Pensions and Fertility: Back to the Roots
The Introduction of Bismarck’s Pension Scheme and
the European Fertility Decline *

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This version: January 2010
Preliminary and Incomplete

Abstract

Fertility has long been declining in industrialised countries and the existence of a public pension system is considered as one of the causes. We use the first comprehensive introduction of a public pension scheme in the world as a natural experiment setting to estimate the direct behavioural effect on fertility. We thus provide information on the importance of the investment motive for childbearing. Our results indicate an almost immediate reduction after the introduction, which accumulates to a reduction of 2-4 births per 1000 persons after a lag of 10 years, i. e. an average decrease of 5-10%.

Keywords: pensions, fertility transition, historical data, transition theory

JEL-Codes: H31, H53, H55, I38, J13, J18, J26, N23, N33

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1 Introduction

Declining fertility is a concern in many industrialised countries. Among the many reasons for the fertility decline, the social security hypothesis is often mentioned as a major cause. Securing one’s old-age provision has been one of the oldest motives for having children, which seems to persist even for contemporaneous fertility behaviour (Billari and Galasso 2009).

It is, however, unclear, to which extent a behavioural response is triggered by changes in the parameters of an existing system only or by the mere existence of a system that was introduced more than 100 years in the past. Our paper tries to shed light on this aspect and asks whether the introduction of a pension scheme as a welfare state institution actually had immediate behavioural effects or whether these were only to be observed with a certain lag. In doing this, we use data from the introduction of the first comprehensive public pension scheme in the world: the public pension scheme, which was introduced in the German Reich in 1889.

Our paper uses the introduction of this pension scheme as a natural experiment and shows that the strongest immediate behavioural effect can be observed as soon as the functioning of the pension system could be observed by the population: when first pensions were paid. The effect persists for the remaining period up to the First World War and amounts to a total reduction of 4 births per 1000 persons or about 10%.

As we use the introduction of the public pension system as a natural experiment and annual data, we employ a new approach to deal with the various factors, which affected fertility at that time. The Demographic Transition has in fact long been the focus of extensive research. Starting with the Princeton European Fertility Project, the fertility decline in Germany, and especially Prussia, has been extensively studied (e. g. Becker et al. 2009; Galloway et al. 1998, 1994 for more recent work).

It seems surprising that, to our knowledge, none of these studies has addressed the extensive changes which were brought forth by Bismarck’s welfare reforms. Many studies even date a more rapid decline in fertility to 1895 or 1896,¹ which is the time when pensions were paid for the first time, as could also be observed by the public. Galloway et al. (1998, 1994) address the introduction of a welfare system by adding a variable on the number of employees in insurance. They do not address insurance against old age and invalidity separately. In particular, the system is not treated as fully functioning before 1911. This is only partly true, because the insurance system before 1911 covered workers with an annual income under a certain threshold. Individuals working as a “worker” or “subworker” made

¹The exact year is difficult to define in many studies, because these do not use annual data.
up around 23% of the German population in 1882. People classified as of these professions made up about 45% of the population. The effect of the introduction of social security in general, and a public pension scheme in particular, should not have been trivial. To account for this fact, we do not only use these figures on the distribution of workers as a proxy, but actual information from the regional pension insurance agencies.

Some studies mention the declining importance of children as an insurance against (old age) risks. In addition, the insurance motive for having children was weakened by the introduction of private insurance and banking services. These effects are difficult to disentangle, though, because of the lack of good proxies for both the insurance system and private insurance and banking. This paper tries to fill this gap and focuses on the impact of the introduction of the modern welfare state on fertility, accounting for alternative investment possibilities.

Section 2 gives a brief introduction to the institutional background. Section 3 provides a theoretical framework to establish the effect of different insurance and investment opportunities on fertility. Section 4 presents both the German and the Prussian data set. Our identification strategy is discussed in section 5. We present our results in section 6.

2 Institutional Background

The public pension scheme in the German Reich was put forward by Reich Chancellor Bismarck (Ritter 1992). He first announced plans for the scheme in the last one of his influential speeches, which laid the foundations for the modern welfare state. He gave the speech on March 29, 1889 (Kohl, 1894). As a consequence, the parliament agreed on the law on public (invalidity) pensions on May 24, 1889.

The system started operating on January 1, 1891 (RGBl. 1889 I S. 97). It was administered by autonomous, federally administered entities called Landesversicherungsanstalten. All workers were obliged to participate in the system. 50% of the contribution sum was raised by the worker and the other half was raised by his employer. The contribution was set at 1.7% of wages. The scheme was intended as a funded system, but contained elements of a defined benefit system. After its first introduction, the pension scheme only covered workers below a certain yearly income. Only in 1911 the system was extended to cover employees, too. We focus on the period before 1911.

In general, workers had to contribute to the system for at least 5 years and would have to be classified as unable to work in order to receive a disability pension. To receive an old-age pension, a worker had to reach the age of 70.
3 Theory

The fertility literature that has developed since Becker’s seminal work (e. g. Becker and Barro, 1988, 1989; Becker 1991) is vast. Our model will follow the Easterlin and Crimmins (1985) approach, who distinguish between the demand for surviving children, the supply of surviving children, and the costs of regulation. Our model will, however, focus on the trade-off between different possibilities to invest for one’s old-age provision. During the fertility transition, many of the determinants of fertility changed. At the same time, however, the alternatives for the provision for old age changed, too, namely the access to the capital market and the access to a public pension scheme. Our model will show that these possibilities involved a partial crowding out of having children for pure investment motives.

4 Data

We use data from both the German Reich and the Prussian Provinces within the German Reich. We collected the data for the German Reich at the Province level, whilst we use Prussian data at the municipal level. In order to analyse the effects of the introduction of the pension system it is important to consider information on the administration and the impact of it. This information is available, but only at the level of the regional pension insurance agencies, which correspond to the provinces of the German Reich to some extent.

As aggregation always comes at the cost of aggregating very distinct areas, we use Prussian data at the municipal level for a more local approach. This data is very rich considering the standards for historical data and is well-known in the literature (e. g. Becker and Wößmann, 2008, 2009; Galloway et al. 1994, 1998). We use regional characteristics in place before the introduction of the pension system, which affect its coverage, to assess its impact. Section 5 provides details on our identification strategy.

The German Reich data set contains information on 44 provinces for 37 years. These are aggregated to the geographical area of 25 regional insurance agencies. Preliminary results as presented in section 6 show a simple difference-in-difference model only with some covariates on size, population structure and after 1891 revenues of the regional insurance agencies. This will be supplemented by rich information on the operation of the regional insurance agencies, which we have on participants, revenues, accepted and denied applications for the payment of pensions, surplus and investment. In addition, we will use the usual indicators as in previous studies, such as percentage of workers in mining, female employment, infant mortality, religion, marriage, ethnic minorities, education, and urbanisation.
The identification of the impact of the pension scheme is difficult in a pure cross-section context. The introduction of the pension system took place at a time when the fertility transition was already taking place. As the main motive for introducing the pension system was to calm social unrest, it is, however, extremely unlikely to be directly related to the birth rate or population policies. The reform should thus be exogenous to earlier developments in the birth rate. The pension system was introduced as the last step of Chancellor Bismarck’s welfare reforms. Beforehand, no comprehensive pension system existed in the German Reich. The introduction of such a comprehensive system can thus be considered a natural experiment. This setting can be used for the estimation of the effect of such a system on fertility. In order to identify the impact of the introduction of the pension system, we make use of the fact that the introduction was not uniform, i. e. there exists a control group and a treatment group for estimation. This means, we can use a simple difference-in-difference framework to identify the effect.

Until 1911 only workers were obliged to participate in the system; and the rest of the population was not covered. We use the variation in the number of workers in each province to compare fertility trends before and after the pension scheme came into place. As the system was neither purely funded nor purely pay-as-you-go, a reliable indicator of the structure of participants is the revenues of each regional insurance agency. We also use this characteristic to divide the sample into a control group and a treatment group for the period for which we observe revenues, i. e. after the system was working in 1891.

The econometric framework is a simple difference-in-difference framework. The outcome of interest for group \( g \) at time \( t \) is the fertility rate \( f_{g,t} \). In the canonical two-by-two difference-in-difference approach, as first laid out concisely in Ashenfelter and Card (1985) and neatly summarised e.g. in Abadie (2005), assumes that between a pre-treatment period \( (t = 0) \) and a post-treatment period \( (t = 1) \), in which the population is observed, some fraction of the population is exposed to some form of treatment. This is frequently indicated by a treatment indicator \( D_{i,t} \), which switches to 1 if group \( g \) has been exposed to the treatment.

The basic model assumes that the outcome \( f_{g,t} \) for group \( g \) in year \( t \) is affected by a timespecific trend \( T(t) \) that is common across groups, but not across time,\(^2\) group characteristics \( Z_{g,t} \), and a error term \( \alpha_{i,g} \), which is correlated within group \( g \). \( \varepsilon_{i,t,g} \) is a individual-specific error term, which is i.i.d.:  

\(^2\)This trend is most often simply captured by time dummies.
\[ f_{g,t} = a_g + T_t + Z_{g,t} \beta_1 + D_{g,t} \gamma + \alpha_g + \epsilon_{g,t}. \] 

(1)

As we use regional variation for identification, it is pivotal to control for error correlation across groups. While results presented in section 6 so far only presents results using the simple Liang and Zeger (1986) correction, we will use more sophisticated methods to account for the error structure.

6 Results

Preliminary results indicate that the introduction of the public pension system caused a comparably stronger decline in the birth rate in those regions, in which a larger fraction of the population was covered by the system. First estimates suggest that the relative decline was up to 10% or 4 births per 1000 inhabitants.

Figures 1–4 in the appendix give a first idea of the effect. All figures compare the birth rate per 1000 inhabitants between two provinces of a different composition with respect to the fraction of people, who would be covered by the pension system. The average birth rate is between 35 and 45 births per 1000 inhabitants.

Figure 1 compares the provinces Schleswig-Holstein and Oldenburg because of the large difference in the number of people insured by the pension system relative to the population. The average population in Schleswig-Holstein was 1,327,773 and the average population in Oldenburg was 389,984.4. The average number of insured persons per 1000 inhabitants was 238 in Schleswig-Holstein and 166 in Oldenburg. Correspondingly, Schleswig-Holstein displays a stronger drop in the birth rate after 1896, when the first pensions were paid, although the birth rates were nearly the same before this period.

Figure 2 compares the Kingdom of Saxony with Westfalen. These areas were geographically relatively close. The Kingdom of Saxony had on average 3,855,414 inhabitants. About 263 out of 1000 persons were later covered by the pension system. Westfalen had on average 2,907,142 inhabitants, and about 179 out of 1000 persons were later covered by the pension system. Here, too, birth rates evolve similarly until about 1891, when the gap is reversed and the Kingdom of Saxony displays a stronger downward trend from 1896 onwards.

Figure 3 compares Schlesien with Westfalen. These areas were both part of Prussia, but Schlesien in the very East and Westfalen in the very West. Schlesien had on average 4,517,126 inhabitants. About 242 out of 1000 persons were later covered by the pension system. It is interesting that Schlesien and Westfalen had almost the same birth rate up to
1896, when a small gap evolves. Schlesien, with a higher number of people covered by the pension system, experiences a stronger decline in the birth rate.

Figure 4 then compares Oldenburg with Braunschweig. These areas were geographically relatively close and both not part of Prussia. Braunschweig had on average 429,348.2 inhabitants. This means that Oldenburg and Braunschweig were relatively similar with regard to the absolute number of inhabitants. About 257 out of 1000 persons were later covered by the pension system in Braunschweig. This was almost 100 more than in Oldenburg. Here, too, birth rates developed similarly until the small gap existing before the introduction of the pension system reversed in 1891 and Braunschweig displayed a stronger fall in the birth rate.

6.1 Multivariate Analysis

A regression analysis using the full sample of all 25 regions for all 37 years confirms a significant drop of the birth rate after the introduction of the pension system in those regions, which were most affected by it. Table 1 in the appendix shows these first results.

The first two columns show results for a simple difference-in-difference approach without additional covariates. The treated units for this analysis are defined as the 4 provinces, which later display the lowest relative number of insured people. This covers all years from 1871-1914. The coefficients displayed in the table refer to the treatment on the treated. We show three alternative treatments. The first one is the immediate introduction of the pension system in 1891. The second one is 1896, when first pensions were paid. The third one is 1906, which was the first time when girls born into a time with the system in place, i. e. 1891 or later, could have children. Column (1) indicates a significant effect after the immediate introduction, which would be strongest at the time when first pensions were paid in 1896. These effects do not, however, remain significant, when a simple error correction à la Liang and Zeger (1986) is used, as displayed in column (2).

Column (3) of table 1 presents results using a different definition for the treatment group. All provinces with the relative number of insured exceeding the median are defined as treated units. Here, we only compare the period after 1896 to the period after 1891. The results confirm a significant reduction of the birth rate of on average 3 births per 1000 persons in 1896. This is between 5% and 10%. The effect remains significant and robust even when a different definition of treatment is used, as in column (4). Treated units are defined as those provinces, which had a relative number of workers higher than the median in the census of 1882, i. e. before the introduction of Bismarck’s welfare reforms, because only workers were covered by the pension system. Simply put, whereas the treatment in column
(3) refers to the current composition of the workforce, the treatment in column (4) refers to the composition of the workforce before the introduction of the reforms. Both approaches lead to basically the same conclusion.

6.2 Sensitivity Analysis

To be added.

7 Conclusion

It is often argued that the existence of a public pension scheme can affect fertility negatively because of the reduced importance of having children for investment reasons. We use data from the German Reich and Prussia from 1878-1914 to show that the introduction of a comprehensive public pension scheme affects fertility negatively. To identify the effect, we use Chancellor Bismarck’s introduction of a comprehensive public pension system for the German Reich as a natural experiment.

While the negative fertility effect of a generous (pay-as-you-go) public pension system has been shown for changes in the parameters of existing pension schemes, our paper uses the introduction of the first comprehensive pension scheme in the world to show the impact of this enormous change in the institutional setting on fertility. We show that such a change in the institutions has an immediate effect after its introduction of a reduction of 2-1 births per 1000 persons, or about 5% and another 5% after first effects of the pension system can be felt, i.e. after first pensions are paid. Our paper thus demonstrates that behavioural effects of such an important institutional change are immediate.

The paper also helps to shed a new light on the European Fertility Decline, for which the introduction of comprehensive insurance has long been considered a cause. Using data from regional insurance agencies, we show that the introduction of the pension system significantly contributed to the decline in fertility.
References


Appendix

A.1 Proofs

A.2 Figures

Figure 1: Birth Rate according to Number of Participants I

In Schleswig-Holstein, a higher number of people was covered by the pension system introduced in 1891.

Figure 2: Birth Rate according to Number of Participants II

In the Kingdom of Saxony, a higher number of people was covered by the pension system introduced in 1891.
In Schlesien, a higher number of people was covered by the pension system introduced in 1891.

In Braunschweig, a higher number of people was covered by the pension system introduced in 1891.
### A.3 Tables

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Dependent variable: number of births per 1000 inhabitants. Treatment on the treated. *: significant at the 10% level, **: significant at the 5% level, ***: significant at the 1% level.

(1): Treatment group: 4 provinces with highest number of participants in the pension scheme relative to population.
(2): Treatment group: 4 provinces with highest number of participants in the pension scheme relative to population.
(3): Treatment group: percentage of number of participants relative to population higher than median.
(4): Treatment group: percentage of workers and subworkers relative to population higher than median.