6. AN UNEXPECTED SOLUTION TO THE POPULATION PROBLEM

INTRODUCTION

We saw in ECN 110A that Western Europe had a distinctive demographic regime in the pre-industrial era - the European Marriage Pattern. Under this marriages for women were late, many women did not marry, there was no fertility control within marriage, but little fertility outside marriage. The European Marriage Pattern kept real wages high before the Industrial Revolution even though there was little technical progress by limiting fertility. In this section we consider what happened to fertility and mortality in Europe as a result of industrialization in the nineteenth century.

European countries experienced a common demographic pattern called the **Demographic Transition** between 1850 and 1980. First death rates dropped, so that birth rates exceeded death rates and there was a period of fairly rapid population growth. But then birth rates also dropped so that the population finally stopped growing, and in some cases has begun to decline. Population growth rates are still high in many parts of the world such as the Middle East and Africa, and there is an economic cost to these countries of high population growth rates.

Thus there has been debate about what measures are needed to reduce fertility in these countries. Some argue that "economic growth is the best contraceptive" so that the key thing to worry about is getting the economies of these countries moving, and that alone will take care of the population problem. In low income economies, it is claimed, children are not expensive, and so parents have many of them. As incomes advance the relative cost of children rises, and people have fewer of them. Others argue that the problem is largely one of introducing affordable contraceptive technology to these societies, and that even at low income levels people always want to have fewer children, they just do not know how to achieve that goal. Yet others claim that the key to fertility decline is to improve the status of women. Women bear most of the costs of high fertility, and given choices would reduce the

number of children they have. By giving women more education and more social status they will be able to exert control over fertility, and so reduce population growth rates. Finally some argue that fertility levels will respond, perhaps with a lag, to declining mortality levels since high levels of fertility are just a response to the high death rates of children in poor societies. What does European experience suggest is the demographic future of other countries?

The decline of death rates in Europe has also been of some interest to historians. Most major medical advances were made only in the twentieth century, yet the decline in death rates starts even before 1870. Why did death rates start declining so early? Three different theories have been offered here. These are that the decline in death rates was the result of better medicine, that it came from more effective public health measures, or that again it was a byproduct of higher incomes.

THE DEMOGRAPHIC TRANSITION

Tables 1 and 2 show the crude birth rates (number of births per thousand of population) and crude death rates (number of deaths per thousand of population) for Britain, Ireland, France, Sweden, Germany and Italy between 1751 and 1991 (where the data was available). As can be seen from the tables, all these countries experienced what is called the **Demographic Transition** in this interval. They switched from a regime of high mortality and high fertility to one of both low mortality and low fertility. The way this process operated is shown graphically in figure 1 for the case of Denmark. As can be seen the mortality decline starts in the late eighteenth century. Fertility declines only in the late nineteenth century. As a result while births and deaths are equal in Denmark around 1750, so that there is no population growth, by the 1790s a gap appears with births exceeding deaths. Thus population grew steadily in most European countries in the nineteenth century, after having been essentially static for centuries.

Table 3 shows the rates of population growth implied for the various countries portrayed in tables 1 and 2 if there was no migration. This is called the natural growth rate of population. The rates are not particularly high - between 1.0 and 1.4% per year for most - but these rates were enough to greatly increase the population of most European countries in the nineteenth century. Great Britain, for example, went from 10.5 million in 1801 to 37 million in 1901. Populations would have increased even more for

TABLE 1: CRUDE BIRTH RATES IN EUROPE, 1751-1991

Year	England	Ireland	France	Sweden	Germany	Italy
1751	34		40	36		
1761	35		39	34		
1771	35		38	33		
1781	36		38	32		
1791	38		36	33		
1801	34		33	31		
1811	40		33	33		
1821	41		32	35		
1831	35	37	30	32		
1841	36	35	28	31		
1851	36	31	27	33		
1861	36	31	27	31		37
1871	36	28	25	30	39	37
1881	32	24	24	29	37	37
1891	30	23	23	27	36	34
1901	27	24	21	26	33	32
1911						
1921	22	22		18	20	28
1931	15	20				23
1941						20
1951						18
1961	16		17	14		
1971		22				
1981						
1991	13		12		9	9

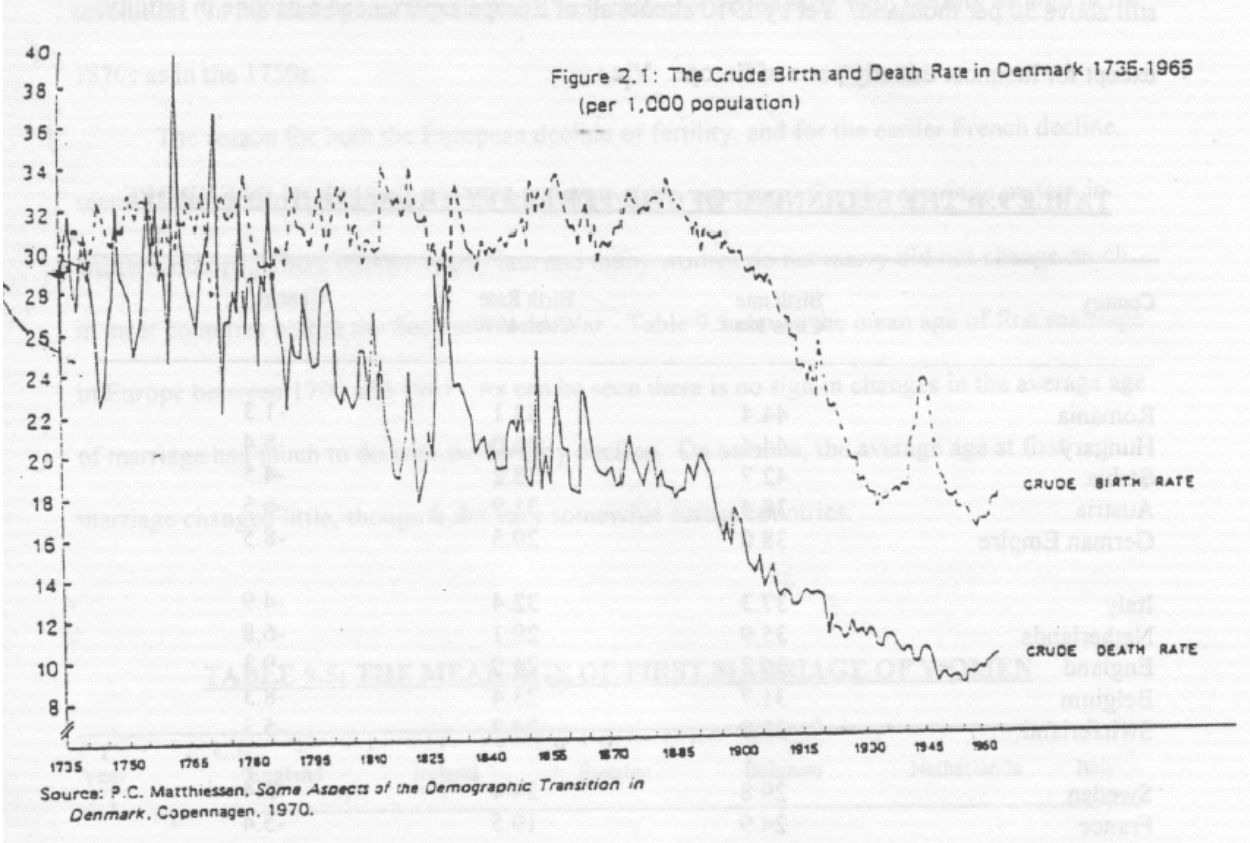
TABLE 2: CRUDE DEATH RATES IN EUROPE, 1751-1991

Year	England	Ireland	France	Sweden	Germany	Italy
1751	28		38	27		
1761	30		38	28		
1771	29		36	29		
1781	29		38	28		
1791	29		35	25		
1801	28		32	28		
1811	27		31	26		
1821	26		28	24		
1831	24		27	23		
1841	25		26	21		
1851	25		26	22		
1861	24		26	20		30
1871	22	17		18	27	30
1881	20	18		17	25	27
1891	19	19		16	22	24
1901	16	18		15	19	21
1911	14	16		14	18	22
1921	12	15		12	13	16
1931	12	14				14
1941						13
1951						10
1961	12		11	14		
1971		22				
1981						
1991	11		9		11	10

TABLE 3: NATURAL GROWTH RATES IN EUROPE, 1751-1991

Year	England (%)	Ireland (%)	France (%)	Sweden (%)	Germany (%)	Italy (%)
1751	0.6		0.2	0.9		
1761	0.5		0.1	0.6		
1771	0.6		0.2	0.4		
1781	0.7		0.0	0.4		
1791	0.9		0.1	0.8		
1801	0.6		0.1	0.3		
1811	1.3		0.2	0.7		
1821	1.4		0.4	1.1		
1831	1.1		0.3	0.9		
1841	1.1		0.2	1.0		
1851	1.1		0.1	1.1		
1861	1.2		0.1	1.1		0.7
1871	1.4	1.1		1.2	1.2	0.7
1881	1.2	0.6		1.2	1.2	1.0
1891	1.1	0.4		1.1	1.4	1.0
1901	1.1	0.6		1.1	1.4	1.1
1911						
1921	1.0	0.7		0.6	0.7	1.2
1931	0.3	0.6				0.9
1941						0.7
1951						0.8
1961	0.4		0.6	0.4		
1971		1.1				
1981						
1991	0.2		0.3		-0.1	-0.0

FIGURE 1: THE DEMOGRAPHIC TRANSITION IN DENMARK



many countries such as Sweden, Germany and Italy had it not been for significant flows of emigrants from these countries, principally to the United States of America. But by the 1970s birth rates fell enough that they were close to death rates for most European countries, and for the last 10 years the natural rate of population increase in many countries in Europe has been negative. That is without immigration many European populations would be declining. Notice also in figure 1 how the death rate in the period before 1880 is very variable from year to year. In the eighteenth century, for example, the death rate varied between 40 deaths per thousand and 22 deaths per thousand in any given year. This

variability of death rates largely disappears after 1880, when death rates year to year follow a much smoother path.

What explains this fertility transition we observe in Europe? Let us begin with fertility. As can be seen in table 1 the level of fertility in pre-industrial England, France and Sweden was in the region of 34-40 births per thousand of population. By the 1870s there were still many European countries with fertility levels in this range. The table below shows fertility levels across Europe circa 1880 and circa 1910. In 1880 most of Europe has fertility levels which are still above 30 per thousand. Yet by 1910 almost all of Europe experienced a decline in fertility, except for the most easterly parts of Europe. Viz.:

Table 4: The Beginnings of the Fertility Transition in Europe

Country	Birth Rate Circa 1880	Birth Rate Circa 1910	Change
Romania	44.4	43.1	-1.3
Hungary	44.4	36.0	-8.4
Serbia	42.7	38.2	-4.5
Austria	38.4	31.9	-6.5
German Empire	38.0	29.5	-8.5
Italy	37.3	32.4	-4.9
Netherlands	35.9	29.1	-6.8
England	34.2	24.9	-9.3
Belgium	31.7	23.4	-8.3
Switzerland	30.0	24.7	-5.3
Sweden	29.8	24.4	-5.4
France	24.9	19.5	-5.4

As can be seen, most of Europe was at pre-industrial fertility levels still in 1880. Yet almost all these countries experienced a decline in fertility over the next 30 years, despite the fact that they were at very different stages of economic development. Thus in terms of fertility, for most of Europe the demographic transition began in the late nineteenth century.

Only France showed a significant decline in fertility before 1880. French fertility levels moved from 38 to 40 per thousand before the French Revolution in 1789 to 25 per thousand by the 1870s. The decline in France occurred continuously in the period 1780-1870, though it is hard to know for sure if the decline preceded the French Revolution or began after the revolution. In the same years Britain had a very different experience, with fertility as high in the 1870s as in the 1750s.

The reason for both the European decline of fertility, and for the earlier French decline, seems to have been the adoption of birth control within marriage. For the marriage pattern in western Europe, where women marry late and many women do not marry did not change much in most countries before the Second World War. Table 5 shows the mean age of first marriage in Europe between 1700 and 1941. As can be seen there is no sign in changes in the average age of marriage had much to do with the fertility decline. On balance, the average age at first marriage changed little, though it did vary somewhat across countries.

Table 5: The Mean Age of First Marriage of Women

Year	England	Ireland	Sweden	Belgium	Netherlands	Italy
1700-49	26.2					
1750-99	24.9					
1800-49	23.4					
1851	25.8			28.6	27.6	
1861	25.4	26.7	27.5	28.0	26.9	
1871	25.1	26.4	27.4		26.1	
1881	25.3	27.3		26.7	26.4	
1891	26.0	28.2	26.9	25.7	26.6	23.9
1901	26.3	28.7		25.2		23.6
1911				25.6		23.4
1921		28.2		24.2	25.7	23.9
1931	25.0	27.4				24.9
1941				23.4		25.1

The percentage of people remaining unmarried also changed little in Europe over the late nineteenth century as Table 6 shows. Since illegitimacy rates remained low throughout these years any decline in fertility in the late nineteenth century had to come from a decline in fertility within marriage.

Table 6: The Percentage of Women Unmarried at Age 40-44

Year	England	Belgium (50-54)	Netherlands (50-54)	Italy
1751	10.7			
1801	6.8			
1821	7.1	23.5	16.2	
1841	9.6	17.7	16.5	
1851	12.2	19.2	16.9	
1861	11.9	18.2	16.4	12.3
1871	12.1		15.8	
1881	11.9	18.9	16.1	12.1
1891	12.4	17.5	16.7	
1901	13.6	16.8	17.1	10.9
1911	15.8		16.9	
1921	16.4	15.4	16.2	11.2
1931	16.4			12.4
1941		10.4	14.7	
1951	14.2			
1961				14.5
1971	7.4			13.9

We find exactly such a decline in marital fertility when we look at figures for the average completed family size of those who did marry in England in this period. The mean completed family size for marriages celebrated in each decade was:

1860s	6.2
1870s	-
1880s	5.3
1890s	4.1
1900s	3.3
1910s	2.8
1920s	2.4
1930s	2.1
1940s	2.0

The low levels of fertility in France compared to the rest of Europe in the years before 1860 were again due to a reduced fertility within marriage. Thus if we compare fertility levels within marriage in various European countries to the levels of the Hutterite families of modern Canada (chosen because they have religious practices that dictate unrestricted marital fertility) we find the comparative rates to be:

France, 1850s	47.8%
Netherlands, 1850s	83.1%
Belgium, 1850s	78.4%
Denmark, 1850s	67.7%
Sweden, 1850s	67.3%

Thus if we want to explain the fertility decline in Europe we need to explain why fertility declined within marriage in the late nineteenth century, and why it declined earlier in France.

With mortality several things stand out. First the high mortality rates of pre-industrial societies. In both England and Sweden in the eighteenth century death rates were 28-29 per thousand in the population. In the absence of emigration and population growth this implies a life expectancy at birth of 36 years (since there was both emigration and population growth the actual life expectancy at birth was lower than this). In France, where the death rate was about 38 per thousand before the Revolution, life expectancy would have been only about 26 years at birth. Thus a more exact

calculation of female life expectancy at birth in France in the 1740s puts it at only 25.7. When life expectancy is low life this, however, most of the deaths are concentrated in the first years of life. In France in the first decade of the nineteenth century 188 infants out of 1000 died before reaching their first birthday, even though by then life expectancy at birth had climbed to 36 for women. This implied that if a girl reached age 1 between 1800 and 1809 she could then expect to live on average another 43 years.[1]

Mortality rates in most European countries began a long decline from the beginning of the nineteenth century. This decline in death rates came before the decline in birth rates in most countries. Also much of the decline to modern levels was achieved by the 1920s before modern medicine could do much to help people through antibiotics and other modern drugs. The life expectancy of French women in the late 1960s was 75.4, in contrast to the 25.7 mentioned above for the 1740s. But life expectancy had already grown to 59 by the late 1920s. This improvement was largely achieved through the reduced mortality rates of infants. Again in France the infant mortality rate was down to 80 per thousand in the 1920s from 188 per thousand in 1800-9. What caused this decline before 1920s and the miracle cures of modern doctors?

FERTILITY

A number of explanation have been offered for the decline in fertility from 1870 on.

1. Families Always Aimed at a Completed Family Size of Two Children

In this view the decline in fertility was a consequence of the decline in mortality. In the stable Malthusian regime of the pre-industrial economy each family has very close to two surviving children (the number is greater than two because not all the children marry). Suppose the ideal completed family size was always close to two surviving children. In an environment with high mortality rates, however, parents know that to have two surviving children they need to give birth to many more children since half of them will die in infancy or early youth. Indeed the uncertainty of infant and childhood deaths will induce them, if they were risk averse, to aim for more than two surviving children in a high mortality society. Thus when they observe the declining mortality rate they will desire fewer child births. But there since

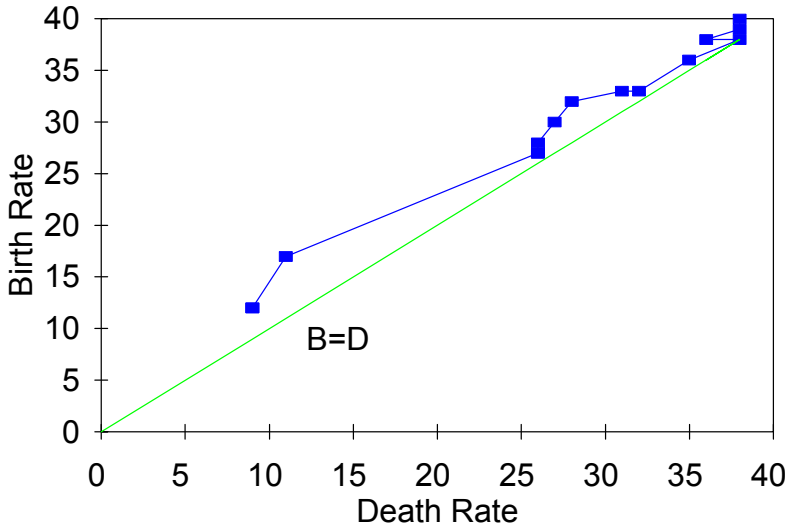
[1] In the Austrian part of the Austro-Hungarian Empire infant mortality was 250 per thousand children as late as the 1880s.

parents have to learn about the decline in mortality there will be a lag between the decline in mortality and the decline in fertility.

A number of findings have been adduced in support of this argument. First there is a close association at any time across Europe in the late nineteenth century between the birth rate in a country and the death rate. Poorer families who experienced higher death rates also had higher birth rates. Secondly the decline in fertility experienced in European countries in the late nineteenth century at different levels of economic development was correlated with a decline in the death rate in each country. France, the country with the anomalous early decline in fertility also shows a more marked decline in mortality than other countries such as Britain or Sweden, as figure 2 illustrates.

But there are a number of findings which are inconsistent with this hypothesis, or at least not easily reconciled. The lag between the mortality decline and the fertility decline can be very long: 70 years for example in Britain. Why would it take three generations for people in Britain to perceive declining mortality rates? Another thing we see within any European country before 1870 are big differences in the numbers of births across families. It was always the case that some women were marrying as early as 16, and they would give birth to 10 or more children, of whom on average four or five would survive to adulthood. Other women would get married at age 35 and have only two or three children, of whom only one or two would survive to adulthood. If there was a common goal of having two surviving children why was there so much variation across women in the age of marriage before 1870.

FIGURE 2: BIRTH RATES AND DEATH RATES IN FRANCE 1751-1991



2. Contraceptive Revolution

Could the decline in fertility be the result of improved contraceptive technology? That is could couples before 1870 always have wished to control fertility but have lacked the knowledge or technology to do so? The objection to this idea is that there is little sign of any improvements in contraceptives in the years before 1914, despite the fertility decline within marriage which had already begun to occur. The main methods of family limitation in the late nineteenth century seem to have been by prolonging lactation, and by withdrawal before ejaculation. The more desperate would resort to eating various poisons to induce abortion. All these methods were available earlier.[2]

Further the French were practicing family limitation within marriage from at least the time of the French Revolution without the aid of any contraceptive advances.

3. Income Effects

Economists have long puzzled over the decline in the number of children per family since 1870. Another thing this decline is clearly correlated with is a rise in incomes. But if people have fewer children as incomes rise it implies that children in economic terms are "inferior" goods, in the same category of goods such as potatoes. Why do people want more housing space, more cars, and more clothes as they get richer, but not more children? Gary Becker, the Chicago economist who recently won the Nobel Prize in Economics, has argued that the demand for children can be analyzed as for any commodity. The key thing we have to add is that there are two constraints on consumption.

The first is the budget constraint: how much a person has to spend. The second is the time constraint - there are only 24 hours in each day with which to consume things. Thus as incomes rise and the budget constraint relaxes, the time constraint on consumption becomes all the more important. Richer consumers will thus tend to switch consumption away from time intensive activities and towards goods that use less time. Thus as people get richer they tend to buy many time saving services, such as prepared foods or restaurant meals. Children as a consumption item are time intensive in the extreme. Thus higher income consumers have switched consumption away from children to goods that use less time - expensive homes, fancy cars, nice

[2] A survey of the wives of Stanford professors in the early part of this century found that while most had small family sizes, those interviewed almost all denied any knowledge of or use of artificial contraceptive devices.

clothes. Further, Becker argues, the way to measure the amount of "child services" parents consume is not just by counting the number of children. Parents can invest more or less quality in each child. As time gets more expensive for parents they choose to have fewer children but children that they invest more in so that they provide more flow of services to the parents.

To check the economic theory of fertility we need to find societies that are rich but differ in other aspects of their social structure. This is difficult since most wealthy societies show a similar social evolution. Richer societies are typically literate, urban, and give higher social status to women. The decline of fertility might thus stem from these changes as opposed to income. To test this theory we would need to either find a society that was modern in all other respects except that real incomes remained low, or a society that was rich but traditional. The second type of rich but traditional society arises because some countries become wealthy as a result of their resource endowments. Countries such as Saudi Arabia went from being poor to rich suddenly as a result of their oil reserves. The evidence from these countries seems to be that high incomes can go along with high fertility levels. The average number of children born to women in Saudi Arabia is still around 6.0, three times as many as most European countries.

4. Modernization

Sociologists have been more attracted to the idea that a more general process "modernization" explains lower fertility. In "modernized" societies women have a very different role. They get much more education, they work outside the home, they can hope to ascent the occupation ladder to high status jobs. They can play important roles in public life. Within families they have much more of a voice over issues such as fertility. All these opportunities for women increase the cost of child rearing. Thus sociologists would argue that the reason countries such as Saudi Arabia have high fertility rates is that women their have very little alternative employment other than rearing children at home. Women cannot drive, cannot travel alone, and cannot mix in public with men who are not their close relatives. They have no political voice.

While modernization theory has its attractions, it must be noted that just as fertility was declining in Britain, married women were retreating from the labor market. Thus the percentage of married women employed was:

	% MARRIED WOMEN EMPLOYED
1851	25
1901	13
1921	12
1931	10

Only after World War II did employment rates for married women reverse this decline. Just as fertility was declining within marriage in England women were becoming more dependent on their husbands.

MORTALITY

Since drugs capable of curing major infectious diseases, antibiotics and sulphonamides, were introduced only in 1935, why did mortality decline long before this. As with fertility there are a variety of theories.

Earlier Medical Advances

In Britain between 1850 and 1971 75% of the reduction in mortality came from reducing the incidence of infectious diseases. How much did medical advances before antibiotics contribute to this? Up until 1935 only two drugs were introduced which were effective against fatal diseases: mercury for syphilis, and cinchona for malaria. But neither of these diseases was a major source of mortality in Europe. The other important advance in medicine before the breakthroughs of the 1930s was the introduction of inoculation against smallpox in eighteenth century England. Smallpox inoculation became common practice in many countries in north west Europe in the early nineteenth century. Indeed some German states made inoculation compulsory: Bavaria in 1806, Hesse in 1807, Baden in 1815 and Wurttemburg in 1817. In 1750 smallpox accounted for 16% of deaths in England. Similarly in Bavaria even in 1802 the same fraction of deaths came from smallpox. By 1850 in England smallpox caused only 1-2% of deaths.

Surprisingly, however, the death rate in England overall fell less between 1750 and 1850 than the introduction of smallpox inoculation would seem to predict. Rates fell from 28 per thousand to 25 per thousand, even though smallpox alone explained 4.5 of each 28 deaths in the earlier period. The introduction of smallpox immunizations similarly had little effect on death rates in Sweden, Norway, and Germany. The reason was that while mortality from smallpox fell many children who would have succumbed to smallpox instead died from some other childhood disease. Before smallpox killed them before one of these other diseases got them.

Other medical advances did occur before 1930. Anesthesia for surgery was introduced in the 1850s. Antiseptic agents were discovered in the 1860s. But these had minor impacts on death rates because while they reduced deaths from shock and infection in surgery, the numbers of people who received surgery was always small.

When we look at the mortality decline in Britain between the

1850s and the 1890s the contribution of declines in deaths from each source was:

Tuberculosis	47%
Typhus, typhoid	23%
Scarlet fever	20%
Smallpox	6%
Diarrhea, Dysentery, and Cholera	9%

The declines in death rates from diseases such as tuberculosis occurred even though there was no effective medical treatment for this until the introduction of antibiotics in the 1930s. Thus modern scientific medicine seemingly played little direct role in declining mortality rates before 1930.

Public Health Measures

Despite little understanding of the exact mechanisms of disease transmission in the nineteenth century doctors did emphasize the need to isolate the sick. Large amounts were spent constructing fever hospitals in cities, which were made spacious and well ventilated to avoid contagion. The walls were regularly washed, and the wards and bedding fumigated with sulfur and nitre. These measures to remove the sick from the population may have helped stop the spread of diseases even though it would do little to help those who were already sick.

Governments also acted to improve public sanitation in cities. Water supplies, for example, were made cleaner. This would have reduced transmission of water borne diseases. Yet as can be seen above the only such diseases which contributed much to declining mortality were diarrhea, dysentery, and cholera which together explain less than one tenth of the mortality decline in late nineteenth century England.

Income

The lack of obvious connections between medical advances and improvements in public health measures on mortality rates has led some to suggest that the major cause of declining mortality was just the rise in real incomes. People were being fed better and were thus better able to resist infection. They lived in more spacious houses, and dined and drank in more spacious public houses, so that diseases like tuberculosis spread less easily. This is sometimes called the “Malthusian argument” because it relies on the idea inherent in the Malthusian model that as income rises

death rates fall.

One reason for support for this view is that death rates declined also in the poorer economies of Eastern Europe where populations remained largely rural and outside the reach of public health measures in cities or of city isolation hospitals for infectious diseases. The only thing left to explain the decline there would be income improvements as a result of the spread of the industrial revolution worldwide.

CONCLUSION

The causes of both the decline in mortality in Europe and the decline in fertility which together constitute the Demographic Transition remain matters where professional historians try to collect evidence and frame tests to support the various viewpoints. Some ideas, such as that the decline in fertility was the result of the development of more effective contraceptives can seemingly be largely discounted. But how much the decline in fertility was a response to lower death rates, an inevitable result of higher incomes, or a consequence of a change in the status of women is very difficult to assess. Similarly the decline in mortality seems largely to come from causes other than better medical knowledge. But how much was from improved public health measures and how much from better material living conditions is again hard to assess.