birmensdorf, 5 Bülach, 6 Buch, 7 Egg, 8 Eglisau, 9 Elgg, 10 Elsau, 11 Embrach, 12 Erlenbach, 13 Fischenthal, 14 Flaach, 15 Glattfelden, 16 Grüningen, 17 Hirzel, 18 Kloten, 19 Maur, 20 Neftenbach, 21 Niederweningen, 22 Oberglatt, 23 Oetwil, 24 Ossingen, 25 Ottenbach, 26 Rafz, 27 Regensdorf, 28 Rorbas, 29 Rümlang, 30 Schöfflisdorf, 31 Seen, 32 Stadel, 33 Stammheim, 34 Sternenberg, 35 Uetikon, 36 Wiesendangen, 37 Wila, 38 Wildberg, 39 Wülflingen, 40 Zell, 41 Zollikon.

proto-industrial areas on the left shore of the lake. The common feature of these parishes is their high share of cotton spinners (43.0 percent in 1787) which makes them comparable to the Highland in this respect.

*V The Wineland:* This group is made up of two parishes of the Wineland proper (Ossingen and Stammheim) and of five parishes in the immediate southern neighbourhood (Buch, Flaach, Neftenbach, Rorbas and Wülflingen). The whole area is an important producer of wine, and virtually no proto-industrial activities can be found there (the spinners-population ratio amounts to 4.2 percent in 1787).

*VI The Lowland:* Eleven parishes of the relatively flat Lowland which was devoted mainly to subsistence agriculture in most of the eighteenth century are brought together in this final group.[18] Here, too, proto-industry is generally of little importance: only 6.2 percent of the total population is recorded as spinners in 1781.[19] However, this figure conceals the fact that at least some parts of the area recorded considerable numers of wool spinners towards the end of the seventeenth century and were de-industrialized afterwards. Some parishes also experienced a limited growth of cottage industry and of other non-agricultural activities in the late eighteenth century (see above). Hence, these parishes cannot be considered as agrarian contexts in the classical sense.

If one compares our sample of parishes with the description of the spatial pattern of cottage industry given above two areas appear to be grossly underrepresented:

a) the relatively rich industrial agglomeration in the immediate vicinity of the capital where work processes requiring skilled labour were located;

b) the areas immediately bordering on the lake. There, proto-industry was associated with an intensive and highly productive agriculture, weaving activities were important, and the proto-industrial upper class of rural putting-out merchants and intermediaries was also concentrated there.

Both of these limitations imply that the subsequent analysis must leave out a whole range of activities which have been termed as 'rich' industries and which may also be associated with distinct demographic patterns.[20] Rather, our investigations will concentrate on the so-called 'poor' industries, mainly on cotton spinning.

[18] Bülach, Eglisau, Glattfelden, Kloten, Niederweningen, Oberglatt, Rafz, Regensdorf, Rümlang, Schöfflisdorf and Stadel.

[19] For Oberglatt and Stadel the number of wool spinners in 1787 is reported in StAZ B IX 70; these figures have been added to the number of cotton spinners. Among the other parishes mainly Rorbas appears to have had a substantial number of wool weavers around this time (StAZ B IX 67, p. 58); however, due to the lack of concrete figures this fact could not be considered in the statistical analysis.

[20] cf. Pierre Deyon, *Fécondité et limites...* (note 12), p. 874f.

## Sources and Methods

Among the some 150 parishes of the Canton of Zürich those were selected for the present analysis which contained a population of at least 600 in 1792 and which were documented with at least three censuses between 1700 and 1771. These two conditions were fulfilled for 44 parishes,[21] but three parishes had to be dropped because of the inadequate quality of their sources (see below). The remaining 41 parishes have a population of a little over 50,000 in 1792, making up some 30 percent of the whole population of the Canton of Zürich at that time.

Why these two criteria? The limitation of the analysis to larger parishes was necessary to avoid the distortion of data by factors peculiar to small contexts, that is, accidental fluctuations in the size of the marriage market, of the age structure, etc. The second criterion was used to assure a minimal documentation of the population size during the first three quarters of the eighteenth century. This requires some more explanations on the organization of censuses in the Canton of Zürich.

Before 1771 censuses were organized exclusively by the church.[22] In 1634 an enumeration of all souls was ordered by the state church, as well as the periodical repetition of such a census after every three years. The enumeration was to be carried out by the parish parsons, so that the household lists are set up on the parish level. In the following years discipline declined, an increasing number of parsons failed to prepare the lists of their parishes, and after 1648/49 no censuses at all took place for some time. In 1670 a new effort was made, resulting in a second general census for the whole Canton of Zürich in 1670/71. Again, enumerations became irregular after this date, following no clear pattern and taking place at varying dates in individual parishes. Nevertheless, for a considerable number of parishes censuses occurred quite often until about the first decade of the eighteenth century. After this time, listings are rather scarce; obviously, no coordinated effort was made to enforce a general census.[23] From 1771 onwards several censuses were

[21] Among these parishes the one of Elsau was retained despite its smaller population because it connected three adjacent parishes or parish groups.

[22] They are to be found under E II 700 and E III in StAZ.

[23] The exception is the chapter of Elgg where a general enumeration appears to have been undertaken in 1738; see the tables provided by Waser, StAZ B IX 27. - Population figures given by Waser for 1700 (and used by Braun, *Proto-industrialization...* (note 2)) appear to rely in part on the material discussed in the text, in part they seem to be Waser's own estimates, which are mostly very unprecise according to research carried out in the framework of the present study; therefore, these figures were not used here. The figures presented by Waser for 1762 (which are also used by Braun) come from a list of all parishes which attempts to measure the in-

carried out by various institutions, eventually even by the state itself.[24] All this census material, together with the parish registers, was used to calculate continuous series of crude birth, marriage and death rates, in principle from 1670/1 to 1796.[25]

In order to obtain population estimates for the years between two censuses the difference between the figure reported by the later census and the sum of the population in the previous census and natural population growth (births minus deaths between the two censuses) was calculated and divided by the number of years between the two censuses. After this, population size in any of the intervening years was calculated as the sum of the previous census, natural growth between the census year and the year in question, and the above-mentioned yearly difference times the number of years between the census and the actual year.

In general, the difference between estimated and actual population sizes in subsequent censuses are not large (5 percent of the previous population or less). However, for a considerable number of parishes differences are substantial before the 1690s or even later which made it advisable to drop the information for those early periods in many cases (in general, the problem was one of an underregistration of deaths). Likewise, three parishes were dropped altogether from the analysis because these differences consistently amounted to more than 10 percent of the population in each previous census over most

comes derived from them by parsons (StAZ G I 9). Population figures – which are apparently included as a rough measure of the economic potential of a parish – are in part very rough estimates (often rounded to hundreds). Therefore, I decided to use this source only if precise figures were given for a parish and if no alternative sources were available.

[24] The following sources were used: 1) The general census in 1771 which may have served as a base for the distribution of grain in rural areas during the crisis of 1771-72 and which was organized by the *Oeconomische Commission* of the *Physicalische Gesellschaft* (StAZ B IX 2). 2) The same society carried out research on the economic situation of the Canton which resulted in the so-called *Oeconomischen Tabellen* containing population figures for a considerable number of parishes at varying dates in the second half of the eighteenth century (mainly during the 1770s and 1780s). 3) For 1796 population figures for all parishes are available from two sources, an enumeration undertaken apparently by the government and a parallel one organized by the church (StAZ B IX 91a; the precise relationships between the two censuses are not clear); 4) Finally, I was unable to find the census for 1792 the results of which are reported by Gerold Meyer von Knonau, *Der Kanton Zürich historisch, geographisch, statistisch beschrieben*, St. Gall and Berne 1834, pp. 62-68; nevertheless, its quality appeared sufficient to permit its use.

[25] Parish registers figure under E III in StAZ.- Very often the yearly totals given by many parsons could be used in exploiting parish registers (ocasional checks usually revealed at best minor differences).

of the period under observation [26] reducing the number of parishes under investigation to 41. Furthermore, a census figure was dropped if the two adjoining periods showed differences between actual and estimated (natural) population growth which were equally large but opposite in sign, a situation which was taken as an indication of errors (usually of underestimation) in the census in question. Merging the two adjoining periods into one and dropping the census in between usually produced satisfactorily small differences.

In some parishes the series of vital statistics are interrupted by changes in the boundaries of parishes (usually by division). Likewise, in the case of Embrach parish registers are of extremely bad quality in the 1730s which led to a major gap in the series of this parish. Finally, in a handful of cases missing data for individual years were estimated by the mean of figures for the eight adjoining years.

Figure 3 reports eleven-year moving averages [27] of birth, death and marriage rates for four typical parishes from different groups. In the subsequent analysis they may help to visualize some of the statistical results.

## Analysis: The Basic Model

The earlier analysis by Braun [28] has clearly shown that the heavily proto-industrialized areas of the Highland have experienced high population growth contrasting markedly with stagnating or even declining levels in the agrarian parts of the Canton. How do these differences come about? Are fertility and nuptiality — as suggested by the literature on proto-industrialization — or mortality the driving force behind this process?

A first way to look at this question is to perform a cross-sectional analysis of the 41 parishes in 1787, the year in which figures for the number of spinners are available, and to correlate the spinners-population ratio with crude birth, marriage, and death rates. In order to smooth the idiosyncrasies of this particular year in particular places average numbers of births, marriages and deaths in the eleven-year period centred in 1787 were used to calculate the rates. The resulting Pearson correlations are .572* for the birth rate, .036 for the marriage rate and .187 for the death rate.[29]

[26] This was the case for Hausen, Mönchaltdorf and Volketswil.

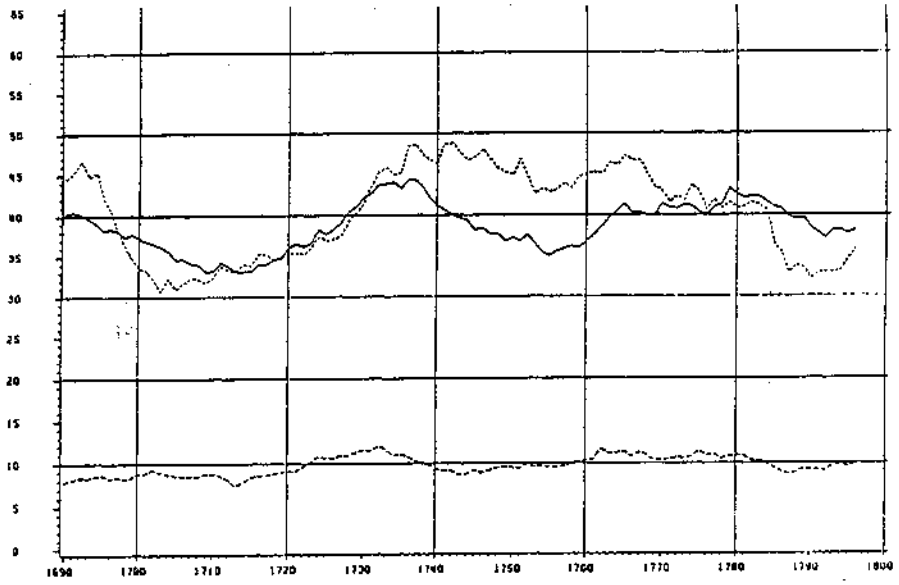
[27] In fact only the raw numbers of births, marriages and deaths are calculated as moving averages of eleven-year periods whereas the population figure is only the one for the year in question. This procedure has the advantage over true moving averages to leave the first and the last year of a series (which are defined by the availability of census figures) unchanged compared to one-year rates.

[28] See the references cited in footnote 2.

[29] An asterisk says that the regression coefficient is larger than twice its standard error. In probabilistic terms this means that the error probability (p) of the rela-

Figure 3
BIRTH DEATH AND MARRIAGE RATES OF FOUR PARISHES IN THE CANTON OF ZÜRICH (per 1000 inhabitants; eleven-year moving averages)

a) Bülach (Lowland)



b) Ossingen (Wineland)

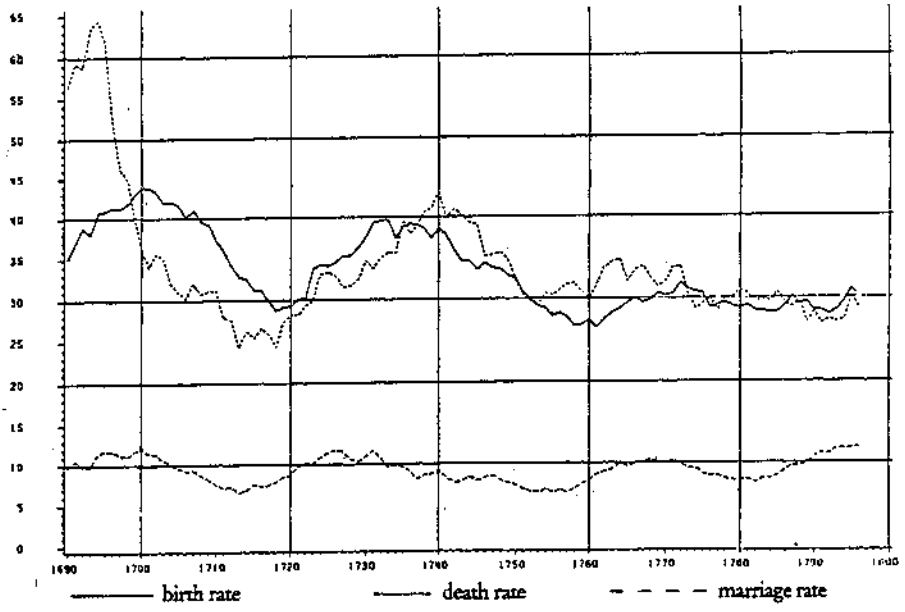
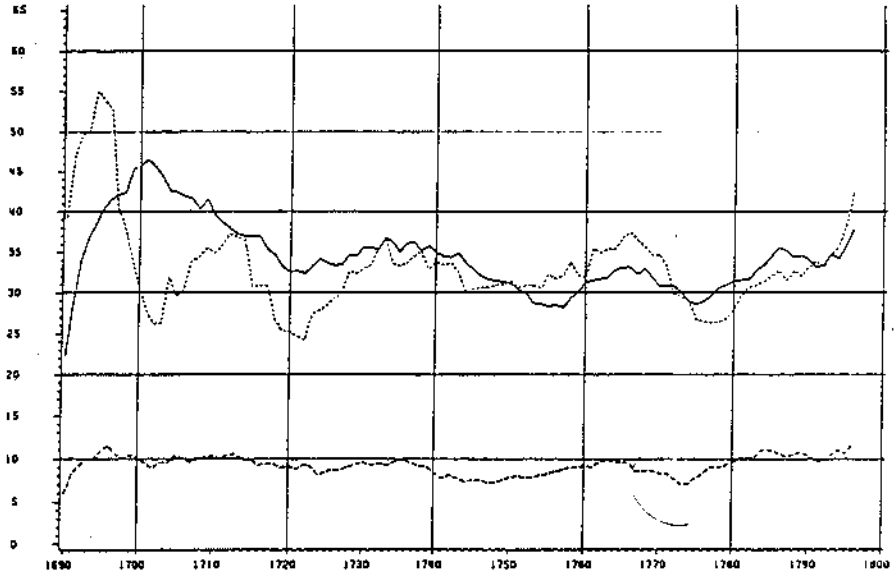
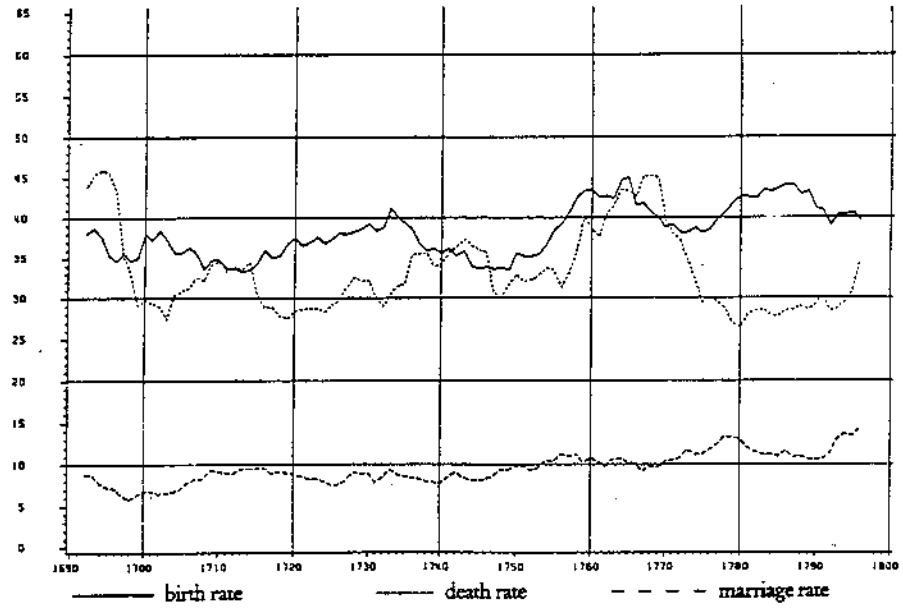


Figure 3 (*continued*)

c) Seen (north-western border area of the Highland)




d) Zell (Highland)



Our expectations are confirmed insofar as the birth rate is strongly correlated with the importance of spinning in a given parish whereas the death rate is not. This means that differences in natural population growth between the proto-industrial and the agrarian parishes in our sample are primarily due to higher birth rates in the former. What is unexpected, however, is the absence of a correlation between the marriage rate and the spinners index. Whether this means that, in the area under investigation, only births are responsive to the opportunities offered by rural industry, or whether the result is to be explained otherwise, will be discussed below.

In order to test the stability of the pattern recorded in 1787 analogous analyses were performed for each decade of the eighteenth century using eleven-year averages for all years in the middle of a decade (i.e. with the rates for 1705, 1715, etc.) and the spinners-population index in 1787. The pattern reported above remains present throughout the second half of the eighteenth century whereas in the first half a negative correlation is found for the death rate and none for the birth rate.[30] Since several parishes with low scores on the spinners index in 1787 must be considered as being subject to a process of de-industrialization (which may raise death rates; compare the record for Bülach in Figure 3a) during the first half of the eighteenth century, it is difficult to draw implications from this result at the present moment. The question will be taken up again below.

Another way to look at how population dynamics differed between proto-industrial and other parishes is to look at time trends. In order to smooth for instabilities due to the particularities of individual parishes and years the data were collapsed into the six major groups discussed above (see Table 1).

The Highland and the (also heavily proto-industrialized) parishes on the left side of the lake and the Limmat river show the expected pattern: birth and marriage rates both increase substantially over time.[31] Death rates increase, too, but less prominently than the birth rates; furthermore, the mag-

tionship is less than 5 percent. Since the present analysis is not based on random samples, however, this test is used here as a descriptive measure to assess the interpretability of a coefficient, rather than as a means to assess statistical significance.

[30] In 1735, for example, the Pearson correlation between the spinners index (in 1787) and the birth rate is −.079, the marriage rate −.180 and the death rate −.479*. In 1755 both, a positive correlation between the spinners-population ratio and the birth rate and a negative one between the former and the death rate are present. In 1705, on the contrary, no correlation is visible at all (with only 30 cases, however); this suggests that the pattern of lower mortality in proto-industrial villages emerged only towards the end of the recuperation phase after the severe crisis of the 1690s.

[31] The coefficient of 0.109 for the birth rate (births per 1000 inhabitants) means that this rate increases by roughly 1 point in ten years and by 10 points in hundred years.

Table 1

TIME TRENDS OF GROSS BIRTH, MARRIAGE AND DEATH RATES, SIX GROUPS OF PARISHES IN THE CANTON OF ZÜRICH 1695-1796

(simple regressions; b: regression coefficient, S.E.: standard error, r: Pearson correlation; *p <.05, +p<.10)

| | | Fertility | Nuptiality | Mortality |
|---|---|---|---|---|
| *Group 1* | b | 0.109* | 0.0171* | 0.080* |
| (Highland) | S.E. | 0.016 | 0.0060 | 0.023 |
| | r | .577 | .272 | .328 |
| *Group 2* | b | −0.041* | 0.0004 | 0.055* |
| (NW border | S.E. | 0.012 | 0.0046 | 0.024 |
| of Highland) | r | −.332 | .008 | .222 |
| *Group 3* | b | 0.038* | 0.0039 | 0.074* |
| (Pfannenstil) | S.E. | 0.016 | 0.0063 | 0.024 |
| | | .225 | .062 | .293 |
| *Group 4* | b | 0.068* | 0.0258* | 0.116* |
| (left of | S.E. | 0.016 | 0.0076 | 0.029 |
| the lake) | r | .396 | .320 | .374 |
| *Group 5* | b | −0.075* | −0.0097+ | −0.033+ |
| (NE of | S.E. | 0.012 | 0.0053 | 0.019 |
| Töss) | r | −.537 | −.179 | −.175 |
| *Group 6* | b | −0.006 | 0.0142* | −0.019 |
| (Lowland) | S.E. | 0.009 | 0.0048 | 0.020 |
| | r | −.062 | .285 | −.094 |

nitude of the trend of all death rates in Table 1 is not very stable.[32] The other groups show either more or less parallel movements of the fertility and the mortality side, such as the Wineland and the Lowland, or a rise of mortality coupled with a relatively slow growth of fertility (the Pfannestil area) or even with a decline of fertility (north-western border area of the Highland).

Obviously, the weaving areas (group III) and the semi-industrial parishes on the north-western border of the Highland (group II) do not follow the

[32] If the series is made to begin in the early 1690s no trends emerge for the death rates except in groups III (positive) and V (negative). Thus, the results for the death rates as they are shown in Table 1 are heavily influenced by the fact that the series begin in the period of recuperation after the disastrous subsistence crisis of the early 1690s. The date of 1695 was chosen as a starting point because the fact that it is located in a period of recuperation means that the trends for fertility and nuptiality are considerably weaker than if a trough such as 1690 is taken as a starting point; thus, the procedure applied ensures that our estimates for the trends of fertility and nuptiality are in no case spurious or exaggerated. See also the results in Figure 3.

classical pattern; insofar the latter cannot be considered as valid for the whole area under consideration. This problem will concern us in more detail in the second part of the analysis.

The agrarian regions, on their part, seem to be subject to some kind of a homeostatic regime with the function of holding population size more or less constant: for both, groups V and VI, the long-term development of fertility and mortality is largely parallel (decline in the case of group V, no significant trend in the case of group VI). In both groups of parishes trends of birth and marriage rates diverge and are higher for the latter. This suggests that regulations of (marital) fertility play an important part in the demographic regimes of these areas; in fact, the crude birth rate of some parishes attains very low levels in the second half of the eighteenth century suggesting the widespread application of conscious birth-control (see the plot for Ossingen in Figure 3b).[33] In the case of group VI this kind of regulating behaviour appears to have allowed a rise of the marriage rate without endangering the stability of population size. This phenomenon can be held responsible at least in part for the previous result that, at the end of the period under consideration, the marriage rate is not correlated with the spinners-population ratio.

In sum, the results shown in Table 1 corroborate the finding of the previous comparative analysis, namely, that rising fertility rates are the driving force behind population growth in the heavily proto-industrialized areas (groups I and IV).

Concerning the mechanisms through which proto-industrialization is associated with an increase in marriage and birth rates it is usually argued that marriages react positively to low grain prices and favourable industrial markets; more precisely, the marriage rate is seen to depend on the relationship between the two, the terms of trade of rural workers, so to speak. At the same time, it is argued that proto-industrial workers do not react by a contractive demographic behaviour on unfavourable developments of their terms of trade, but rather by self-exploitation.[34]

Hence, it is to be expected that the coefficient of the export duty – our indicator for the proto-industrial business cycle – over grain prices is positively related to the marriage rate and is able to explain the increase of the latter over time.[35] Furthermore, this relationship should be stronger when the

[33] No family reconstitution studies have been carried out on the rural parts of the Canton of Zürich so far; hence, empirical support for the above contention is rather weak at the present moment. Nevertheless, it may be mentioned that birth control was practised in Zürich itself from the middle of the seventeenth century onwards; see Ulrich Pfister, *Die Anfänge von Geburtenbeschränkung, eine Fallstudie (ausgewählte Zürcher Familien im 17. und 18. Jahrhundert)*, Berne 1985.

[34] See, in particular, Mendels, *Proto-industrialization...*, and Kriedte et al., *Industrialization Before Industrialization...* ch. 3 (both note 2).

[35] In fact, this coefficient is not a precise measure of the terms of trade since ex-

terms of trade improve than when they decline. Finally, considering the previous result that no correlation between the degree of proto-industrialization and fertility was present before the middle of the eighteenth century one may suspect that the relationship between the terms of trade and the marriage rate is stronger in the second half of the century than before.

These hypotheses are tested with a similar design as by Mendels,[36] namely by regressing marriage rates on grain prices,[37] the amount of the export duty and the coefficient between the two. Absolute figures are used in contrast to Mendels who analyzed growth rates, probably to avoid problems associated with multicollinearity and auto-correlation. In the present case these problems are handled by residualizing birth and marriage rates by the time trend (except for equation 1 in Table 2). Furthermore, the coefficient of the export duty over grain prices was entered into a regression together with its two components (or main effects) in order to test whether the terms of trade effect per se was really present or not.[38] However, models of this kind suffer heavily from multicollinearity which renders the estimates of regression parameters unreliable; nevertheless, the terms of trade variable usually has the strongest effect. Since the problem of multicollinearity stems largely from the strong correlation between the export duty (which has always low coefficients) and the export duty-grain price ratio it was decided to present models omitting the main effect of the export duty. A final difference to the models presented by Mendels is the absence of a time lag in the present analysis, whereas Mendels found a one-year lag.[39] In fact, an immediate effect of proto-industrial business cycles appears more sound: marriages are concluded immediately when conditions are favourable.

Table 2 presents the results for the Highland (group 1); virtually identical results can be established for the parishes on the left of the lake (group IV). Equation 1, in which the time trend is considered explicitly, shows that the

port duties catch both price and volume aspects of business cycles. Insofar as demographic behaviour probably also reflects variations in the size of textile production (determining the quantity of labour demand) this indicator may even be superior to a pure terms of trade variable.

[36] *Proto-industrialization...* (note 2), p. 205f.

[37] Yearly averages of wheat prices on the market of Zürich have been kindly made available by Peter Giger; cf. GIGER, *Zürcher Kornmarktpolitik...* (note 13).

[38] It seems to me that the terms of trade variable, as a coefficient, should be treated in the same way as an interaction effect, making hierarchical testing advisable. Mendels does not discuss this problem and introduces only the terms of trade variable.

[39] Actually, the data for the export duty concern the 'budget period' of the State of Zürich which was from 1 August to 31 July; thus, there is a slight time lag on the life statistics.- The lag structure was established in the same way as by Mendels; the results are not shown here.

Table 2

DETERMINANTS OF CRUDE MARRIAGE AND BIRTH RATES IN NINE PARISHES OF THE HIGHLAND OF THE CANTON OF ZÜRICH 1695-1796

(Multiple regressions; b: regression coefficient, S.E.: standard error, ß: standardized regression coefficient; all rates except in equation 1 are residualized by the time trend; *p <.05)

| | (1) year | (2) grain price | (3) export duty/ grain price | (4) nuptiality t-1 | (5) constant | (6) $R^2$ |
|---|---|---|---|---|---|---|
| *a) Marriage Rates* | | | | | | |
| b | −0.005 | −0.176 | $0.146 \cdot 10^{-3}$* | – | 14.854 | .326 |
| 1) S.E. | 0.014 | 0.160 | $0.053 \cdot 10^{-3}$ | – | | |
| ß | −.066 | −.174 | .570 | | | |
| *Growth of export duty negative (n = 44)* | | | | | | |
| b | – | −0.327* | $0.074 \cdot 10^{-3}$* | – | 0.617 | .255 |
| 2) S.E. | | 0.111 | $0.035 \cdot 10^{-3}$ | | | |
| ß | | −.398 | .284 | | | |
| *Growth of export duty positive (n = 57)* | | | | | | |
| b | – | −0.415* | $0.073 \cdot 10^{-3}$* | – | 0.904 | .234 |
| 3) S.E. | | 0.129 | $0.028 \cdot 10^{-3}$ | | | |
| ß | | −.378 | .306 | | | |
| *1695-1750* | | | | | | |
| b | – | −0.616* | $0.071 \cdot 10^{-3}$ | – | 2.023 | .193 |
| 4) S.E. | | 0.244 | $0.089 \cdot 10^{-3}$ | | | |
| ß | | −.388 | .123 | | | |
| *1751-1796* | | | | | | |
| b | – | 0.008 | $0.146 \cdot 10^{-3}$* | – | −3.190 | .465 |
| 5) S.E. | | 0.102 | $0.033 \cdot 10^{-3}$* | | | |
| ß | | −0.013 | .690 | | | |
| *b) Birth Rates (independent variables lagged one year)* | | | | | | |
| b | – | −0.753* | $0.214 \cdot 10^{-3}$* | – | 0.496 | .257 |
| 6) S.E. | | 0.205 | $0.055 \cdot 10^{-3}$ | | | |
| ß | | −.324 | .348 | | | |
| b | – | −0.528* | $0.158 \cdot 10^{-3}$* | 1.096* | 0.196 | .412 |
| 7) S.E. | | 0.188 | $0.050 \cdot 10^{-3}$ | 0.212 | | |
| ß | | −.227 | .254 | .423 | | |

expansion of proto-industry as measured by the export duty can explain the increase of the marriage rate recorded in Table 1 above: The coefficient of export duties over grain prices is the only variable with a substantial effect on marriage rates, and the size of the time trend is reduced to zero (from 0.017 to − 0.005). The same point is illustrated graphically in Figure 4 were a function of the grain price, the export duty and the coefficient of these two vari-

ables fits the birth rate and its increase over time quite well.[40] In other words, these two results demonstrate statistically that the increase of fertility (and, implicitly, of population) in the Highland area occurred as a direct response to the expansion of proto-industrialization.

Equations 2 and 3 in Table 2 differentiate the time series as to whether the amount of the export duty expanded or shrank in each year considered. No difference is found between the two equations; the regression coefficient of the terms of trade effect is virtually identical ($0.074 \cdot 10^{-3}$ vs. $0.073 \cdot 10^{-3}$). This means that the proto-industrial population under investigation is able to react on adverse economic conditions by a contractive behaviour; the same point is illustrated graphically by the decline of the birth rate (actual and predicted) during the severe crisis of the late 1760s – early 1770s and the difficult years from the late 1780s onwards (Figure 4). This result is in accordance with the material presented by Levine[41] on the English village of Shepshed, although he does not perform a statistical analysis of his data. At the same time it contrasts with the results of Mendels who finds no effect for his terms of trade variable in years of negative growth rates of linen prices; however, this may be due to shortcomings of his statistical analysis.[42]

Another question addressed in Table 2 concerns the possible differences between the first and the second half of the century which were suggested earlier in this analysis (equations 4 and 5). The results show no effect for the export duty – grain price ratio in the first half ($0.071 \cdot 10^{-3}$) and a very sizeable one ($0.146 \cdot 10^{-3}$) in the second half of the eighteenth century. This suggests that the model of population growth induced by rising fertility as a response to an expansion of textile markets prevailed mainly from about 1750 onwards and was virtually absent before (an improvement of the fit of the overall model from around 1750 onwards is also visible in Figure 4).

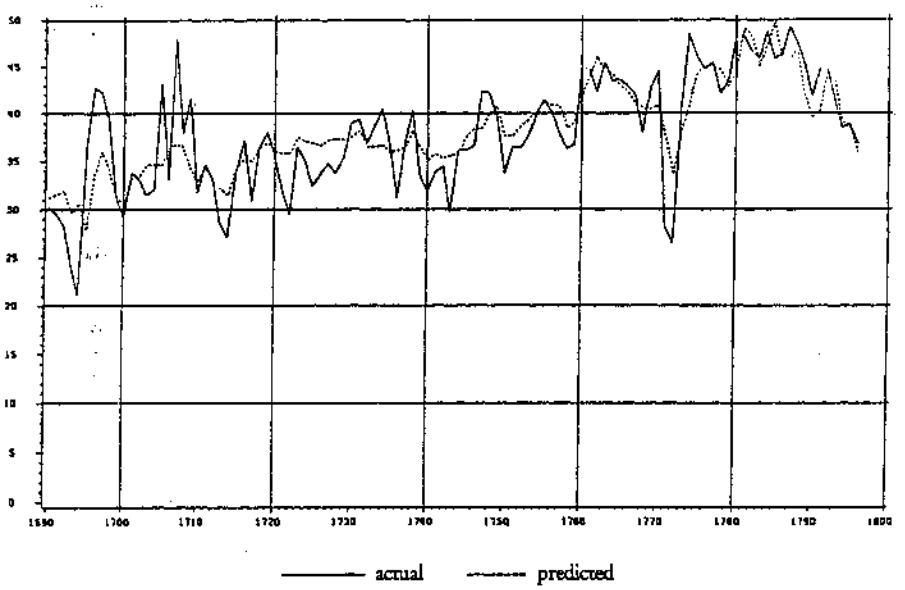
This result, together with the previous finding that mortality was negatively correlated with proto-industry during the first half of the eighteenth century suggests the hypothesis that mortality was responsive to the size of

[40] The regression coefficients (standard errors in brackets) of the estimated function are: constant 30.900, grain price −0.346 (0.345), export duty $0.379 \cdot 10^{-4}$ ($0.305 \cdot 10^{-4}$), export duty over grain price $0.391 \cdot 10^{-3}$ ($0.168 \cdot 10^{-3}$); $R^{\bar{2}}$ is .597. All independent variables are lagged one year in this case (see text below).

[41] *Family Formation...* (note 4), pp. 58, 63, 66.

[42] Mendels works with growth rates of raw numbers of marriages whereas the present study uses the absolute level of marriage rates. If a population grows at different rates at different times the meaning of growth rates of numbers of marriages may vary: in times of rapid growth even an increase in numbers of marriages may imply a decline of the marriage rate provided that the number of marriages grows more slowly than the population. If such a period is analyzed together with a period of slow population growth the results may evidently be misleading. Hence, the analysis of Mendels may underestimate the contractive capacity of proto-industrial populations.

Figure 4
BIRTH RATES IN NINE PARISHES OF THE HIGHLAND, 1695-1796, ACTUAL AND PREDICTED




*Note:* For the regression function see footnote 41 in the text.

exports and/or its ratio to grain prices during that time. Regression analyses analogous to those in Table 2 (but with varying lags up to three years) were performed but did not yield positive results. This leads to the conclusion that, during the first half of the century, the expansion of proto-industry had a beneficial impact within the framework of population dynamics of the '*type ancien*', that is, it alleviated the pressure of periodical small-scale subsistence crises and accentuated the positive impacts of favourable agricultural conditions. This is visible, for example, from the very low death rates most cotton spinning areas experienced during the 1720s, a decade of very favourable climatic and agricultural conditions.[43] Only around the middle of the century a structure emerged where demographic variables (mainly the fertility side) were directly responsive to developments on textile markets. The critical importance of the time around 1750 is also suggested by contemporary descriptions of proto-industrial areas which set in from the 1770s onwards and

[43] See the graph for Zell in Figure 3.d; In several other parishes, such as Bauma and Ottenbach, even lower death rates (eleven year averages) of around 20 per 1000 are sustained over several consecutive years. For climatic information, see CHRISTIAN PFISTER, *Klimageschichte der Schweiz 1525-1860*, Berne 1984, vol. I, p. 129f.

which make frequent use of formulations insinuating that the features observed are of relatively recent origins, and there are signs which suggest that a class of virtually landless industrial workers emerged only around the middle of the century.[44] Thus, the change in the demographic regime coincides with a change in the social base of cottage workers. This in turn may be traced back to the accelerated pace of proto-industrial growth (cf. Figure 1 above) and to the higher wages associated with it which facilitated the creation of households devoid of a viable agricultural base.

The final section of Table 2 reports results on the determinants of the birth rate. Here, preliminary analyses have pointed to a one-year lag which obviously reflects the simple fact that fertility decisions require at least nine months to materialize themselves in births. Therefore, the independent variables in this panel have been lagged one year.

The purpose of this part of the analysis is to investigate to what extent fertility reacts directly on favourable economic conditions through fewer spontaneous abortions (due to better nutrition) and/or conscious fertility decisions, or whether economic conditions are entirely mediated through the marriage rate. The first alternative is suggested in part by the result that the spinners-populations ratio is correlated with fertility but not with nuptiality, and that the time trends in Table 1 are stronger for fertility than for nuptiality (groups I and IV).

Equations 6 and 7 in Table 2 show that the regression coefficients for both grain prices and the terms of trade decline substantially with the introduction of the marriage rate as a control variable, but their size remains considerable. The decline may be somewhat underestimated since the method used here does not take into account fully the lag structure of the relationship between marriages and births. Nevertheless, it can be said that fertility reacts partly in independence from the marriage rate.

Insofar as the areas besides the proto-industrial groups I and IV are concerned, in most of them the export duty or its coefficient with grain prices are not related to the marriage and the birth rates.[45] For the agricultural areas

[44] Hirzel, (*Beantwortung der Frage...*, note 12), for example, often uses the formulation "ist gemein geworden" (has become common). The clearest reference to the relatively late origin of the classical proto-industrial economic, social and cultural patterns described in the studies of Rudolf Braun (see note 2 above) I have found so far comes from a discussion between farmers from Fischenthal (a Highland parish) and the *Oeconomische Commission of the Physicalische gesellschaft* in 1779 (StAZ B IX 68, p. 261): "The men present from Fischenthal admitted that, even by their times, no bread had been eaten in their areas, now they use 50 Mütt of wheat every week from outside". This statement suggests that a virtually landless class of rural cottage workers buying its food on grain markets emerged only about the middle of the century (if "by their times" can be understood to mean some 20 to 30 years).

[45] Exceptions are the marriage rate in group VI and the birth rate in group II for

this result is quite consistent with common perceptions: one would barely expect an influence of industrial cycles on the demographic behaviour in these contexts. On the other hand, the fact that areas with an important sector of weavers (group III) and the semi-industrialized areas in the north-west of the Highland (group II) do not adjust their (short-term) demographic behaviour to the situation on industrial markets is somewhat disturbing and will, therefore, concern us in the second part of the paper.

To sum up the first part of our analysis, most current theories on the relationship between proto-industrialization and demographic change are borne out by the results of the present study, and by the comparison between proto-industrialized areas dominated by a population of spinners largely devoid of any substantial agricultural base and agrarian areas after 1750s. The former achieve high rates of population growth mainly through an increase of the marriage rate and a corresponding rise of fertility. The rise of the marriage rate can be (even statistically) accounted for by the rise of textile production providing new employment opportunities and, as a consequence, facilitating the formation of new households. Three minor modifications of this general picture arise from the facts that, first, some agrarian areas were able to support high and increasing marriage rates, too. However, there was no concomitant rise of the birth rate, suggesting the existence of a homeostatic demographic regime which keeps population size more or less constant in these areas. Second, there are signs pointing to a possible direct link between proto-industrial business cycles and the fertility rate in areas with a large population of spinners. This link may be mediated by better nutrition in favourable years causing fewer spontaneous abortions, or by conscious fertility decisions. Third, contrary to the assertions by Mendels and Medick, proto-industrial populations (at least those under investigation in the present study) appear to be capable of a contractive response to adverse conditions on the markets of their products.[46] The contrary claim by Mendels may suffer from methodological short-comings.

In the first half of the eighteenth century, however, the model outlined above was of minor relevance, at best. The areas noted for the cotton industry were mainly distinguished by very low death rates in periods of favour-

both of which an effect slightly larger than twice the respective standard error is found. These results are neither consistent nor stable (they disappear if the length of the period is altered or if the time trend is considered explicitly).

[46] MENDELS, *Proto-industrialization...*; KRIEDTE et al., *Industrialization Before Industrialization...* ch. 3 (both note 2). Implicitly, this result questions Medick's hypothesis that high incomes derived from a large number of children constituted an incentive to marry and thus supports the theoretical critique made by HEIDI ROSENBAUM, *Formen der Familie: Untersuchungen zum Zusammenhang von Familienverhältnissen, Sozialstruktur und sozialem Wandel in der deutschen Gesellschaft des 19. Jahrhunderts*, Frankfurt a. M. 1982, p. 219.

able harvests during this period. This suggests that before the acceleration of proto-industrial growth around 1750, cottage industry supported the prosperity of a mainly agrarian economy and was not associated with the emergence of a landless, full-time proto-industrial working class.

Furthermore, in two kinds of contexts the basic model does not hold at all: first, for areas with large proportions of weavers and, second, for areas with a modest presence of cottage industry. In both groups of parishes, marriage (and birth) rates are not related to cycles in textile production and, correspondingly, these areas do not experience a substantial expansion of their population. The 'deviant' behaviour of weaving areas is also shown in Table 3 below while (in equation 2) the weavers-population ratio does not add anything to the explanation of fertility differentials among the parishes under investigation; the birth rates of the parishes dominated by weaving activities can be quite accurately predicted by considering only their (rather small) numbers of spinners.[47] In the case of the north-western border area of the Highland the simple spinning-fertility relationship as reported in Table 3 (equation 1) grossly overestimates the birth rates of most of these parishes:[48] In these cases the spread of spinning obviously is not associated with a corresponding modification of demographic patterns.

Hence, the second part of this analysis will investigate these 'deviant' areas in more detail and will look for limitations and possible conditions for the operation of the classical model.

## Further Analysis: The Role of Communal Order

Even contemporaries did not consider the relationship between proto-industrialization and demographic processes in the Canton of Zürich to be a linear one. The councillor and general surgeon Johann Kaspar Hirzel, an important member of the enlightenment movement in Zürich, wrote in 1788:[49]

> "What I have mentioned on Horgen [a proto-industrial area on the left side of the lake; U.P.] shows that with increased population much new land is reclaimed. However, this happened mainly in the hilly parts of Grüningen and the Enner-Amt of Kyburg [i.e., the Highland; U.P.]; where land was available to be reclaimed; and where opportunities are available to buy the materials which are necessary for the improvement of the soil, agriculture

[47] The simple regression of the birth rate on the spinners index (equation 1 in Table 3) estimates a birth rate of 36.7 for Egg (actual birth rate 36.2) and of 35.4 for Maur (actual value 37.4). These two parishes are those with the largest weaver groups in the present study.

[48] Estimated values (actual values in brackets) of birth rates: Elgg 38.5 (33.9), Elsay 37.3 (32.1), Embrach 36.0 (31.1), Seen 38.5 (35.1), Wiesendangen 38.8 (23.1).

[49] *Beantwortung der Frage...* (note 12), p. 124.

> will not only not suffer from the expansion of manufactures, but will even increase considerably. This requires, though, that the houses can be multiplied and can be put into the estates which is possible in all these places as well as in the communities located around the town.
>
> However, where houses are standing close together in villages, and their number is limited to *Gerechtigkeiten*, then, with all industry and all their earnings, the population cannot increase so much, and agriculture must suffer if the estates are divided too much, and if manufacturing spreads. To this we must attribute the fact that the Knonauer Amt, albeit with similar industry as the dominion of Wädenswil, has fallen back with regard to population and that the tithes have declined there in recent times."

The basic argument of Hirzel in this passage is that the relationship between cottage industry and population (and, less interesting in the present context, agriculture) varies according to the availability of land resources and to the social context: Where few land resources are available and where the social context does not permit their efficient exploitation proto-industrialization will not be associated with an increase of population. The element of the social structure Hirzel considers as decisive is the *Dorfordnung* or the communal rules regulating the establishment of newcomers in the village as well as the conditions under which new holdings may be created or old ones divided.

These rules were mostly established in so-called *Einzugsbriefen*. In these charters the government of the Canton granted to a village community the right to raise a fee on newcomers (*Einzugsgeld*) and stipulated rules regarding the use of the commons, the division of holdings (i.e., *Gerechtigkeiten*) and the erection of new houses. These rules were set up by the government upon the request of the individual village community which usually complained through its messengers and advocates that, because of its "attractive local amenities" it was overwhelmed by too many newcomers. This and other evidence suggests that the *Einzugsbriefe* were a reaction of rural communities to population pressure and social differentiation.[50] They begin to appear in the first half of the sixteenth century, whereas the mass of them date between 1550/60 and the middle of the seventeenth century with some late-comers (mostly increases in the severity of the rules laid down in earlier charters) in the second half of the same century; the whole process was largely terminated by 1700. Therefore, in the later statistical analyses the amount of the fee to be paid by newcomers (*Einzugsgeld*) in 1700 will serve as an indicator for

[50] See Otto Sigg, *Bevölkerungs-, agrar- und sozialgeschichtliche Probleme des 16. Jahrhunderts am Beispiel der Zürcher Landschaft* (Schweizerische Zeitschrift für Geschichte 24, 1974, p. 20). A detailed discussion of the topic is also provided by Peter Witschi, *Dörfliches Allmendgut, obrigkeitliche Einzugspolitik und ländliche Industrialisierung im alten Zürich* (Zürcher Taschenbuch 103, 1983, pp. 100-106).

the severity and rigidity of these institutional barriers against population growth in individual parishes.[51]

*A priori*, severe communal rules may form a powerful barrier against the expansion of cottage industry in a village. Braun tries to show that in those areas where commons were small or nonexistent and where no strong and organized rural upper class was able and concerned to keep out newcomers as well as to prevent a fragmentation of holdings *Einzugsbriefe* were established late and contained only weak rules.[52] These were the same areas which were strongly proto-industrialized in the eighteenth century. This relationship can be confirmed with the material of the present study: the Pearson correlation between the amount of the *Einzugsgeld* and the spinners-population ratio in 1787 is a substantial −.453 for the 38 parishes with information available.[53]

The fact, however, that this correlation is far from unity means that at least in some parishes cottage industry spread despite relatively strong institutional barriers against population growth.

In an area where restrictive communal rules go together with a spread of proto-industry the latter cannot be expected to be linked with the emergence of a group of proto-industrial workers with a small or nonexistent agricultural base. Rather, a moderate introduction of textile production as a part-time

[51] If several communes are part of the same parish the mean of the individual communes was taken (in the case of Egg only the two major communities were considered because the others were very small). For the three Highland parishes of Bauma, Fischenthal and Sternenberg a value of zero was coded because no documents are available for them. In the case of Bauma there is an explicit statement from the late eighteenth century saying that a communal order is lacking (StAZ A 99.1, Bauma 17.5.1793). Sternenberg was created only in 1706 out of individual farms which hitherto belonged to Bauma and Wila. Hence, there probably was no communal order, but, to remain conservative, half of the value for Wila (or the mean of the values for Bauma and Wila) was taken. Fischenthal, too, is a parish consisting largely of scattered farmsteads at the beginning of the eighteenth century; a value of zero can be quite safely assumed (the results remain unchanged if Fischenthal is coded as missing). The other parishes with no documents are Buch, Stammheim and Wülflingen. They are all situated in areas with substantial *Einzug* taxes, so that their communal order was probably quite strong but not officially legalized, or that simply their documents have gone lost. In the case of Wülflingen the existence of an *Einzug* tax is mentioned in 1650 (StAZ A 99.6, Wülflingen 26.8.1650). Therefore, these latter three parishes have been coded as missing.

[52] BRAUN, *Industrialisierung und Volksleben...*, p. 38 ff., and *Proto-industrialization...* p. 299ff (both note 2); the same conclusions are reached by WITSCHI, *Dörfliches Allmendgut...* (note 50), pp. 106-110. For a parallel English context, see B. A. HOLDERNESS, *"Open" and "Close" Parishes in England in the Eighteenth and Nineteenth Centuries* (Agricultural History Review 20).

[53] The correlation increases to −.487 if the number of weaving looms is added to the number of spinners.

occupation may be one strategy of an agricultural community to preserve an existing social and economic order threatened by internal population pressure, diminishing returns, etc. Other possible strategies to stabilize such a situation may be emigration or a decline of fertility. Hence, one may presume that proto-industrialization will not be associated with high birth and marriage rates in such a context.

An overall test of this general hypothesis can be undertaken by introducing the value of the *Einzugsgeld* into a multiple regression with the birth rate of the 38 villages for which the necessary information is available. Since it is suggested that fertility is low where both proto-industrialization and *Einzug* scores attain high levels one expects a negative coefficient for the interaction effect of these two variables (spinners-population ratio times *Einzug*). The results in Table 3 (equations 3 and 4), though somewhat disturbed by the effects of multicollinearity, clearly support the above contention: the interaction effect (line 5) has a substantial impact on the birth rate which is independent from the spinners-population ratio, and $R^2$ is more than 10 points higher than in the model including only the main effects (.413 vs. .289 in equation 3).[54] The parishes whose estimated values of the birth rate are substantially improved by equation 4 are Affoltern, Elgg, Embrach, Seen and Wiesendangen.[55] Affoltern is one of the two parishes included here situated in the Knonau area which was mentioned above by Hirzel as an example of his second, 'no population growth model'. The other parishes are four of the five ones that form our group II (north-western border area of the Highland). The rather contractive demographic behaviour of this group of parishes as evidenced by Table 2 may, therefore, be taken as a reflection of a situation which is marked by the combined appearance of a rigid communal order and cottage industry.

Why do relatively rigid communal structures, proto-industrialization and fertility occur together in these parishes of the north-western border area of the Highland? Although these parishes differ among each other with regard to both social and agricultural structures, the following general patterns appear present:

Like many other areas the parishes under investigation experienced a substantial population growth in the course of the sixteenth century and a corresponding threat of a fragmentation of holdings associated with pauperiza-

[54] For readers interested in significance tests it may be noted that the difference of between equations 3 and 4 in Table 3 is highly significant with an F-value of 7.2; for procedures in interaction testing see Paul D. Allison, *Testing for Interaction in Multiple Regression* (American Journal of Sociology 83, 1977, pp. 144-153).

[55] Actual birth rates and those estimated by equations 1 (but with n = 38) and 4 are, respectively: Affoltern 38.6, 47.5, 39.0; Elgg 33.9, 38.9, 33.8; Embrach 31.1, 36.5, 32.5; Seen 35.1, 38.9, 36.2; Wiesendangen 23.1, 39.2, 35.3.

Table 3

DETERMINANTS OF CRUDE FERTILITY RATES IN 1787, 41 VILLAGES IN THE CANTON OF ZÜRICH

(multiple regressions; b: regression coefficients, S.E.: standard error, ß: standardized regression coefficient; *p <.05, rates are based on 11-year averages of numbers of births)

| | | | (1) n = 41 | (2) n = 41 | (3) n = 38 | (4) n = 38 |
|---|---|---|---|---|---|---|
| 1 | constant | b | 34.30 | 34.16 | 36.48 | 35.57 |
| 2 | spinners/ population 1787 | b | 19.96* | 19.98* | 16.56* | 28.74* |
| | | S.E. | 4.58 | 4.63 | 5.26 | 6.36 |
| | | ß | .572 | .573 | .490 | .850 |
| 3 | weavers/ population 1787 | b | | 4.68 | | |
| | | S.E. | | 15.35 | | |
| | | ß | | 0.40 | | |
| 4 | *Einzug* 1700 | *b* | | | −0.016 | 0.007 |
| | | S.E. | | | −0.016 | 0.017 |
| | | ß | | | −.148 | .066 |
| 5 | spinners-ratio times *Einzug* | b | | | | −0.404* |
| | | S.E. | | | | 0.139 |
| | | ß | | | | −.489 |
| 6 | $R^2$ | | .310 | .294 | .289 | .413 |

*Note:* Equations 3 and 4 exclude Buch, Stammheim and Wülflingen for lack of data on the *Einzug* tax.

tion. It can be documented that — apart from setting up institutional barriers against population growth — these communities reacted with an expansion in the output of wine.[56] Wine production, being more labour intensive than other agricultural work, provided a solution to the problem of population expansion, at least in the short run. However, the yields were low in this area by comparative standards, and the produce of the vineyards of the common people was considered to be of very inferior quality.[57] At the same time, the fact that the areas which could be used for wine production were rather small (due to climatic and topographic reasons) led to an extreme fragmentation of holdings.[58] Low productivity and small holdings produced a rural lower class which was eager to find additional sources of income. It is

[56] SIGG, *Sozialgeschichtliche Probleme...* (note 50), pp. 12-15.

[57] HIRZEL, *Beantwortung der Frage...* (note 12), p. 91f; see also StAZ B IX 67a, p. 135.

[58] For example, in Wiesendangen in 1771, two thirds (91 out of 135) of all households had vineyards between one eighth and one Juchart (= 29 metric ares = 0.72 acres) 16 (11.9 percent) had nothing and 28 (20.7 percent) had more than one Juchart of wine. In the parishes of the Wineland proper, such as Stammheim in 1770, only one third of all households had one Juchart or less in vineyards (source: StAZ B IX 86 and 88).

suggestive that in 1771 many people of Wiesendangen were reported to work in the vineyards of neighbouring Winterthur, and that wages for work in vineyards were very low in this area[59] which stands in sharp contrast to the universal complaint of the non-availability and high cost of agricultural labour in the Canton of Zürich around this time. Low wages certainly increased the attractiveness of cottage industry as an occupation especially in the course of the latter's rapid expansion during the second half of the eighteenth century. Accordingly, already in 1692 a poor woman of Seen is reported to work both as a spinner and in her vineyard. Likewise, in Elsau in the same year proto-industrial activities are often pursued by people who had a vineyard as their sole possession in land.[60] However, spinning could not provide for more than a supporting seasonal occupation:[61] in the face of the relatively rigid communal order the lack of an agricultural base would have entailed a loss of important communal rights (provision of timber and firewood, grazing rights, etc.). In sum, the area under investigation presents a case of an unsuccessful conversion to commercial agriculture, that is, large-scale wine production.[62] The expansion of vineyards and the emergence of important features of the social structure of 'close villages' – institutional barriers against population growth, emigration and low fertility levels[63] – did not resolve the basic problem produced by sixteenth-century population growth: land poverty among large sectors of the population.[64] A moderate introduction of cottage industry appears to have been the consequence of this deadlock.

To sum up, the analysis of the present section shows that the relationship between proto-industrialization and demographic structures in the Canton of Zürich varies according to the rigidity of communal regulations regarding the settlement of newcomers and the foundation of new holdings or the division of old ones. In contrast to the classical proto-industrial areas of the Highland

[59] HIRZEL, *Beantwortung der Frage...* (note 12), p. 93; StAZ B IX 67a, p. 136 and B IX 86.

[60] StAZ A 61.5.

[61] The enumeration of cotton workers in 1787 notes for the area in question that spinning either stops completely in summer or is reduced by half (Embrach), whereas the reduction for the Highland is evaluated at one fourth only (StAZ B IX 70). JOHANN HEINRICH SCHINZ, *Versuch einer Geschichte der Handelschaft der Stadt und Landschaft Zürich*, Zürich 1763, p. 180, states that in the inner parts of the dominion of Kyburg, of which the area concerned forms a part, "although they spin and weave, this takes place in the slack times between work in the fields".

[62] See the general discussion by MENDELS, *Seasons and regions...* (note 11), p. 184ff.

[63] For the latter see Table 1 and the discussion above; high rates of emigration are suggested by the high number of absent people recorded in several villages of the area in 1771 (see StAZ B IX 86 and the discussion of contemporaries in B IX 69a, p. 127).

[64] For the discussion of land poverty as a decisive prerequisite of the spread of proto-industrialization see GULLICKSON, *Agriculture and Cottage Industry...* (note 6).

where such regulations are weak or absent fertility is relatively low in proto-industrialized areas with rigid regulations. This is due to the fact that in those areas proto-industrial activities, together with a restrictive fertility regime, develop as a response to stabilize a given agricultural economic and social system threatened by relative overpopulation and low agricultural returns, particularly regarding wine production.

## Proto-industrial Areas not Engaged in Cotton Spinning: A Short Discussion

It is much more difficult to devise an explanation for the 'deviant' behaviour of the Pfannenstil group than of the parishes in the north-western border area of the Highland. Apart from the two facts that in all parishes of the former group cotton spinning is not the main proto-industrial activity and that their marriage and birth rates (both on the group and on the parish levels) are not influenced by proto-industrial business cycles they have little in common. Their demographic development is rather heterogeneous and individual parishes do not show patterns very similar to those of other groups.[65] Furthermore, in regard to their economic structure they belong to different areas: Zollikon, Erlenbach and Uetikon are part of the lake area marked by an intensive and heavily commercialized agriculture (particularly of wine production) whereas Egg and Maur belong to an area which was reputed for rather bad agricultural performance, at least before the last quarter of the eighteenth century.[66] Finally, their proto-industrial structure varies considerably: some parishes are engaged in cotton weaving, others in silk manufacture; and the former differ in regard to the relative dominance of weaving over spinning (compare Egg and Maur in Figure 2). In the face of all these divergences it is impossible to formulate an explanation of the demographic patterns of this area without a detailed study of the social and economic situation of each parish – a task which is clearly beyond the scope of this paper.

The only conclusion which can be reached at the present moment is that areas with 'rich' and diverse proto-industries may not – perhaps precisely because of their diversity – follow the classical pattern of population growth led by rising marriage and birth rates. This result has several parallels in previous studies.[67]

[65] In hierarchical cluster analyses of time series such as those presented in Figure 3 the parishes under consideration appear as outsiders which are integrated into other groups rather late in the hierarchical process of cluster formation (cf. note 15 above).

[66] Hirzel, *Beantwortung der Frage...* (note 12), p. 80-83, StAZ B IX 67: 424-441.

[67] A high diversity implies the possibility of a flexible response to changing demand patterns and, thus, a reduced dependence on business cycles. For previous studies with

## Concluding Remarks

One of the principal findings of the present study is that a wide variety of different demographic patterns can be associated with proto-industrialization. To be sure, in two of the most important proto-industrial areas of the Canton of Zürich (the Highland and the parishes left of the lake) very clear support can be found for the classical pattern in the second half of the eighteenth century. During this period substantial population growth was brought about in these areas by rising fertility which can be shown statistically to react on the expansion of textile markets. However, even in these areas population growth during the first half of the eighteenth century was determined primarily by mortality. If this growth pattern was influenced by proto-industry (something which our data do not prove explicitly) the impact was probably indirect, namely to improve the functioning of an existing agricutural system by providing employment for the poor during the dead season. Furthermore, in other areas and parishes proto-industry was never associated with the classical demographic pattern. On the one hand, these were areas with strong institutional barriers against population growth where these same barriers had failed to prevent a fragmentation of holdings and where, as a consequence, an important group of land-poor people eager to earn a supplementary income had emerged. The rigid communal structures in these areas, however, did not at the same time allow a lasting expansion of population supported by cottage industry; hence, fertility remained at fairly low levels. On the other hand, the few parishes included in the study which were not primarily engaged in cotton spinning, but in cotton weaving and (perhaps) the silk industry, did not follow the classical pattern either. While the reasons for this cannot be fully explored in the present analysis, the finding nevertheless corroborates a tendency found in previous studies, namely, that 'rich' industries do not necessarily follow the demographic patterns recorded in the larger and quantitatively more important areas of 'poor' industries. Clearly, the former should be given more attention than they have received so far.

All these results question the universal validity of the interpretation advanced by Mendels and Levine and the assumptions about the 'demo-

similar results, see DEYON, *Fécondité et limites...* (note 12), p. 874f (French examples). An interesting example can be found in pre-famine Ireland. In the analysis of ALMQUIST, *Pre-famine Ireland...* (note 4) weaving is not correlated with most indicators for female and male marriage propensity whereas spinning is (see Almquist's correlation matrix on p. 711; the correlation between weaving and the percentage of all males married disappears if controlled for spinning). Perhaps the weak results obtained by JOEL MOKYR *(Why Ireland Starved; A Quantitative and Analytical History of the Irish Economy, 1800-1850,* London 1983, pp. 52-64) can be explained by his disregard of this distinction between spinning and weaving.

economic' system of proto-industrialization advanced by Medick.[68] Therefore, some theoretical revisions might seem appropriate.[69] To be sure, the basic idea that a growth of proto-industry, due to slow or non-existent technological progress, requires a parallel increase of labour inputs, should be retained. However, one may go on then and ask what kind of processes are conducive to such an increase of the labour force. Two typical solutions can be envisaged: extensive and intensive growth. Extensive growth in this context means that proto-industry slowly spreads to more and more places in a region, absorbing labour surpluses generated by the unequal seasonal distribution of agricultural work and/or the sexual division of labour. After a place is integrated into proto-industrial production no further expansion of cottage industry takes place there in principle, and new labour has to be sought elsewhere. This kind of proto-industrial expansion is associated with zero or at best moderate population growth, since cottage industry mainly supports the functioning of a given agricultural structure. Intensive growth, on the other hand, means that economic and social structures are transformed with the introduction of proto-industry. This transformation permits demographic processes which respond to proto-industrial business cycles and, hence, allow the emergence of a virtually landless rural industrial working class. Of course, organizational costs are higher in the case of the first type of expansion than in the case of the second (costs for finding new labour and keeping up contacts with them, control of quality and size of production).

Examples of the extensive mode of expansion of the labour force can be seen in the Pays de Caux[70] and in the Canton of Zürich as a whole before the middle of the eighteenth century. Intensive growth of labour supply began only after spinners wages had risen in the wake of an expansion of weaving which was accompanied by shortages of yarn. The fact that an expansion of yarn production was possible only through substantial wage increases suggests that the second sequence emerged only when the first one had run into difficulties because of mounting organizational costs.

Whereas the demographic corollaries of intensive growth of labour may be found quite universally and correspond more or less to the classical pattern, the case may be different where proto-industry supports a given agricultural structure without transforming it. Even in the relatively narrow con-

[68] MENDELS, *Proto-industrialization...* (note 2); LEVINE, *Family Formation...* (note 4); KRIEDTE et al., *Industrialization Before Industrialization...* (note 2), ch. 3.

[69] Some of the following arguments may resemble those presented by GUTTMANN and LEBOUTTE, *Rethinking Proto-industrialization...* (note 5), p. 603ff. However, attempts are made here to present them in a theoretical framework which is more concise than in their study. Their 'novelty thesis', for example, is already for most part present in my basic argument why one may expect a link between proto-industrialization and demographic processes.

[70] See the research work by Gullickson cited in note 6.

text of the Canton of Zürich, two distinct demographic patterns of the extensive mode were found: population growth by low mortality (Highland and Knonau area before 1750) and stagnating population in a situation of low or even declining fertility (north-western border area of the Highland). They apply to areas each marked by differing types of agriculture, contrasting organization of rural communities and, hence, a differing role of cottage industry within rural economic and social structures. In other words, the demographic concomitants of rural industry in a context of an extensive growth of the labour force can be specified only through a careful analysis of the specific role it plays in a particular context.