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Heterogeneous Savers and their Inflation Expectation during German Industrialization: Social class, Wealth, and Gender

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Abstract

Using microeconomic data on 2,500 savers of the savings bank *Ludwigsburg*, we study individual savings behavior in 19th century-Germany. We show that wealthy savers responded to an increase in the expected inflation rate (and falling real interest rate) by increasing their savings, suggesting that they pursued a real saving target that could only be defended by saving more when investment conditions became adverse. Workers' savings behavior changed over time. For a long time, poorer, often female, working-class savers were forced to reduce their savings in times of high prices because they had to spend most of their income on essential consumer goods. This changed in the 1880s, when the living conditions of the working class improved significantly due to rising real wages and greater social security. We therefore observe a structural break in the savings regime: the originally negative relationship between inflation expectations and savings was reversed into a positive one. Looking only at the aggregate may obscure the true motives and changes in behavior of heterogeneous savers.

JEL Codes: D15, E21, N33
Key words: Expectations, inflation, industrialization, inequality, heterogeneous savers

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Introduction

Since 2016, European savers have to cope with zero nominal interest rates. More recently, this lack of profitable savings opportunities has been made worse by a sharp rise in the cost of living driven by soaring rents, food and energy prices. In the wake of the Russian invasion of Ukraine inflation will most likely continue. Thus, the real interest rates are and will remain negative which implies that many savers have to fear a decline in their real wealth. What adaptation can we expect in such an adversarial situation?

The logic of the Euler Equation (see Draeger/Nghiem 2021) suggests that if real interest rates fall, current consumption will rise and less will be saved because the lower real interest rate will make future consumption more expensive compared to today's consumption. However, this straight-forward conclusion may only apply to wealthier economies with well-established social insurance systems and a variety of options to diversify investments. In poorer countries with less developed social insurance systems and few alternative investment opportunities, savers may even be forced to increase their nominal savings when real interest rates fall in order to defend their real savings target which they provide for times when they are unable to work.

In this paper, we use the example of the *Oberamtssparkasse Ludwigsburg*, located in the German state Württemberg, to investigate how historical savers reacted to changes in inflation rates in an environment of constant nominal interest rates. The basis of our research is a new microeconomic panel dataset with information on 2,500 individual savers, whose deposits and withdrawals we recorded on a daily basis. Our data cover the long period from 1852 to 1910, when average incomes were lower and the social safety net much more permeable than today. These differences suggest that the precautionary motive to save was more pronounced in 19th century-Germany than in today's highly developed industrialized countries.

The German savings banks, which had originally been founded with the aim of offering low-income workers a way to save small amounts on a regular basis (Wysocki 1980), attracted more and more depositors from the wealthier middle class in the course of the 19th century. By the eve of the First World War, the savings banks had grown to become the banking group with the highest total assets within the diverse German banking landscape. German savings banks held 24.8 percent of the assets of the German banking sector in 1913, just ahead of the much-vaunted universal banks (Calomiris 1995) with a share of 24.2 percent (Guinnane 2002, p. 81). Given the economic importance that savings banks had during German industrialization, it is particularly worth taking a closer look at the origin of their financial resources.

At first glance, the statistical analysis of our panel data seems to offer little surprise, because, in the aggregate, historical savers behaved according to the logic of the Euler equation: a reduction in real interest rates, which we capture by explicitly observing the inflation rates and the nominal interest rates (which were rather constant in our observation period), led to a decline in nominal annual savings. However, this first impression is deceptive. When examined in detail, the various historical German saver groups show heterogeneous behavior. Note that we cannot observe savers' incomes directly. What we can do is infer the distribution of income and wealth from savers' occupation and their average savings. Only the poor savers in our sample seemed to behave according to the standard economic explanation, while the wealthier savers defied it when they increased their annual savings in the face of higher inflation rates.

We explain the behavior of the wealthier savers in our sample by their desire to keep a target amount of real savings for old age and other emergencies out of a precautionary motive. When this savings goal was threatened by higher inflation rates, given the stable nominal interest rates, these savers had no choice but to save a higher nominal amount than before. The strong and regular fluctuations in the inflation rate (see Figure 3) also suggest another interpretation. Savers who expected that the current high inflation rates would soon be replaced by price declines may have saved more only in order to be able to consume more in the coming deflationary phase.

Caroll (2001, p. 24) is not the only one to conjecture that the precautionary motive (and the positive relationship between inflation and savings derived from it) should apply to a particular extent to poor savers. Nevertheless, we observe that the poorer savers in our sample responded to higher inflation rates with lower savings. In our view, this behavior resulted from the low income of poor savers, which barely exceeded the subsistence level even in good times. In times of higher inflation, poor savers might have turned into poor hand-to-mouth consumers who had to spend (almost) all their income on basic consumption goods to secure their livelihood. That is why, in most of the 19th century, poor savers' savings decisions cannot be explained by the Euler equation (Kaplan et al. 2014, p. 78). Poor German savers may not have lacked the will to save in times of inflation, but they lacked the ability to save. This changed in the 1880s, when the living conditions of the working class improved significantly due to rising real wages and greater social security. We therefore observe a change in the savings regime in the *Oberamtssparkasse Ludwigsburg*, where the overall negative relationship between inflation expectations and savings was reversed into a positive one.

Taken together, our empirical analysis leads to the remarkable result that the behavior of heterogeneous savers, which may be explained either by a precautionary motive or by income

poverty, in the aggregate, spuriously suggests that historical savers acted in accordance with neoclassical consumption theory. Thus, our finding adds further evidence to the observation that neglecting socioeconomic factors when using the Euler equation for consumption can lead to a serious aggregation bias (Attanasio/Weber 1993).

Another surprise of our study is the high proportion of female savers, who formed the clear majority in our sample of depositors at *Oberamtssparkasse Ludwigsburg* over the entire period under study, averaging 58 percent per year, and with saving amounts similar to those of men. These women came predominantly from the working class, were often single or widowed, and were frequently employed as maids, servants, or midwives. Alter et al. (1994) identified a similarly high proportion of female savers, 57 percent, among individuals who opened a savings account with the Philadelphia Saving Fund Society in 1850.[1] Interestingly, among these American women, low-income servants proved to be particularly disciplined long-time savers who were able to accumulate substantial savings over their lifetimes.

Similar to what Alter et al. (1994) find for the Philadelphia Saving Fund Society, most savers in 19th century Germany made no more than one or two deposits per year (Wysocki 1980, p. 85). This also applies to savers at the *Oberamtssparkasse Ludwigsburg*, who made an average of 1.7 deposits per year.

Determinants of Saving

Although economists sometimes speculate about various saving motives of households (Browning/Lusardi 1996, Canova et al. 2005), in mainstream economics saving is not treated as an independent optimization problem but explained as a by-product of the optimal intertemporal consumption decision. To Friedmann (1957) we owe the notion that a forward-looking individual does not simply spend her entire annual income on current consumption but chooses today's and future consumption levels in a way that maximizes her lifetime utility function. In doing so, the individual has to adhere to the intertemporal budget constraint, according to which the present value of her lifetime consumption cannot be greater than the present value of her total wealth, which consists of her financial wealth and her present and future labor income. The solution of this optimization problem leads to the well-known Euler equation for consumption:

$$u'(c_{today}) = \beta(1+r)u'(c_{future}) \qquad (1)$$

[1] Wadhwani (2002) confirms this finding for a sample of savings accounts opened at the Philadelphia Saving Fund Society between 1886 and 1900, among which even sixty percent were held by women.

where $u'(c)$ denotes the marginal utility of consumption, β the time preference[2] and r the real interest rate. The Euler equation states that the individual has reached her intertemporal optimum when she is indifferent between consuming another unit of income today and saving that unit and using it to finance consumption in the future. Because, in each period, savings result from the difference between income and consumption, the choice of the optimal intertemporal consumption path also determines the development of optimal savings over time.

The Euler equation can be used to predict how the optimal consumption path changes when the real interest rate increases. We have to consider both a substitution effect and a countervailing income effect. The substitution effect suggests that when real interest rates rise, current consumption will be reduced and more will be saved because the higher interest rate will make future consumption cheaper compared to today's consumption. However, we also have to keep in mind that an individual whose total wealth has grown due to the increased interest rate will strive to spread her greater wealth over all periods. The income effect therefore implies that when real interest rates rise, current consumption will also rise, and current savings will fall. Which of these two effects predominates in a specific context is a question that can only be answered empirically. Many empirical studies observed a negative relationship between real interest rates and today's consumption (Aizenman et al. 2017, Draeger/Nghiem 2021) and therefore concluded that the substitution effect was larger than the income effect. This has therefore become the standard interpretation of the Euler equation.

Assuming diminishing marginal utility of consumption, Friedman's (1957) reasoning leads to the conclusion that a forward-looking individual will strive to smooth her annual consumption over her lifetime. Moreover, if it is possible for an individual to borrow and thereby transfer future income to the present, the life cycle hypothesis of Ando and Modigliani (1963) emerges. The two authors postulate that people get into debt at a young age because during their training and early career their income is not yet sufficient to finance the desired level of consumption. By contrast, in a midlife phase, when people are at the peak of their careers and earn correspondingly well, their income is large enough to repay the accumulated debt of their youth and, in addition, to build up positive savings without having to accept noticeable losses in consumption. In old age, when income from work falls sharply, people then draw on these savings to defend their accustomed standard of living as far as possible, even as retirees.

[2] Time preference $0 \leq \beta \leq 1$ is a measure of individuals' impatience and indicates how much they prefer present consumption to future consumption.

However, the models explained so far only work as described if perfect foresight on the part of decision-makers is assumed. In order to optimize their intertemporal consumption and saving paths for decades to come, individuals would have to be able to predict with certainty how high their income will be in each of the remaining periods. In reality, however, people are uncertain about the future level of their income because many personal misfortunes such as job loss, illness, or work accidents cannot be predicted with sufficient accuracy.[3] This uncertainty, already unavoidable in "normal" times, increases during economic crises, pandemics and wars, when people must expect more frequent and greater personal hardships.

To protect against the occurrence of such unpredictable negative events, it may be prudent to build up a safety reserve of savings, the specific amount of which defies the usual logic of consumption smoothing. All other things being equal, the looser the social safety net, the higher the targeted buffer stock will be (Caroll 2001). Following this argument, it is conceivable that, in the middle of the 19th century, German savers felt strong incentives to build up a safety reserve of savings. After the introduction of the Bismarckian social insurance in the 1880s, however, the precautionary motive might have become less urgent in the subsequent period. Such an interpretation is suggested by a study of Lehmann-Hasemeyer and Streb (2017), who show that the expansion of the German social safety net in the 1880s reduced the average savings of Prussian savings account holders by about 15 percent of a worker's annual income. Because old-age pensions were still very meager and unemployment insurance did not yet exist (Guinnane/Streb 2021), it can nevertheless be assumed that German savers continued to consider it necessary to build up a (perhaps reduced) safety reserve even after the introduction of the Bismarckian social insurance.

Regardless of the specific amount of the targeted safety reserve, in the case of increasing inflation rates (and rather constant nominal interest rates), the precautionary motive will lead a saver to increase her nominal savings today in order to keep the future purchasing power of her savings constant. We therefore find it plausible to assume that during our observation period many savers felt the desire to respond to rising prices by increasing their savings. It is an open question, however, whether they had the financial means to actually do so in times of inflation. Although Banerjee and Duflo (2007) claim that even in today's developing countries, the poorest members of society are capable of saving if only they refrained from spending on stimulants, intoxicants, and other "unnecessary" consumption expenditures, it nevertheless

[3] Hall (1978) concluded from this insight that the consumption path of a rational individual follows a random walk. Because a rational individual has already considered all foreseeable future events when determining her intertemporal consumption path, short-term changes in consumption will only occur if the individual is surprised by an unexpected event.

cannot be denied that poor households generally find it more difficult to save a certain share of their income on a regular basis. “To the poor, saving is a luxury” (Shefrin/Taler 1988, p. 628). In particular, because poor savers were largely excluded from the credit market, it can be assumed that, in our period under consideration, poor savers were forced to reduce their savings in times of inflation because it would otherwise have been impossible for them to buy essential consumption goods.

Taking all these arguments together, it becomes clear that it is by no means a foregone conclusion that a reduction in real interest rates leads to lower savings. For a long time, macroeconomic panel studies were used to test this hypothesis empirically. Masson et al. (1998) examine the determinants of savings for 21 industrialized countries in the period between 1971 and 1993 and 40 developing countries between 1982 and 1993. For industrialized countries, they confirm the assumed positive relationship between real interest rates and savings, but for developing countries they observe an insignificant negative relationship.[4] Loayza et al. (2000) extend the study to a total of 150 different countries over the period 1965 to 1994 and, unlike Masson et al. (1998), find that an increase in real interest rates causes a decrease in saving. Aizenman et al. (2017) look at the more recent period from 1995 to 2014 for 135 countries. Their study supports the assumption of a positive relationship between real interest rates and savings. However, they point out that a negative relationship can also emerge in least developed countries when output volatility is high. Considered together, these studies suggest that the positive relationship between real interest rate and savings is less pronounced in developing countries than in developed countries, where people are wealthier and protected against life’s risks by a tight social safety net.

In the last decade, microeconomic studies that analyze the empirical saving behavior of individual households using national survey data have gained prominence. These studies have several advantages (Burke/Ozdagli 2013). First, they avoid the biases that arise in the aforementioned macroeconomic panel studies due to idiosyncratic differences across the countries under consideration. Second, they use information on the individuals’ expectations about future inflation and interest rates, which makes it easier to identify their specific motives and to prove causality. Third, microeconomic studies draw on a wide range of socioeconomic data from the households surveyed, which makes it possible to explain individual saving

[4] In 1990, Edey and Britton Jones (p. 44) summarized the empirical research done up to that time as follows: “There is little or no direct effect of the real interest rate on consumption spending [and therefore on saving], both income and substitution effects are small or hard to detect.”

behavior as a function of gender, age, marital status, education and income, thus avoiding aggregation bias.

Many of these microeconomic studies were motivated by Eggertson and Woodford's (2003) monetary policy proposal to create expectations of higher inflation in consumers during periods of very low nominal interest rates because, according to the logic of the Euler equation, the resulting decline in expected real interest rates would trigger an expansionary increase in current consumer spending.[5] Recent surveys that explicitly asked about consumers' inflation expectations were quickly seen as the best source to test whether the inflation channel proposed by Eggertson and Woodford (2003) actually worked. At the same time, researchers became accustomed to examining the influence of expected inflation and the nominal interest rate separately, in part because many researchers assumed that the consumers surveyed would not understand the concept of the real interest rate. From a more general perspective, Caroll (2001, p. 41) emphasizes "the spectacular contrast between the sophisticated mathematical apparatus required to solve the optimal consumption problem and the mathematical imbecility of most actual consumers." The financial illiteracy of savers asserted by Caroll should give us pause for thought, especially as we examine the behavior of uneducated workers in the 19th century.

In an influential microeconomic study based on the Michigan Survey of Consumers, Bachmann et al. (2015) found that between 1984 and 2012, the willingness of U.S. consumers to purchase durable consumer goods today did not increase with an increase in expected inflation. Bachmann et al. (2015) explain this result by money illusion among consumers, who would not understand the difference between nominal interest rates and real interest rates. Burke and Ozdagli (2013) confirm the empirical results of Bachmann et al. (2015) with the New York Fed/RAND-American Life Panel Household Expectations Survey for the period 2008 to 2012. Unlike Bachmann et al. (2015), however, Burke and Ozdagli (2013) attribute the lack of a positive relationship between expected inflation and current consumption not to financial illiteracy but to an income effect resulting from pessimistic expectations about the future. Because consumers would expect that the increase in their future nominal income would not keep pace with the inflation rate, they also reduced their current consumption due to a lower expected lifetime wealth.

In contrast to the U.S. survey data, surveys from Japan and Europe tend to confirm the presumed inflation channel of monetary policy. Ichiue and Shusaka (2015) show, based on a Bank of Japan survey, that Japanese households in the late 2000s responded to an increase in

[5] See also Krugman, Paul (1998). Eggertson (2008) argues that increased inflation expectations led the U.S. out of the Great Depression of the 1930s.

their inflation expectations by increasing their consumption today. This relationship had been particularly true for wealthier households without a liquidity constraint and those households that had themselves experienced the high inflation rates of the 1970s. The latter point refers to the observation made by Malmendier and Nagel (2016) that an individual's past personal experience of inflation influences her current inflation expectations and thus also her current savings decisions.[6] Based on national survey data, Vellekoop and Wiederholt (2019) for Dutch households between 2008 and 2016 and Dräger and Nghiem (2021) for German households in 2015 and 2016 provide further proof for a positive relationship between expected inflation and current consumption.

Our own microeconomic study differs from the aforementioned projects in two key respects. First, unlike the analyses that focus on the early 21st century, we consider the long period from 1850 to 1910, a period in which average incomes were lower and the social safety net much more permeable than today. These differences suggest that the precautionary motive to save was more pronounced in 19th century-Germany than in today's highly developed industrialized countries. Second, we have no surveys available for our study that would explicitly ask about inflation expectations and many socioeconomic control variables. Therefore, we are forced to work with sparser information. In many cases, the archival records of the *Oberamtssparkasse Ludwigsburg* provide us with information on the gender and occupation of the savings account holder. From the amount of total savings and the frequency of transactions, we can additionally infer the wealth of the saver and the seriousness of her saving activities; however, her income is unknown to us. Similarly, we do not know the specific inflation and interest rate expectations of historical savers and can therefore only examine how they responded to recent changes in these two variables.

Notwithstanding limited data availability, we succeed in transferring the methods of modern microeconomic studies on the relationship between inflation expectations and current consumption to a more distant historical period. A major advantage of our study is that we do not have to limit ourselves to rather short survey periods but can look at the long-term behavior of savers over a period of more than fifty years. We provide empirical evidence that the savers of the *Oberamtssparkasse Ludwigsburg* were composed of clearly distinguishable

[6] In addition, Conrad et al (2020) emphasize that individual inflation expectations may also differ because heterogeneous consumers use different sources of information. Malmendier and Nagel (2011) investigate whether individuals' experience of macro-economic outcomes have long-term effects on their risk attitudes, as often suggested for the generation that lived through the Great Depression. Using the data from the Survey of Consumer Finances from 1960 to 2007, they show that individuals who have witnessed comparatively low stock market returns throughout their lives report lower willingness to take financial risk and are less likely to participate in the stock market.

heterogeneous groups, each of which reacted differently to changes in the inflation rate and nominal interest rates. Moreover, our project adds to the few economic history studies that use microeconomic data to analyze the structure and behavior of savings bank customers in the 19th century. To date, research has focused on American savings banks such as the Philadelphia Saving Fund Society (Alter et al. 1994, Wadhwani 2002) and the New York Emigrant Industrial Savings Bank (White and Ó Gráda 2003). The epistemic interest of these studies was primarily to find out how savers behave in the exceptional situation of financial crises. In contrast, we seek to understand what decisions savings bank customers made during "normal" economic times.

Finally, our research also relates to recent studies that examine the ways in which German savings banks fostered German economic development. Based on extensive archival studies, Proettel (2020) reveals that the Württemberg savings banks extended many mortgage loans to tradesmen and emerging industrial firms in the early 20th century, thereby promoting the commercial middle class in particular. Lehmann-Hasemeyer and Wahl (2021) strengthen this finding with their quantitative study, which shows that the population of Prussian cities with their own savings bank grew faster in the 19th century than the population of Prussian cities without one.

Data

In the German Kingdom of Württemberg, whose territory in southwestern Germany is today one of the country's economically most successful regions, regional savings banks (*Oberamtssparkassen*), which were responsible for the entire administrative district, came into being in most of the 64 districts (Oberämtern[7]) during the course of the 19th century.[8] One of these was the *Oberamtssparkasse Ludwigsburg*, which publicized its founding purpose of educating the poor to save on December 21, 1851, in the newspaper *Ludwigsburger Tagblatt*: "The purpose of the institution is to induce impecunious or poorer persons living independently and dependent in the district to accumulate savings, which are also easily spent uselessly or wasted, by paying interest on even small deposits [...]." The savings bank's first customer was Barbara Kuhnle, who paid ten guilders into her newly opened savings book on January 2, 1852 (Röder/Klotzbücher 2002). The *Oberamt Ludwigsburg*, located near the state capital, was one of the most industrialized regions in Württemberg and in 1906 comprised 60,324 predominantly

[7] The *Oberämter* were the lower administrative units and correspond roughly to the American county or the Prussian *Kreis*.
[8] The regional savings banks added to the countrywide savings bank *Württembergische Landessparkasse*, which had already been founded in 1818.

Protestant inhabitants (Proettel 2020, p. 23). It is therefore not surprising that the *Oberamtssparkasse Ludwigsburg* (hereafter simplified as savings bank Ludwigsburg) belonged to the top third of the largest savings banks in the state in terms of its financial assets at the end of 1913 (Proettel 2020, p. 49).

The *Wirtschaftsarchiv Baden-Württemberg* has preserved the complete deposit books of the savings bank Ludwigsburg for the period 1852 to 1910.[9] In these deposit books, all account movements (deposits, withdrawals and interest payments) were recorded for each savings account. In principle, the savings accounts in the deposit books were sorted in the order in which they were opened. Therefore, the oldest deposit book contains the accounts that were opened immediately after the foundation of the savings bank; the later deposit books include the accounts that were opened at a later date. However, a special feature must be noted here. When the space allocated in a deposit book for a particular savings account was used up, reference was made at the end of the records to the specific page in a later deposit book where the account was continued. Because of this procedure, deposit books also contain records of savings accounts that had existed for long periods of time and had not been opened in the current volume but had only been continued there. [See Table 1 "Descriptive statistics" here.]

We randomly selected fifty newly opened savings accounts from each of the fifty surviving deposit books and followed the development of these savings accounts through subsequent deposit books, if necessary, until their closure. On average, a savings account was held for 5 years; the longest-held savings account in our sample lasted nearly 46 years. For all savings accounts, the name and place of residence of the account holder have been preserved. Based on the name, we can distinguish not only private individuals and institutional depositors, but also male and female savers.[10] The latter held an average of 55 percent of the savings accounts per year in our sample.[11] [See Figure 1 "Observed active savings accounts, total and by gender" here.]

Figure 1 illustrates how many active savings accounts we observe in a given year. This number remained low until the mid-1870s because no more savings accounts were newly opened than were closed in the same year. Starting in the second half of the 1870s, we observe a sharp increase in open accounts until we reach a plateau of up to 541 accounts open at the same time around the turn of the century. At the end of our observation period, the number of

[9] The inventory signature is Baden-Wuerttemberg Economic Archives (WABW) Y 525.
[10] We did not select purely children's savings books because we assume that children did not make independent savings decisions.
[11] For 41 percent of female savers, we know their marital status, of which four percentage points were married and 37 percentage points were single or widowed.

observed active accounts decreases rapidly because more and more of the still open accounts were continued in the deposit books starting with number 51, which were not available to us for data extraction. Accordingly, the decline in observed open accounts should not be understood as a dramatic change in savers' behavior, but rather as a data availability problem for which we control using saver fixed effects. Figure 1 also shows that female account holders formed the majority until the mid-1890s and only then fell behind men. Figure 2 illustrates that, with the exception of the Prussian-Austrian War of 1866, during which many soldiers, who were stationed in the garrison Ludwigsburg, withdrew their balances from the savings bank, men saved higher amounts on average than women between 1852 and the mid-1880s. Subsequently, women saved as much or even more than men. [See Figure 2 "Savings at the end of the year by gender" here.]

The 2,500 savings account holders in our sample include 28 institutional investors such as associations, which we will not consider further below. In addition, we drop all savings accounts held for less than two years because the duration of these accounts was simply too short to find out how their holders responded to annual changes in the inflation rate. Therefore, the number of savings accounts we examined is further reduced to 1,772 (see Table 1, Panel 2). Note that the short life of some accounts should not be interpreted as a general indication of a lack of desire to save. Mobile factory workers, craftsmen and servants who only lived in the *Oberamt Ludwigsburg* for a short period of time because they found better employment in the city of Stuttgart, for example, had to give up their recently opened account with savings bank Ludwigsburg in the course of their move.

For 1,233 of the remaining 1,772 savings accounts, the deposit books of the savings bank Ludwigsburg additionally contain information on the occupation of the account holder, from which we can infer his social position in the German society.[12] We rely here on a classification scheme introduced by the social historian Reinhard Schüren (1989), who assigned a total of about 6,500 German occupational titles to one of six different social classes. Following Schüren (1989, p. 314), we have separated savers into the social classes of (1) lower working class (e.g., unskilled workers, day laborers), (2) middle working class (e.g., semi-skilled workers), (3) upper working class (e.g. skilled laborers, lower white-collar workers, and lower civil servants), (4) lower middle class (small farmers, master craftsmen, middle civil servants), (5) upper middle class (e.g., full farmers, middle entrepreneurs), and (6) upper class

[12] Thus, information on the occupation of the savings account holder is available for just under 70 percent of the savings accounts we analyzed. Because the savers whose occupation we know about held their savings accounts for a somewhat shorter period on average than the other savers, the mean share of savers with information on occupation per year is only about 50 percent (see Table 1).

(landowners, large entrepreneurs, academics).[13] [See Table 2 "Savers' social classification" here.]

Table 2 shows that nearly 70 percent of the savers in our sample belonged to the working class, as intended by the founders of the savings bank Ludwigsburg. Another nearly 30 percent came from the middle class. In contrast, the total of 11 savings account holders from the upper class make up just 1 percent of our sample. The social classification of female savings account holders is even more lopsided, with 94 percent of them belonging to the working class.

In what follows, the social class of the savers will serve us as a proxy variable for their unobservable income and wealth. In addition, we use existing information on the average annual savings of an account holder, to estimate the wealth of a saver independent of her social class.[14] As has been standard practice since Piketty's (2014) seminal book, we distinguish the Bottom50 percent, Next40 percent, and Top10 percent of the owners of savings.

Because the deposit books of the savings bank Ludwigsburg accurately documented any movement on the savings accounts in our sample, we were able to record every single transaction, be it deposits, withdrawals, or interest payments, on a daily basis. However, due to the small number of only 1.7 savings deposits that savers made on average per observation year, it makes little sense to focus on monthly or even higher-frequency changes in our empirical analysis. Instead, we examine how savers responded to annual changes in inflation rates.

In the pre-industrial period, the cost of food dominated consumption expenditures, especially among the lower classes. Allen (2001, p. 421) estimates that around 1750 a poor household in Strasbourg had to spend 37 percent of its budget on vegetable foods alone and 80 percent overall on all foods, including beverages. One hundred years later, the situation had hardly improved. Engel (1857, p. 170) calculated that in the mid-19th century, a Saxon working-class household had to spend 62 percent, a "middle-class family" 55 percent, and a "family of affluence" 50 percent of its budget on food. Selgert (2013, p. 166) assumes that even the households of senior civil servants in Baden still spent about one-third of their consumption expenditure on food. We use the cost-of-living index calculated by Hohls (1995, Table 5) to approximate the inflation experience of the savers from the savings bank in Ludwigsburg. This index is based on food and energy prices in the relation 3:1.[15]

[13] Donges and Selgert (2021) examine the social background of Prussian inventors based on Schüren's classification scheme.

[14] Until the founding of the German Empire, Württemberg used the guilder currency, after that, as in the rest of Germany, the mark currency. We have converted guilder amounts to mark amounts at the rate of 1 guilder = 1.71 marks. On the introduction of the mark, see Burhop (2011) p. 120.

[15] Data was taken from GESIS Data archive, Cologne. histat. Studynumber 8177, Datafile Version 2.0.0.

In the already quoted announcement of the *Ludwigsburger Tagblatt* of December 21, 1851, it was also stated that the deposits of the newly founded savings bank Ludwigsburg were to bear interest at 4 percent "until further notice." Even though the savings bank deviated from this stipulation in a few individual cases and temporarily granted higher or lower interest rates, our calculation of the interest rates actually granted makes it clear that nominal savings interest rates changed very little between 1852 and the end of the 19th century when they were always between 3.9 and 4.0 percent on median.[16] After the turn of the century, median interest rates were slightly reduced to as low as 3.6 percent. [See Figure 3 "Median nominal interest rate and inflation" here.]

Figure 3 shows that the annual inflation rate based on Hohls' (1995) cost-of-living index fluctuated widely relative to the rather rigid nominal interest rates. Similar to the current period of zero nominal interest rates, the change in real interest rates was thus primarily driven by price changes. That is why we focus on inflation in the following.

Empirical results

Unlike other scholars, who can draw on survey data for their microeconomic studies, we do not know about the specific inflation expectations of our historical savers. To estimate their inflation expectations, we rely on four different methods. Three of these measures assume that historical savers formed their inflation expectations based on their past experience. Differences arise with regard to the length of the past period that savers might have considered relevant for their current expectation formation. Malmendier and Nagel (2016) argue that a person's inflation expectation is shaped by her lifelong experiences. Since we do not know the date of birth of a historical saver, we instead consider her long-term inflation experiences since opening her savings account. In our first specification, we therefore assume that the saver-specific current inflation expectation is equal to the mean of the inflation rates that occurred since the opening of her savings account. Our next two specifications suppose a much shorter experience horizon when assuming that current inflation expectations correspond to the mean of the inflation rates of the past three years and the inflation rate of the previous year, respectively. Our fourth specification neglects past experience when postulating that every annual change in prices was leading to a corresponding change in (rational) inflation expectations. In defense of this bold assumption, one can argue that a historical saver, who was surprised by unexpected developments such as a sudden price increase, revised her expectations

[16] To calculate the savings account-specific nominal interest rate, we divided the interest payments made at the end of a year by the average monthly savings amount for that year.

accordingly in a timely manner. In this case, the actual inflation expectation would equal the actual inflation rate. In the following, we use all four specifications of inflation expectations. It will become clear that the first specification explains saving behavior much worse than the other proxies for inflation expectation.

The basis of our empirical investigation is an unbalanced panel with up to 11,382 saver-year observations. We prefer a fixed-effect model in which we can address the unobservable heterogeneity of savers through savings account-specific fixed effects. Thus, we estimate the following baseline regression equation using the fixed effects (FE) panel data estimator:

$$ln(savings) = c + \alpha_1 Inflation\ Exp_{it} + \pi_t + \delta_i + \epsilon_{it} \qquad (2)$$

The dependent variable *ln(savings)* measures the account balance at the end of the actual for saver i; π_t are year fixed effects and δ_i are saver fixed effects. Standard errors are clustered on individual level. $Inflation\ Exp_{it}$ represents the four proxy variables we alternatively use to estimate historical savers' inflation expectation. [See Table 3 "Baseline regression" here.]

Table 3 presents the results of our baseline regressions. Overall, the Euler equation appears to be confirmed as we observe a negative relationship between our proxies of inflation expectation and the account balance, except for the average inflation since the account was opened. Current inflation has the largest negative coefficient, followed closely by the coefficient of the average inflation in the previous three years. The effects are highly significant and large: If the current inflation rate rises by 1 percentage point, for example, the account balance declines by about 28 percent (exp(0.25)-1). Model 5 assumes a non-linear relationship. In fact, while a small price increase may lead to a rise in savings, the higher the current inflation rate, the greater the decline in savings. [See Table 4 "Social class" here.]

To learn more about the differences in savings behavior between different types of savers, we break the sample into subgroups according to different socio-economic characteristics. Table 4 shows the estimates for different groups of savers of whom we know the social class. It reveals that the focus on the aggregate of all savers masks the heterogeneous behavior of different groups of savers. According to model (6), (9) and (12) of table 4, and contrary to the standard interpretation of the Euler equation, the small group of upper-class savers increased their savings as their inflation expectations rose (and thus real interests fell), suggesting that they were trying to defend a planned real savings target. The middle class, however (models (2), (5), (8) and (11), did not respond to changing inflation expectations, perhaps due to a lack of financial literacy or little interest in economic issues. It is therefore all the more surprising that the working class (model (4), (7) and (10)) significantly reacted to

rising inflation expectation by reducing their savings. If we consider only the female savers, the estimates are even larger (See table 5). It seems unlikely that male and female workers were characterized by above-average financial literacy and knew how to adjust their period consumption in line with the Euler equation. It is more likely that these savers had to reduce their savings in times of high inflation in order to be able to finance their basic present consumption. That workers' dissaving was driven by current hardship and not by changes in inflation expectations, is supported by the observation that in the case of female savers the negative coefficient of the current inflation rate (model 7, Table 5) is by far the highest in the respective horse race. [See Table 5 "Female savers" here.]

Since we cannot observe the individual income of savers in our sample, it is not possible to directly test the hypothesis that a decline in real income during periods of high inflation led to reduced savings by the working class. However, we do know for each saver the average amount they had saved at the end of each year. Therefore, we can at least examine whether the asset-poor savers behaved differently from the asset-rich savers. Indeed, Table 6 reveals a clear difference between the Bottom90 percent and the Top10 percent of owners of (average) savings. While the Bottom90 percent reduced their savings when they expected inflation to rise, the Top10 percent behaved in exactly the opposite way. This is evidence that the Top10 percent acted out of a precautionary motive and defended their targeted buffer-stock, while the Bottom90 percent became hand-to-mouth consumers in times of inflation, with little left to save. [See Table 6 "Wealth" here.]

Table 7 illustrates that upper-class savers by no means had the highest average balances. On the contrary, it was the working-class savers who saved the most. For this reason, the distribution of savings documented in table 6 does not seem to offer a good approximation of the unknown distribution of income. In the further analysis, we therefore return to the social classes known from table 4. [See Table 7 "Average account balance across the social classes" here.]

The savers we analyzed kept their savings accounts open for a median of 4.3 years, which means that for half of them we only observe an active savings period of between two and four years. In contrast, just under twenty percent of all savers were customers of the savings bank Ludwigsburg for a period of ten years or more. To check whether our results are driven by short-term or long-term savers, we distinguish these two groups of savers in Table 8. It turns out that it was primarily long-term savers who reduced their savings as inflation expectations rose. Short-term savers, on the other hand, increased their savings when the inflation rate was high in the previous year. [See Table 8 "Long-term savers" here.]

The 1880s saw a fundamental improvement in the living conditions of the working class in Germany. This development had two main causes. First, real wages began to rise sustainably (Pfister 2021, p. 101), allowing workers to participate in the general increase in prosperity and to rise above the subsistence level for the first time. Second, the introduction of the Bismarckian social insurance system in the form of health insurance (1883), accident insurance (1884), and invalidity and old-age insurance (1889) protected workers from the risk of poverty that could result from illness, industrial accidents, old age and death (Guinnane/Streb 2021). We suspect that this structural break led to a change in savings behavior. We have therefore divided the period under review into the period before 1884 and the period since 1884.

The two panels of Table 9 illustrate the dramatic change in saving behavior. In the period before 1884, there is a negative correlation between inflation expectations and savings, because the working class reduced their savings in times of high prices. In the period since 1884, we no longer observe this hand-to-mouth behavior of the poorer savers. Higher real wages and more social security evidently meant that even when inflation was high, the working class no longer had to reduce its annual savings. From now on, all social classes increased the savings when inflation expectations were rising. This positive relationship between inflation expectations and savings might have been the result of a pronounced and widespread precautionary motive. Figure 4 clearly visualizes this change in savings regimes. In the period before 1884, inflation was negatively related to the percentage change in savings, whereas it was procyclical after the introduction of the reform. While this finding does not support the standard interpretation of the Euler equation, it does support the assumption that saving behavior is different in developed countries than in developing countries. Note that the results of our baseline regressions in Table 3 are driven by the pre-Bismarck period. [See Figure 4 “Change in savings and inflation before and after Bismarck” and Table 9 “Different savings regimes” here.]

Conclusions

Recent microeconomic studies on the relationship between inflation expectation and saving focus on highly developed industrial countries because only these countries provide the required survey data in the necessary quantity and quality. That is why methodological issues lead to the neglect of savings behavior in less developed countries, which, as older macroeconomic studies suggest, is less well explained by the standard interpretation of the Euler equation for consumption.

Our microeconomic study of the saving behavior of southern German savers in the 19th century, when average incomes were low and the social safety net was initially loosely knotted, allows us to analyze individual saving behavior in an underdeveloped state. We experiment with different proxies for inflation expectations, and it turns out that historical savers primarily rely on contemporaneous price experience when forming their experience. Upper-class savers responded to an increase in the expected inflation rate (i.e., falling real interest rates) by increasing their savings, suggesting the interpretation that they pursued a specific real savings target that could only be defended by saving more when investment conditions became adverse. The fact that such a savings target existed at all may have been due to the precautionary motive. Many German savers took advantage of the well-developed German financial system to protect themselves against life risks such as old age, illness and unemployment by building up private savings.

The fact that savings activity in the aggregate declined as inflation increased, which misleadingly suggests the validity of Euler's equation for our historical case, can be explained by the behavior of poor, often female, lower working-class savers who had to reduce their savings in times of rising food prices because then they needed most of their current income to finance essential consumption. This changed in the 1880s, when the living conditions of the working class improved significantly due to rising real wages and greater social security. We therefore observe a structural break in the savings regime: the originally negative relationship between inflation expectations and savings was reversed into a positive one. Hence, our study confirms that concentrating on the aggregate can obscure the true motives and changes in behavior of heterogeneous savers.

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Appendix

Table1: Descriptive statistics of the full sample and the reduced sample (individual savers who saved more than two years)

Panel 1: Full sample (2500 savers)	**Mean**	**Median**	**Minimum**	**Maximum**
Total number of open saving accounts per year	253.3	191.5	9	604
Share of female savers per year	55.35%	56.11%	37.76%	68.75%
Average account balance in Mark (end of year)	256.9	247.7	72.3	736.9
Average account balance in Mark (end of year, women)	251.1	234.2	24.7	757.2
Average number of transactions per year	2.1	2.0	1.6	3.1
Number of savings deposits per year	1.7	1.7	1.5	2.2
Share of savers with information on occupation per year	50.14%	50.59%	14.85%	83.04%
Lifespan of accounts over all savers in years *	4.9	3.2	0.0	45.9
Share upper class savers per year	0.7%	0.0%	0.0%	4.5%
Share middle class savers per year	20.5%	19.0%	0.0%	40.2%
Share working class savers per year	78.8%	80.0%	58.5%	100.0%
Panel 2: Reduced sample (1772 savers)	**Mean**	**Median**	**Minimum**	**Maximum**
Total number of open saving accounts per year	223	186	8	541
Share of female savers per year	58.0%	58.1%	39.8%	73.7%
Average account balance in Mark (end of year)	264.3	252.6	65.3	751.6
Average account balance in Mark (end of year, women)	259.8	238.2	24.7	778.0
Average number of transactions per year	2.0	2.0	1.6	2.6
Number of savings deposits per year	1.7	1.7	1.4	2.2
Share of savers with information on occupation per year	50.64%	51.26%	17.86%	82.52%
Lifespan of accounts over all savers in years *	6.3	4.3	2.0	41.0
Share upper class savers per year	0.5%	0.0%	0.0%	2.0%
Share middle class savers per year	19.9%	18.1%	0.0%	40.5%
Share working class savers per year	79.6%	81.8%	58.0%	100.0%

Note: With the exception of the lines marked with *, this table does not describe the characteristics of the distribution of individual savings accounts, but the characteristics of the distribution of all savings accounts open in a calendar year.

Table 2: Savers' social classification

	Upper Class (6)	Middle Class (4+5)	Working Class (1+2+3)	Total
In absolute numbers				
Women	1	24	412	437
Men	10	340	446	796
Total	11	364	858	1,233
In percent				
Women	0%	5%	94%	100%
Men	1%	43%	56%	100%
Total	1%	30%	70%	100%

Note: Aggregation of the six social classes according to Schüren (1989, p. 314).

Table 3: Baseline regression

	(1)	(2)	(3)	(4)	(5)
			Ln savings		
VARIABLES	FE	FE	FE	FE	FE
Average Inflation since account was opened	0.00594				
	(0.0145)				
Average inflation in the previous three years		-0.235***			
		(0.0316)			
Inflation in the previous year			-0.151***		
			(0.0251)		
Current inflation				-0.243***	0.0525*
				(0.0239)	(0.0316)
Current inflation squared					-0.000766***
					(0.000109)
Constant	2.330***	6.919***	6.248***	6.888***	6.225***
	(0.382)	(0.151)	(0.0971)	(0.132)	(0.0862)
Year and saver fixed effects	y	y	y	y	y
Observations	11,382	11,321	9,614	11,382	11,382
R-squared	0.127	0.127	0.104	0.127	0.127
Number of id	1,772	1,769	1,772	1,772	1,772

Clustered standard errors in parentheses (clustered by saver)
*** p<0.01, ** p<0.05, * p<0.1

Table 4: Social class

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						Ln savings						
	Working class	Middle class	Upper class	Working class	Middle class	Upper class	Working class	Middle class	Upper class	Working class	Middle class	Upper class
VARIABLES	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE
Average Inflation since account was opened	-0.00589	0.0431	-0.00851									
	(0.0243)	(0.0521)	(0.276)									
Average inflation in the previous three years				-0.335***	0.208	0.659***						
				(0.0585)	(0.166)	(0.143)						
Inflation in the previous year							-0.214***	-0.122	1.058***			
							(0.0365)	(0.0819)	(0.251)			
Current inflation										-0.293***	0.375	0.618***
										(0.0437)	(0.300)	(0.135)
Constant	1.542**	8.777***	3.757***	7.031***	5.653***	5.243***	6.015***	6.291***	6.731***	6.865***	5.324***	5.496***
	(0.736)	(2.076)	(0.723)	(0.227)	(0.524)	(0.106)	(0.118)	(0.245)	(0.489)	(0.191)	(0.772)	(0.156)
Year and savers fixed effects	y	y	y	y	y	y	y	y	y	y	y	y
Observations	4,767	1,942	67	4,753	1,942	67	3,910	1,580	56	4,767	1,942	67
R-squared	0.119	0.152	0.553	0.115	0.151	0.553	0.089	0.225	0.556	0.119	0.151	0.553
Number of id	858	364	11	858	364	11	858	364	11	858	364	11

Clustered standard errors in parentheses (clustered by saver)
*** p<0.01, ** p<0.05, * p<0.1

Table 5: Female savers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
					Ln savings			
	Working class women	Middle class women	Working class women	Middle class women	Working class women	Middle class women	Working class women	Middle class women
VARIABLES	FE	FE	FE	FE	FE	FE	FE	FE
Average Inflation since account was opened	0.000290	0.0780						
	(0.0315)	(0.103)						
Average inflation in the previous three years			-0.444***	-0.176				
			(0.0508)	(0.167)				
Inflation in the previous year					-0.522***	-0.192		
					(0.0563)	(0.164)		
Current inflation							-0.936***	0.0992
							(0.0804)	(0.0943)
Constant	-0.617	6.395***	7.285***	6.829***	6.050***	6.448***	8.300***	6.290***
	(0.521)	(0.122)	(0.297)	(0.405)	(0.172)	(0.103)	(0.350)	(0.148)
Year and savers fixed effects	y	y	y	y	y	y	y	y
Observations	2,237	156	2,234	156	1,826	132	2,237	156
R-squared	0.227	0.518	0.220	0.509	0.181	0.498	0.227	0.509
Number of id	412	24	412	24	412	24	412	24

Clustered standard errors in parentheses (clustered by saver)
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Wealth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
							Ln savings					
	Bottom 50	Next 40	Top 10	Bottom 50	Next 40	Top 10	Bottom 50	Next 40	Top 10	Bottom 50	Next 40	Top 10
VARIABLES	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE
Average inflation since account was opened	0.0195	-0.0127	-0.0129									
	(0.0198)	(0.0270)	(0.0311)									
Average inflation in the previous three years				-0.166***	-0.270***	1.035***						
				(0.0542)	(0.0560)	(0.0355)						
Inflation in the previous year							-0.118**	-0.152***	0.527***			
							(0.0482)	(0.0277)	(0.0220)			
Current inflation										-0.194***	-0.262***	0.498***
										(0.0456)	(0.0306)	(0.0171)
Constant	1.361**	3.132***	3.694***	5.114***	7.854***	4.795***	4.642***	7.012***	7.343***	5.157***	7.776***	6.267***
	(0.625)	(0.514)	(0.222)	(0.333)	(0.290)	(0.0519)	(0.245)	(0.208)	(0.0742)	(0.308)	(0.248)	(0.0571)
Year and savers fixed effects	y	y	y	y	y	y	y	y	y	y	y	y
Observations	4,490	4,922	1,970	4,447	4,904	1,970	3,606	4,215	1,793	4,490	4,922	1,970
R-squared	0.056	0.166	0.399	0.052	0.165	0.398	0.043	0.138	0.372	0.055	0.166	0.398
Number of id	886	708	178	883	708	178	886	708	178	886	708	178

Clustered standard errors in parentheses (clustered by saver)
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Average savings across the social classes

	Average account balance			
Social class	Mean	Median	Min	Max
Working class	332.98	201.19	6.58	956.66
Middle class	297.74	253.49	1.08	1343.38
Upper class	205.75	130.24	2.19	1059.52
Total	234.04	166.29	1.08	1343.38

Table 8: Long-term savers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
					Ln savings			
	between 2 and 9 years	more than 10 years	between 2 and 9 years	more than 10 years	between 2 and 9 years	more than 10 years	between 2 and 9 years	more than 10 years
VARIABLES	FE	FE	FE	FE	FE	FE	FE	FE
Average Inflation since account was opened	0.0310	0.00979						
	(0.0281)	(0.0210)						
Average inflation in the previous three years			-0.0329	-0.298***				
			(0.0945)	(0.0322)				
Inflation in the previous year					0.231***	-0.197***		
					(0.0881)	(0.0248)		
Current inflation							-0.0525	-0.274***
							(0.0776)	(0.0265)
Constant	4.911***	2.069***	6.227***	7.365***	5.288***	6.553***	6.256***	7.243***
	(1.150)	(0.426)	(0.387)	(0.168)	(0.221)	(0.112)	(0.336)	(0.151)
Year and savers fixed effects	y	y	y	y	y	y	y	y
Observations	6,102	5,280	6,066	5,255	4,669	4,945	6,102	5,280
R-squared	0.054	0.226	0.054	0.222	0.053	0.188	0.054	0.226
Number of id	1,436	336	1,433	336	1,436	336	1,436	336

Clustered standard errors in parentheses (clustered by saver)
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Different savings regimes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ln savings							
	Before 1884							
	Working class	Middle class	Working class	Middle class	Working class	Middle class	Working class	Middle class
VARIABLES	FE	FE	FE	FE	FE	FE	FE	FE
Average Inflation since account was opened	0.0117	0.159**						
	(0.0330)	(0.0660)						
Average inflation in the previous three years			-0.210***	0.295*				
			(0.0530)	(0.170)				
Inflation in the previous year					-0.141***	-0.00396		
					(0.0324)	(0.0324)		
Current inflation							-0.182***	0.438*
							(0.0375)	(0.253)
Constant	2.230***	8.436***	5.982***	4.448***	5.235***	5.417***	5.727***	4.864***
	(0.711)	(1.927)	(0.235)	(0.703)	(0.175)	(0.180)	(0.185)	(0.477)
Years and savers fixed effects	y	y	y	y	y	y	y	y
Observations	963	137	949	137	770	107	963	137
R-squared	0.113	0.544	0.101	0.517	0.088	0.896	0.113	0.517
Number of id	193	30	193	30	181	29	193	30

Clustered standard errors in parentheses (clustered by saver)

*** p<0.01, ** p<0.05, * p<0.1

	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
						Ln savings						
						Since 1884						
	Working class	Middle class	Upper class	Working class	Middle class	Upper class	Working class	Middle class	Upper class	Working class	Middle class	Upper class
VARIABLES	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE
Average Inflation since account was opened	-0.0507	0.00351	-0.00851									
	(0.0309)	(0.0666)	(0.276)									
Average inflation in the previous three years				0.552***	0.525***	0.659***						
				(0.0676)	(0.128)	(0.143)						
Inflation in the previous year							0.897***	1.206***	1.058***			
							(0.156)	(0.340)	(0.251)			
Current inflation										0.258***	0.245***	0.618***
										(0.0316)	(0.0597)	(0.135)
Constant	4.288***	4.629***	3.757***	4.558***	4.843***	5.243***	4.760***	4.636***	6.731***	5.361***	5.607***	5.496***
	(0.147)	(0.265)	(0.723)	(0.123)	(0.188)	(0.106)	(0.154)	(0.288)	(0.489)	(0.0850)	(0.124)	(0.156)
Year and savers fixed effects	y	y	y	y	y	y	y	y	y	y	y	y
Observations	3,804	1,805	67	3,804	1,805	67	3,140	1,473	56	3,804	1,805	67
R-squared	0.106	0.091	0.553	0.104	0.091	0.553	0.072	0.113	0.556	0.104	0.091	0.553
Number of id	736	346	11	736	346	11	736	346	11	736	346	11

Clustered standard errors in parentheses (clustered by saver)
*** p<0.01, ** p<0.05, * p<0.1

Figure 1: Observed active saving accounts, total and by gender

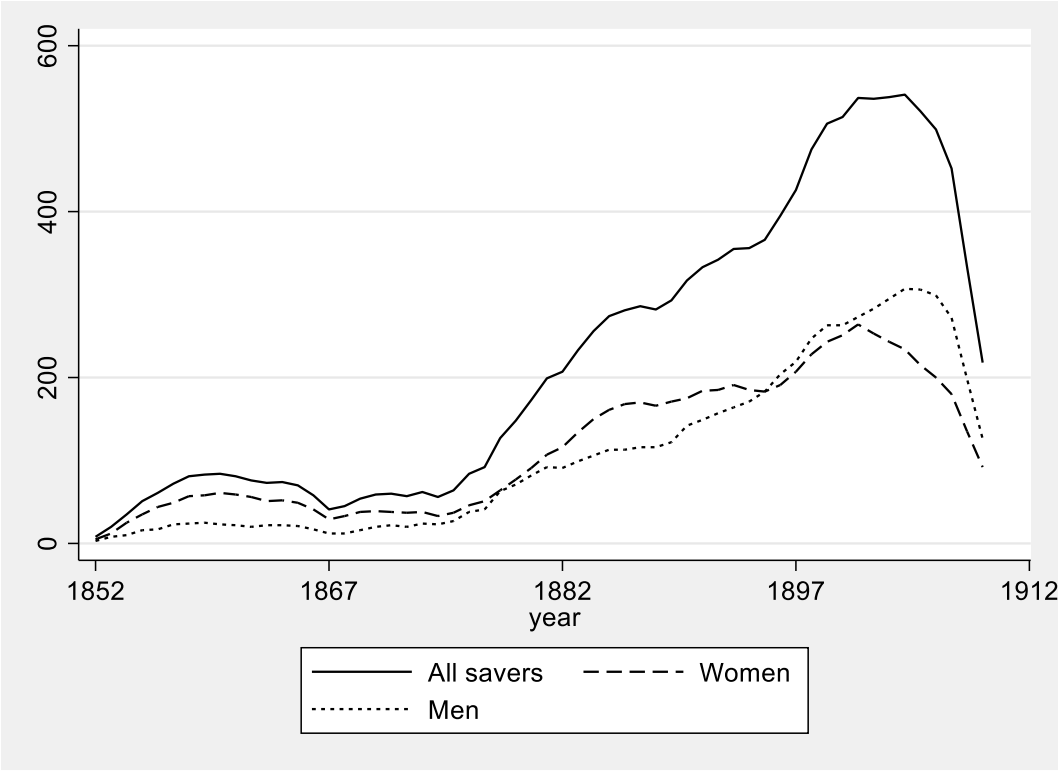


Figure 2: Savings at the end of the year by gender

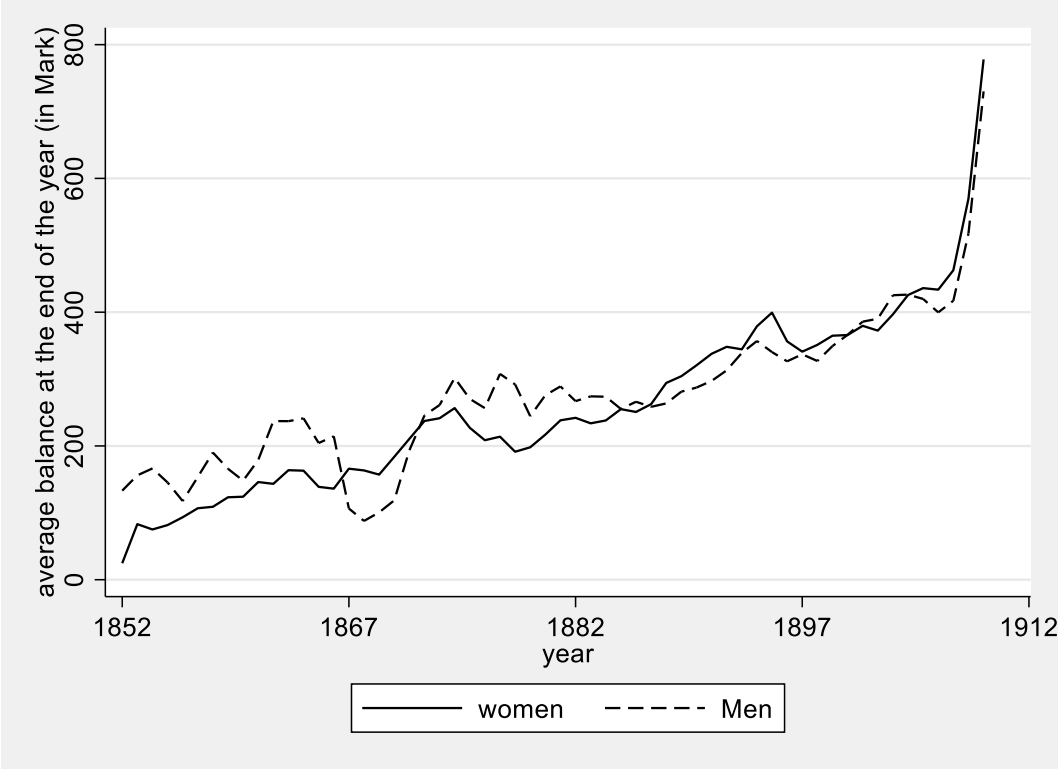
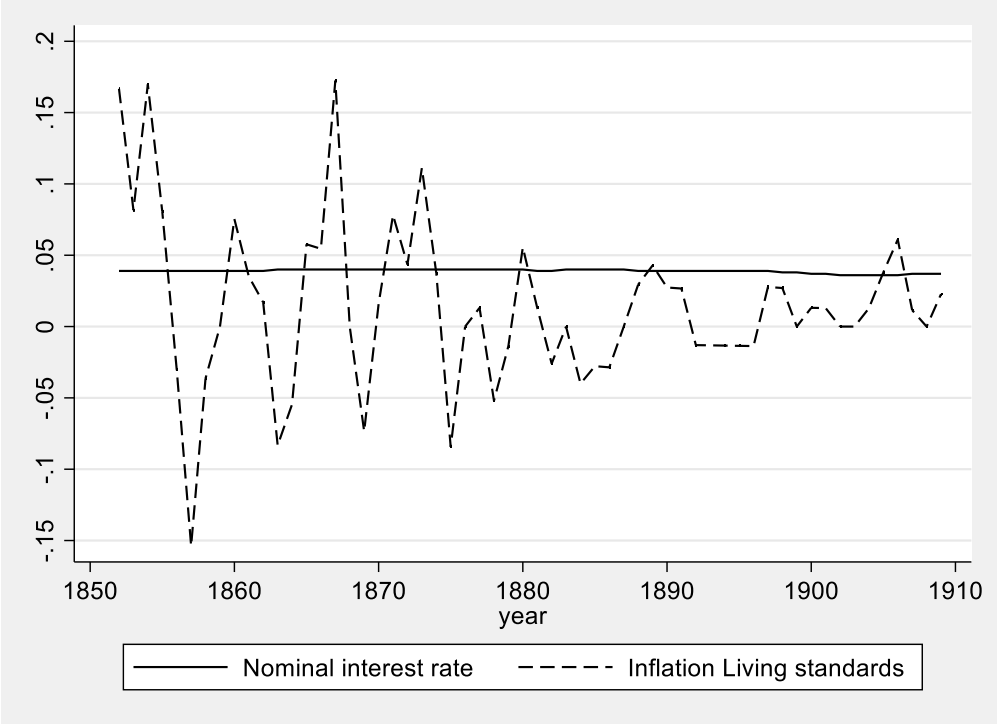
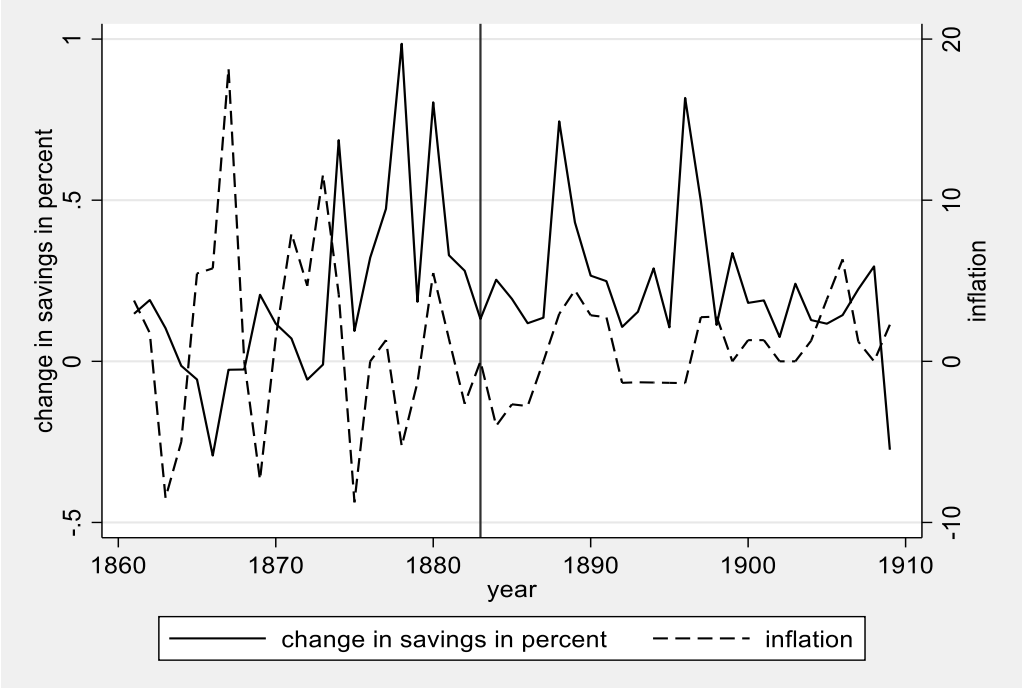


Figure 3: Median nominal interest rate and inflation rate



Source: Median nominal interest rate: own calculations; inflation rate: calculated from Hohls (1995).

Figure 4: Change in savings and inflation before and after Bismarck's social reforms



Source: Average change in savings: own calculations; inflation: calculated from Hohls (1995).