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# The Name Says It All

Multigenerational Social Mobility in Switzerland, 1550-2019

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# THE NAME SAYS IT ALL *
## MULTIGENERATIONAL SOCIAL MOBILITY IN SWITZERLAND, 1550-2019

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Preliminary version - December 5, 2020

Social mobility is a key element of meritocratic societies. We analyze multigenerational social mobility with a hand-collected yearly Swiss dataset for the timespan from 1550 to 2019. With our surname-based approach, we measure an average persistence rate of 0.42 over 15 generations. We show how close the different social status indicators match with each other using surnames. A moderate cyclical pattern indicates that social mobility was lowest in wartime generations with a major spreading afterwards. Furthermore, we show a significant influence of the grandparental generation. Overall, we conclude that the analysis of surnames is suitable for investigating the long-term permeability of the entire society. Surnames are a promising indicator for new insights into multigenerational social mobility.
Keywords: multigenerational social mobility, education, profession, wealth, surnames
JEL Codes: H00, I20, J62, N00.

# I. INTRODUCTION

The degree to which individuals can climb the social ladder out of own effort is a central defining aspect of society. This so-called intergenerational social mobility is a crucial element of meritocracies as it is an important aspect of equal opportunities (Roemer and Trannoy, 2015; Torche, 2015; Kampe, 2016).

While there are already several empirical short-term studies on social mobility, multigenerational analyses are sparse. However, multigenerational social mobility analyses are essential to investigate longer-term trends in social mobility development in a society and to find out what influence the grandparental generation has. The few existing previous long-term studies (Clark, 2014; Clark and Cummins, 2014a; Clark and Cummins, 2014b; Clark et al., 2015) have focused their investigations on rare surnames of high and low social status. These studies find a very high long-term persistence of 0.7 to 0.9 for different countries. Chetty et al. (2014) show that the rarity of the surname could significantly influence the measured social mobility. We will use a surname-based approach, which does not only include the elite and the lower class, but investigates the general permeability of a society.

For this reason, we measure long-term social mobility over 15 generations taking into account all surnames and thus the whole society. However, it is difficult to obtain a complete yearly dataset of all surnames for such a long timespan. We were able to collect such a dataset for Basel, Switzerland. This narrow geographic focus additionally makes the sample more homogeneous, reducing the problem of random influences (Clark, 2014; Favre, Floris, and Woitek, 2018). We focus on multigenerational educational mobility but execute various cross-checks with other social status indicators.

The newly assembled main dataset at hand, consists of two parts. One part is based on the University of Basel's matriculation registers, showing for each semester the surnames of the newly enrolled students. The other part stems from birth and baptismal registers containing the surnames of each child born in Basel. These two yearly datasets allow us to estimate social

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mobility based on each surname's average social status in each generation. Thanks to this comprehensive dataset, we do not only include families of high social status, but rather all families.

We calculate intergenerational social mobility by determining the mean relationship between two successive generations' social status across all families. We use and compare various established methods ranging from simple Pearson correlation coefficients to Spearman rank correlation coefficients to regression models. In the latter, we include two or three successive generations, while controlling for generation-specific fixed effects as well as for the frequency of the respective surnames.

Our comprehensive analysis on multigenerational social mobility shows that the average persistence rate over more than 450 years is equal to 0.42, which confirms previous estimates for the last two to three generations, also holding for a longer timespan. In other words, on average, the parent's social status explains 42 percent of the children's social status. If we look at the development of social mobility over the last 15 generations, we see that it has remained relatively constant on a long-term average, and additionally shows a cyclical pattern. For example, social mobility is lowest in wartime generations and rises significantly afterwards in the post-war generations.

The cross-checks of university education with guild membership, inheritance wealth tax, membership in parliament, and census data show that social mobility measured by different social status characteristics hardly varies. Thus, the surname method allows us to measure the underlying social status, which covers family-specific aspects.

Our analysis builds on the literature of multigenerational social mobility, reviewed by Solon (2018) and Black and Devereux (2011). The short-term literature focusing on the analysis of two to three generations finds an average persistence rate of 0.4-0.6 for Western Countries (Solon, 2018), with distinct disparities between countries. In contrast to those short-term analyses, the studies of Clark and co-authors measure an average persistence rate of 0.7-0.9

for various Western Countries (Clark, 2014; Clark and Cummins, 2014a; Clark and Cummins, 2014b; Clark et al., 2015), when analyzing rare surnames. With our study, by including all surnames and by using different analysis methods, we can build a bridge between the two bodies of literature and actually determine the overall permeability of the society with a surname-based approach. Furthermore, we argue that the measured mobility hardly varies across different social status indicators. The surname approach allows for consistent insights into multigenerational social mobility analysis.

The remainder of this paper is structured as follows: Section II provides an overview of the current state of research. The underlying dataset is described in section III, and the method used to determine the intergenerational social mobility in section IV. In the fifth section, we present intergenerational social mobility development between 1550 and 2019, including several external validity tests and multiple robustness checks. Finally, section six draws the conclusion and grants a look at possible follow-up research.

## II.    INTERGENERATIONAL SOCIAL MOBILITY

Various indicators can analyze the extent of intergenerational transmission of social status, namely income, wealth, profession, education, or political representation (Black and Devereux, 2011; Corak, 2013; Lee and Seshadri, 2019; Solon, 2018). The existing literature uses several of those indicators. The analysis of intergenerational social mobility requires that the individuals studied can be linked to their respective ancestors and descendants. Therefore, most existing studies are limited to the analysis of the last two to three generations. The results point to an average intergenerational correlation of 0.4 to 0.6 (Black and Devereux, 2011; Solon, 2018), although the results vary widely.

The lowest social mobility in Western Countries is measured for the USA (Chetty et al., 2014; Olivetti and Paserman, 2015; Bratberg et al., 2017; Corak, 2013), while the Scandinavian countries show the highest social permeability, with an average persistence rate of about

0.2 (Bratberg et al., 2017; Vosters and Nybom, 2017). For Switzerland, Bauer (2006) estimates an overall income elasticity of 0.455 based on the Swiss Labor Force Survey. A similar result can also be seen in Corak's comparative country study (Corak, 2016), whereas Chuard and Grassi (2020) measure an average persistence of 0.153 only.

These cross-country and single-country studies focus on few generations due to data limitations. Studies with a long-term perspective over many generations deviate from these short-term results (Clark, 2014; Clark and Cummins, 2014a; Clark and Cummins, 2014b; Clark et al., 2015). Using surname data, they measure a long-term persistence rate of 0.7-0.9. Clark's analyses have produced four fundamentally new insights:

1. Social mobility is significantly lower than expected for the elite and the lowest stratum of society in all countries.

2. Social mobility for the elite hardly varies across countries and over time, even though China has undergone a radical communist revolution, whereas Sweden and the United Kingdom have been advocating increased political participation of so far underprivileged parts of the population.

3. The intergenerational correlation lies between 0.7 and 0.9 and is universal. Deviations from this correlation are rare and predictable.

4. The extent of social mobility is not significantly different when alternative indicators are used to measure social status (e.g., education, income, or occupational status).

In their analyses, the main focus is on rare surnames of high social status. Chetty et al. (2014) show that the rarity of the surname significantly influences the estimated social mobility. Thus, they outline that the focus on rare surnames of high social status might explain why Clark and co-authors measured such high intergenerational persistence rates.

This raises the question of whether the surname-based approach is only suitable for investigating the elite's persistence, or whether it can also be used to measure the general

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permeability of a society, which is a major goal of research on intergenerational social mobility. With this study, we try to close the existing research gap.

In addition to analyses by Clark and co-authors, other studies use surname-based approaches. The recently published paper by Barone and Mocetti (2020) compares the distribution of Florence's taxpayers' surnames from 1427 with those in 2011 and finds a significant earnings elasticity of about 0.04. The analysis of Güell, Mora, and Telmer (2015) uses a different surname-based approach. The method's underlying hypothesis is that the more important the inheritance of social status is, the more informative surnames are. In their calibrated model, the authors find an intergenerational educational correlation of 0.6 for Spanish Catalonia.

In a new comparison of the different surname-based approaches, Santavirta and Stuhler (2020) conclude that most existing analyses are based on rare surnames, which is especially problematic if these families are not representative of the whole society (Santavirta and Stuhler, 2020). Therefore we want to study both elitist families and society as a whole.

In order to do this, we need a comprehensive annual dataset that allows the consideration of all surnames in society over 15 generations. We were able to collect such a dataset for Basel, Switzerland (see section III). Our study, therefore, focuses on Basel, Switzerland. This narrow geographic focus also makes the sample especially homogeneous, reducing the problem of random influences (Clark, 2014; Favre, Floris, and Woitek, 2018). We focus on educational mobility but execute various cross-checks with other social status indicators to evaluate the generalizability of our results.

In addition to the complete dataset, Basel and its university are particularly well-suited for the analysis because enrollment is not reserved for a specific social class even in the Middle Ages. From the beginning of the University of Basel's establishment in 1460, servants, grooms, printers, and clerks were found among the enrolled students (Bonjour, 1960). Even

in the 18$^{th}$ century, when the University of Basel underwent a steady process of familiarisation and traditionalisation, the social composition remained diverse. University education in Basel was by no means exclusively the privilege of the economically and socially leading classes (Bonjour, 1960). At the same time, however, since its foundation in November 1459, the University of Basel has been referred to as a distinguished university. As a pontifically founded council university, it was the birthplace of European humanism (Bonjour, 1960). In its decrees on the university, the Basel Council repeatedly referred to the academic tradition of the great models of Paris, Vienna, Oxford, etc., thus placing the young University of Basel in a binding European context (Bonjour, 1960). At the same time, the economically and socially upper middle classes were strongly represented at University of Basel. Among the enrollees were many sons of merchants, magistrates, and patricians (Bonjour, 1960). Against this background, we can exploit a unique dataset to an institutional setting differing to the previously analyzed universities. The underlying dataset will be presented in the following section.

## III.   DATA

Table I gives an overview of our hand-collected dataset. Our main dataset consists of two kind of registers; the matriculation registers and the baptismal and birth registers.

The student data of the University of Basel are available in the matriculation registers since 1460, the university's year of opening, without gaps. There are even edited versions for the years 1460 to 1818, which provide information on the German translations of the partially latinized surnames in late medieval Basel. While surnames have existed in Basel since the 13$^{th}$ century, they were still written very inconsistently within families for a long time (Mischke, 2015). For our core analysis, we only use the newly enrolled students at the University of Basel who came from Basel. Otherwise, we cannot apply our method of determining the mean social status for each surname in each generation (We will discuss the method in detail in section 4). Accordingly, in the primary analysis, we use the entries of 31,275 students.

Basel's baptismal and birth registers are used to determine the distribution of surnames in each generation's society. Baptismal registers are available for the years 1490 to 1875, and birth registers are included in the analysis for the years thereafter. Unfortunately, no data on baptized or newborn children in Basel has been preserved for the years before 1490. Thus, we could not include the first generation of student data in our analyses. As the data is very sparse until 1529[1], we use the baptismal data only from 1530 onwards for the core analysis. As newborns are not potential students, we shift the data collected from the baptismal and birth registers by 20 years. Since the university statutes did not prescribe a minimum age, the average age at enrollment was under 20 years, especially for the early years. Thus, we also reduce the timespan to 15 years in a robustness test (see section V.D.). The corresponding test shows that the results remain stable when this assumption is relaxed. Therefore, we start our analysis in the year 1550, where the first newborns were 20 years old. We include a total of 594,888 newborns in the analysis. Across the two datasets, 7,665 different surnames are part of the analysis.

Therefore, in the primary analysis, social mobility is determined based on education as a characteristic of social status. To check whether the measured social mobility varies with alternative social status measures, we complement our primary dataset with four other status indicators. On the one hand, we further include guild master data from 14 guilds with a total number of 6'898 observations since 1550. On the other hand, we examine with the help of 951 inheritance tax data entries over 70 years, whether the educational mobility of the wealthiest families differs from the average educational mobility between 1850 and 1907. Finally, we execute two additional external validity tests using data on Basel's political elite for the years 1570 to 1600 (185 observations) and data on occupational status based on a census from 1850 (30,052 observations).

[Table I]

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1. We have also digitized all baptismal register entries that existed for Basel before 1529. However, we found (see Data Appendix) that data before 1529 are only from one single church (Theordor's church in Basel) and are incomplete. There were only 190 observations for 1490 to 1529, dating only from 1491 to 1497. Thus, a well-founded analysis of the baptismal register entries before 1530 is not possible.

Figure I shows an extract from the two most important data sources of our analysis: the matriculation registers of the University of Basel and the baptismal registers of Basel. Unfortunately, it was impossible to use programs with handwriting recognition options for the transcription because the entries of the matriculation registers are composed of countless handwritings. It was common practice for students to enter themselves into the register at the matriculation (Bonjour, 1960). Therefore, this is a hand-collected dataset. To eliminate typing and recognition errors as much as possible, we cross-checked the older record's transcripts with the help of research assistants.

[Figure I]

Figure II shows the respective proportion of students by origin. We distinguish between students coming from Basel ($BS$), the rest of Switzerland ($CH$), or from abroad ($NCH$). We divide into $CH$ and $NCH$ from the perspective of present-day Switzerland. It is not difficult to see that almost 75 percent of the students at the University of Basel initially came from abroad. This also underlines the university's radiance at the time as the birthplace of European humanism (Bonjour, 1960). Today, the proportion of students from the rest of Switzerland is the highest, while the proportion of students from abroad and Basel is around 20 percent.

As the graph shows, educational migration has been an integral part of the university's life since its foundation in the late Middle Ages. In general, the University of Basel's founding and its early international character are partly determined by the city's economic-geographical location. The major trade routes ran through Basel from north to south, pilgrimages from the Netherlands and Burgundy to Rome passed through here, and travelers left the Rhine ship in Basel to continue their journey ashore (Bonjour, 1960). There were also different streams of refugees to Basel. This may also explain why the total number of surnames in our data set is considerable. For example, in the 16th century, the Huguenots immigrated to Basel as Protestant religious refugees. Thus, geographical mobility is a critical component that can influence social mobility.[2] Our study's goal is not to identify the drivers of social mobility but

2. In Basel, the potential for migration to interfere with existing social structures is even apparent in the

rather to create a sound basis for measuring social mobility over many generations by looking at the entire society's permeability. Identifying causal channels offers a good opportunity for further research, and migration could be a possible starting point.

In addition to the social mix of the Basel student body described in Section II, the range of subjects offered at the university must also be addressed. From its foundation in 1459, the university was divided into four faculties: theological, legal, artistic, and medical, whereas today it is divided into seven faculties (Bonjour, 1960). Thus, a degree from the University of Basel made it possible to pursue different professions from the very beginning. This circumstance offers the advantage for our analysis that the educational status was already closely linked to economic status in the Middle Ages. This was especially true because many wealthy people had their children enrolled at the university. Coupled with the possibility that poor students were also admitted to the university, Basel offers an ideal social mobility research setting.

[Figure II]

## IV. EMPIRICAL APPROACH

Usually, social mobility ($s$) is not determined directly, but indirectly by estimating the so-called persistence rate ($\beta$). The latter shows by what extent the social status of one generation is related to that of the previous generation. Therefore the following relationship is used:

$$s = 1 - \beta \tag{1}$$

Two approaches are widely used in economics to determine the extent of intergenerational social mobility: correlation analysis and simple linear regression. They both analyze the relationship between the social status of the parental generation and the one of their children (Solon, 2018; Black and Devereux, 2011).

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legislation. In November 1545, for example, the Council prohibited French immigrants from holding political office or marrying Basel women (Rosen, 1971).

While a regression estimator also considers the ratio of the variances in the two consecutive generations, a simple Pearson correlation coefficient does not (Checchi, Fiorio, and Leonardi, 2013). For this reason, we are complementing the Pearson correlation with the estimation of a pooled OLS regression model.

The regression model is expressed in equation 2, where $y_{t,z}$ is the social status $y$ of surname $z$ in generation $t$ and $y_{t-1,z}$ is the social status $y$ of surname $z$ in the parental generation $t-1$, whereas $\beta_{t-1,z}$ measures the extent of social persistence.

$$y_{t,z} = \alpha + \beta_{t-1,z} \cdot y_{t-1,z} + \epsilon_{t,z} \qquad (2)$$

In addition to this two-generational model, we estimate the following three-generational model by including the grandparental generation $t-2$ according to equation 3. While $\beta_{t-1,z}$ again captures the connection between the parental and the child generation, $\beta_{t-2,z}$ describes the extent of the independent influence of the grandparental generation.

$$y_{t,z} = \alpha + \beta_{t-1,z} \cdot y_{t-1,z} + \beta_{t-2,z} \cdot y_{t-2,z} + \epsilon_{t,z} \qquad (3)$$

Furthermore, we calculate the Spearman's rank correlation coefficients, as they prove to be more robust across specifications (Chetty et al., 2014).

To estimate the models described, we need to derive for each family $z$ in each generation $t$ the social status $y$. To calculate this from Basel's university and birth data, we use the approach of Clark and Cummins (2014b).

In a first step, we calculate the so-called relative representation ($rr$) for each surname $z$ in each generation $t$. We use the birth and student data to determine whether the respective surname is over- or under-represented at the university in the respective generation. We calculate the relative representation as follows:

$$rr_{t,z} = \frac{\dfrac{m_{t,z}}{\sum\limits_{z} m_{t,z}}}{\dfrac{b_{t,z}}{\sum\limits_{z} b_{t,z}}}, \tag{4}$$

whereby $m_{t,z}$ is the number of persons with surname $z$ in generation $t$ in the matriculation registers and $b_{t,z}$ is the number of persons with surname $z$ in generation $t$ in the birth registers.

In addition to the relative representation by surname and generation, we determine a specific type of academisation rate (in the following called academic ratio $(ar)$) for each generation. In other words, we consider the percentage of Basel's population attending the University of Basel for each generation according to equation 5.

$$ar_t = \frac{\sum\limits_{z} m_{t,z}}{\sum\limits_{z} b_{t,z}} \tag{5}$$

This allows us to absorb a general trend towards increased academization. Figure III illustrates this trend. It shows the development of the academic ratio $(ar)$ over time. While until the beginning of the 20$^{\text{th}}$ century it was always between 1 percent and 3 percent, it rose to 5 percent, 7 percent and finally 9 percent in the three youngest generations studied. At the same time, we also control for the University of Basel's reputation, which has fluctuated over the centuries (Bonjour, 1960). This allows an estimate of social mobility that is as unbiased as possible.

[Figure III]

In order to derive the mean social status for each surname $z$ in each generation $t$, we therefore combine the academic ratio $(ar)$ with the mean social status $(y)$ for each surname $(z)$ in each generation $(t)$. We further make three assumptions:

1. The distribution of social status in the population follows a normal distribution.

2. The distribution within an analyzed family $z$ also follows a normal distribution and has

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the same standard deviation as within the whole society.

3. The average generation length equals 30 years.

Clark has proved for various datasets that those three assumptions are fulfilled in different countries and epochs (Clark, 2014). The first one also seems reasonable with respect to the law of large numbers, stating that each distribution approximates a normal distribution with increasing numbers of observations. We relax the third assumption in the course of our robustness test, in which we let the generation length vary between 25 and 30 years (see section V.D.).

Figure IV illustrates the approach of determining the mean social status per surname and generation.

[Figure IV]

The bold black dashed line indicates the area under the black curve, which corresponds to the academic ratio in Basel's society. At the same time, it also indicates the rate of academization of a particular family $z$. The latter can be determined by multiplying the total population's academic ratio by the average relative representation of the specific surname $z$. In the case presented, the analyzed family is overrepresented at the University of Basel because its average social status lies above society's average (its mean is shifted to the right). With the help of those two areas and assuming a normal distribution, the difference between the mean value of the specific surname $z$ and that of the whole society can be derived in standard deviation units according to equation 6:

$$y_{t,z} = \Phi^{-1}(\mathrm{ar}_t \cdot \mathrm{rr}_{t,z}) - \Phi^{-1}(\mathrm{ar}_t) \tag{6}$$

We derive this mean social status again for each surname $z$ in each generation $t$. Considering all surnames in all generations, we calculate the correlation coefficients and estimate the regression models mentioned above.

# V.   RESULTS

## V.A.   *What the surname's frequency tells us*

Before presenting our analysis's main results in section V.B., this section will focus on specific families. For example, figure V clarifies that not all families are proportionally represented at the University of Basel. The figure compares the actual representation of families that each have the same expected representation. In the right part of the graph, those names are listed that occur relatively frequently in society, i.e., more common surnames. If they were all proportionally represented at the university, we would expect that they all appear relatively frequently in the matriculation registers. However, there are large disparities between families. While the surnames *Keller* and *Huber* are also common at university, the surnames *Kunz* and *Scherrer* are much less common among enrolled students. A difference can also be made out for rare surnames, as the comparison between the surnames *Iselin* and *Bischoff* shows. Thus, there is an apparent variance in the relative representation at the University of Basel, which we can exploit.

[Figure V]

In a next step, it is worth looking at the development of particular elite families' relative representation over time. There are two ways to do this. On the one hand, an exogenously (historically) defined elite can be observed over time. On the other hand, the development of an endogenously defined elite based on the dataset can be observed more closely. In the following, we look at both types of the elite. We start with the exogenously defined elite. In figure VI the focus is on the so-called "Daig" families. Towards the middle of the 17$^{\text{th}}$ century a trading elite emerged in Basel. This elite owed its position in particular to its success in the silk and cloth trade. Until today this group of long-established families is known as "Daig" in Basel. The name "Daig" comes from a dam or defence system. This name expresses that the families who belonged to the Daig tried to distinguish themselves from the "new rich" (Sarasin, 1997).

It is not sharply defined from the historical documents which families belonged or still belong

to this ominous "Daig". However, with the help of different sources, it is possible to identify 16 surnames that belonged to the "Daig". They are listed in the notes of figure VI. Of course, not all of these families were formative for Basel at the same time. For example, the Bernoulli family did not immigrate to Basel until the 17th century. As can be seen from Part A of the figure, these families were always quite heavily overrepresented at the University of Basel. This is also supported by the fact that five of the ten most common surnames among the University of Basel's rectors since its foundation in 1459 come from the "Daig" families. Interestingly, there was a clear peak in the Middle of the 19th century, which was reached over four generations of steady growth. After this point, again, a steady relative social decline over four generations can be observed. Only in the youngest generation did the relative representation of the "Daig" families at the University of Basel increase again.

Part B of the figure focuses on four of these 16 families. It is apparent that the course of events observed in part A is hardly recognizable. Instead, we observe relatively strong volatilities in individual families over the generations. It is also interesting to note that the relative representation of certain families develops partly parallel and in the same direction. Moreover, there are always generations - i.e., the generation around 1800 - where the four families are very similarly represented at the University of Basel.

[Figure VI]

However, these high fluctuations in relative representation over generations should not be interpreted as high social mobility, as those elites stay strongly over-represented in the whole period analyzed (i.e., their relative representation at university is always greater than one). Figure VII makes this even more evident. There, father-son constellations are represented for *Burckhardt* and *Bernoulli's* families, which speaks for a very high persistence over four generations. One should note that figure VII gives an incomplete picture because the fathers depicted each had several children. However, it would be too comprehensive to show the entire family tree here. Nevertheless, this figure provides important insight. It becomes evident that

the two families over-represented at the University of Basel were not both purely academically renowned. While the Bernoulli family continued to build their reputation as a scholarly family beyond Basel, the Burckhardt family was involved in the silk cloth trade for many generations and was part of the guilds (especially the "Safran" guild). Thus, they had a very formative influence on Basel's politics: during the 150 years from the middle of the 17th century to 1798 (the end of the guild republic and Napoleonic invasion) five Burckhardts were guild masters and seven Burckhardts became mayors of Basel (Teuteberg, 1990). From this, it is evident that, at least in the past, the different characteristics of social status in a family were often similarly pronounced. This will be analysed in more detail in section V.C., in particular, to see whether the educational mobility at the center of our analysis is also interpretable as a more general social mobility.

[Figure VII]

To complement the analysis of these well-known Basel surnames, we will additionally analyze the endogenously defined elite based on our dataset. As shown in figure VIII, the change in status of the top families seems to occur at different speeds depending on the period under study. The elite's lowest segment is recorded between 1750 and 1900 (see part B of the figure). This is also consistent with the observation we made in the analysis of the "Daig" families. It is important to emphasize that family names of the Basel "Daig" are represented in all three periods considered: Iselin, Socin, Bernoulli, Burckhardt, and Vischer. A particularly striking fall of the elite is observable between 1900 and 2000 (part C of the figure). However, we must acknowledge that this phenomenon must not be interpreted directly as a sharp increase in social mobility. Instead, many surnames are ranked in the same order in recent years, which means that the average ranking is much higher.

[Figure VIII]

These individual case studies are valuable to get a first impression of the analysis of surnames and to realize that the different status indicators such as political representation,

occupational status, or education are very often linked with each other.

The illustrations already give a first indication that the surname method measures the underlying social status, as Clark (2014) claims. This could be since the surname method captures family-specific characteristics that significantly influence social status. For example, particular customs, expressions, professional and private networks, and available financial resources, all of which are family-specific, are decisive for an individual's social status. If the analysis is surname-based, these family-specific values are recorded.

In the following sections, these case studies are supplemented by a comprehensive empirical analysis to examine the average social mobility for Basel's society since the late Middle Ages.

## V.B. *Main mobility estimates*

We calculate an overall Pearson correlation coefficient for the relationship between one generation's social status and that of the previous generation of 0.494 and a similar Spearman's rank correlation coefficient (0.488). Both values are significant at the 1% significance level. These results correspond with previous findings that estimated social mobility in Switzerland for the last two to three consecutive generations (Bauer, 2006; Corak, 2016).

Thanks to the annual observations, we are not only able to calculate the average correlation, but also to look at the dynamic development of social mobility since the late Middle Ages. Looking at the Spearman's rank correlation coefficient over time, we find a cyclical pattern with four distinct peaks (see figure IX). Interestingly, all of these peaks are observable at a time when severe conflict prevailed in Basel, with a major increase in social mobility afterwards.

1. **Thirty Years' War** (generation 1599-1629): This generation was marked by the Thirty Years' War (1618 - 1648)(Rosen, 1971). During the 17th century - particularly at the

time of the Thirty Years' War - absolutist tendencies became increasingly prominent in Basel (Stritmatter, 1977).

2. **Liberal revolution** (generation 1659-1689): The unilateral expansion of positions of power in the government by specific families was the reason for a major revolutionary movement, which led to the parliament being given more power (Rosen, 1971).

3. **Civil war** (generation 1809-1839): It was in this generation that the conflict-ridden separation of the cantons of Basel-City and Basel-Country took place (Rosen, 1971).

4. **World War I and World War II** (generations 1899-1929 and 1929-1959): These generations experienced the First and the Second World War. Basel is close to Germany and France and was affected by bombing (Rosen, 1971).

[Figure IX]

While providing interesting insights into the dynamic of social mobility's long-term development, those correlation coefficients do not take into account the variance of social status within a generation. The variance in social status describes social inequality within a generation and may have a significant influence on the extent of social mobility. Additionally, the correlation coefficients cannot deduce the influence of the grandparental generation on their grandchildren's social status. In the existing literature, there is ambiguity concerning the influence of the grandparental generation. Many studies use methods that only consider two successive generations (Chetty and Hendren, 2018, Chetty et al., 2014; Clark, 2014). However, several recent studies found a significant and considerable influence of the grandparental generation, even when controlling for the social status of the parents (Hällsten and Pfeffer, 2017; Kroeger and Thompson, 2016; Long and Ferrie, 2018; Song, 2016). Significant effects of the grandparental generation were measured in terms of wealth and occupational status, but not in terms of income (Adermon, Lindahl, and Waldenström, 2018; Dribe and Helgertz, 2016).

In order to examine those factors, we perform pooled OLS regressions. We find a significant influence of the grandparental generation with a coefficient of 0.186 (see table II). This find-

ing suggests to include the grandparental generation in the analysis. The social persistence coefficient is slightly higher (0.492 instead of 0.453) if we only consider the parental generation.

If we further control for generation fixed effects (column 3) and the surname frequency in the respective generation (column 4), the coefficient decreases to 0.431 and 0.424, respectively. Column 5 shows that the inclusion of the great-grandparental generation does not improve the model, as the great-grandparents do not have a significant effect on the social status of the children. Therefore, our baseline model is given by the model in column 4.[3] Our analysis thus shows that while the influence of the parents is at 42 percent, that of the grandparents is only half as large and already the generation of the great-grandparents has no significant effect on social status inheritance. This phenomenon could be called the Buddenbrooks effect. Thomas Mann's Nobel Prize-winning social novel "Buddenbrooks" describes the parallel rise and fall of various rival families. For example, all three families who successively own the house on Mengstrasse go through the same cyclical history of success: the successful Johann Buddenbrook buys the house from the then already unsuccessful Dietrich Ratenkamp. Two generations later, the Buddenbrooks are replaced similarly by the Hagenström family as homeowners. These temporary family success stories can only be sufficiently reflected in multigenerational social mobility analyses.

[Table II]

## V.C.   *External validity: Surnames in comparison to other status indicators*

To verify whether the measured mobility in our study is a merely specific educational mobility, we investigate different sub-samples in a first step. Those sub-samples are based on the guild master registers over the whole timespan of 15 generations and on wealth tax data from 1850 to 1907 (see table I in section III for more details). We find a correlation of 0.454 and 0.422 for the guild master's and the inherited wealth's subsample, respectively. This finding indicates

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3. We have further discarded another model. We estimated an additional model by including the interaction effect between the two generations in the regression model in addition to the parental and grandparental social status. Since the interaction effect was very small and not significant, we rejected this model.

that the average measured social mobility remains stable across various subsamples based on different social status indicators.

[Table III]

Furthermore, we examine the generalizability of the measured social mobility using the members of Basel's political elite for the years 1570 to 1600. We use a list of the elite, assembled by Schüpbach-Guggenbühl (2002). This register shows that 18 of the 185 people listed are enrolled at the University of Basel. This corresponds to nearly 10 percent of all elite members. Furthermore, we have a look at the composition of the narrow political leadership elite, which comprised only 58 of the total of 185 people (Schüpbach-Guggenbühl, 2002). It is striking that two-thirds of those enrolled at the University of Basel belonged to this narrow circle of the political elite, while in total, it was only one-third of all elite members. This shows a clear connection between the educational status and other characteristics of social status.

Additionally, we use census data from 1850, containing over 30,000 observations (see table I in section III). The census includes all Basel households. Additionally, it indicates the professions of many people. Using a coding scheme by Clark and Cummins (2014a), we code the professions. Then, from our educational analysis of the respective generation, we select the families in the top three ranks (i.e., the families with the highest relative representation at the University of Basel in this generation). These are the Burckhardt, Staehelin, and Bernoulli families. For these three surnames, we analyze the occupations of all family members in the census data. The codes range from 1 to 7, with 7 being the profession with the highest status. In fact, as table A.1. in the Appendix shows, most occupations of the members of the three families mentioned are very highly coded. The average code is equal to 5.72. Thus, also for the year 1850, we confirm that a high social status, which we measure with the university enrollment, corresponds to a high social status measured by another characteristic of social status, such as occupational status.

## V.D.  *Robustness tests*

We calculate the presented estimation results with the entire dataset, assuming a generation length of 30 years and an average age at enrollment of 20 years. Although these assumptions seem reasonable on average, the regression can be estimated using assumptions that differ from this baseline model. Table IV presents those robustness tests in columns (2) and (3), whereas column (1) shows again the baseline results.

[Table IV]

In model (2) the assumed age at enrollment is changed. In the Middle Ages at least two thirds of all Basel students were not yet 20 years old (Bonjour, 1960). The university statutes did not specify a minimum age. Thus one could already begin one's studies as a 14-year-old boy (Bonjour, 1960). Therefore, it seems reasonable to run the robustness test with an average age at enrollment of 15 years. As can be seen from model (2), the change in this assumption has only a small impact on the estimated coefficient. While the persistence coefficient between parents and children decreases from 0.424 to 0.412, that between grandparents and children increases from 0.157 to 0.199.

In model (3), we reduce the assumed generation length from 30 years to 25 years. This new assumption leads to a drop of the coefficient to 0.362. Since the change in the assumption regarding generation length has a considerable influence on the measured persistence, it seems reasonable to use historical sources to determine the average generation length. In Western Europe, marriage and the birth of the first child took place relatively late since the 16th century. This phenomenon is also known as the "western european marriage pattern". The literature shows that men in the 16th century were already almost 30 years old when their first child was born; academics even older (Dennison and Ogilvie, 2014; Seccombe, 1990). This also applies to Basel. Additionally, many people from Basel have married several times and thus became parents in multiple stages of their lives. The assumption of an average generation length of 30 years thus seems plausible.

Overall, the results are remarkably stable across the various social status indicators and methodologies. Moreover, if we look only at the last two generations, we obtain very similar results to Bauer (2006) for Switzerland and Corak (2013) for other countries. Thus, the surnames seem to be a good approximation for family links and indeed measure the underlying social status, which covers various family specific aspects.

## VI.   CONCLUSION

Social mobility is a core concept in liberal meritocratic societies. Our analysis of social mobility with hand-collected annual data since 1550 has shown that the average social persistence is equal to 0.42 over 15 generations. The measured persistence is relatively constant across different social status characteristics, according to our cross-checks with guild masters, inheritance tax, political elite and census data. Thus, surnames are useful to determine the underlying social status of families and consequently for deriving a precise measure of social mobility. The generation of grandparents seems to influence the educational status of their grandchildren. The coefficient is slightly higher (0.49 instead of 0.45) if we only consider the parental generation. By controlling for generation fixed effects and the surname's frequency in the respective generation, the coefficient further declines to 0.42.

The development of the Spearman's correlation coefficient over time shows that although intergenerational social mobility over the last 15 generations was equal to 0.49 on a long-term average, it showed a cyclical pattern. It is striking that social mobility always decreased before wartime, was lowest in the war generation and increased again in subsequent generations.

If we compare our results for the last two generations with the existing literature, we find a very similar mobility rate, although family relationships can only be established via pseudo links based on surnames. It seems, therefore, that the methodology of surnames is appropriate to analyze an overall average social mobility rate in society over several centuries.

Overall, we claim that the analysis of surnames is suitable both for investigating the stickiness of the elite and for analyzing the permeability of society as a whole, if the dataset is sufficiently comprehensive. The great advantage of this surname-based approach is that it allows measuring the underlying social status, which remains constant across different indicators of social status such as education, wealth, profession, or political representation. Thus, surnames are a promising indicator for new insights into multigenerational social mobility.

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# Tables and Figures

Table I: Overview over the dataset

| Variable | Description | Number of observations |
|---|---|---|
| newly enrolled students | students newly enrolled at University of Basel between 1550 and 2019 | 142 792 |
| newly enrolled students from Basel | students newly enrolled at University of Basel between 1550 and 2019 who come from Basel | 31 275 |
| newborns in Basel | baptimized or new-born children between 1550 and 2004 | 594 888 |
| distinct surnames in core analysis | distinct surnames among all newborns and all students over all generations | 7 665 |
| guild masters | guild masters of 14 different guilds between 1550 and 2019 | 6 898 |
| inheritance tax register entries | entries in the inheritance tax registers between 1850 and 1907 | 951 |
| elite 1570 - 1600 | members of Basel's elite between 1570 and 1600 | 185 |
| census data | census data 1850 including each household member's occupation | 30 052 |

sources: see Data Appendix

Table II: Intergenerational persistence between two, three and four generations

| | social status generation $t$ $(y_t)$ | | | | |
| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| social status generation $t-1$ $(y_{t-1})$ | 0.492*** | 0.453*** | 0.431*** | 0.424*** | 0.358*** |
| | (0.014) | (0.025) | (0.025) | (0.024) | (0.037) |
| social status generation $t-2$ $(y_{t-2})$ | | 0.186*** | 0.181*** | 0.157*** | 0.200*** |
| | | (0.024) | (0.024) | (0.024) | (0.040) |
| social status generation $t-3$ $(y_{t-3})$ | | | | | 0.036 |
| | | | | | (0.040) |
| generation FE | no | no | yes | yes | yes |
| control surname frequency | no | no | no | yes | yes |
| Observations | 3618 | 1567 | 1567 | 1567 | 722 |
| $R^2$ | 0.244 | 0.314 | 0.338 | 0.354 | 0.338 |
| Adjusted $R^2$ | 0.244 | 0.314 | 0.332 | 0.348 | 0.324 |

*p<0.1; **p<0.05; ***p<0.01

*Notes.* Pooled OLS estimates with standard errors clustered at the surname level, (1) two-generational model (2) three-generational model (3) three-generational model including generation Fixed Effects (4) three-generational model including generation Fixed Effects and controlling for surname frequency, (5) four-generational model including generation Fixed Effects and controlling for surname frequency

Table III: Different measures of social mobility: of guilds and inherited wealth

| | social status generation $t$ ($y_t$) | | |
| --- | --- | --- | --- |
| | (1) | (2) | (3) |
| social status generation $t-1$ ($y_{t-1}$) | 0.424*** | 0.454*** | 0.422*** |
| | (0.024) | (0.041) | (0.039) |
| social status generation $t-2$ ($y_{t-2}$) | 0.157*** | 0.174 *** | 0.224*** |
| | (0.024) | (0.041) | (0.040) |
| generation FE | yes | yes | yes |
| control surname frequency | yes | yes | yes |
| Observations | 1567 | 560 | 586 |
| $R^2$ | 0.354 | 0.385 | 0.388 |
| Adjusted $R^2$ | 0.348 | 0.368 | 0.372 |

*p<0.1; **p<0.05; ***p<0.01

*Notes.* Pooled OLS estimates with standard errors clustered at the surname level, (1) baseline model, corresponds to model (4) of table 1 (2) sub-group estimate with guild master's data (3) sub-group estimate with inheritance tax data

Table IV: Robustness tests: Varying average age at enrollment and generation length

|  | $y_t$ | | |
|  | (1) | (2) | (3) |
|---|---|---|---|
| $y_{t-1}$ | 0.424*** | 0.412*** | 0.362*** |
|  | (0.024) | (0.026) | (0.024) |
| $y_{t-2}$ | 0.157*** | 0.199*** | 0.188*** |
|  | (0.024) | (0.026) | (0.025) |
| generation FE | yes | yes | yes |
| control surname frequency | yes | yes | yes |
| Observations | 1567 | 1568 | 1837 |
| $R^2$ | 0.354 | 0.340 | 0.306 |
| Adjusted $R^2$ | 0.348 | 0.333 | 0.299 |

$^*$p<0.1; $^{**}$p<0.05; $^{***}$p<0.01

*Notes.* (1) baseline model, generation length = 30 years, age at enrollment = 20 years (2) generation length = 30 years, age at enrollment = 15 years (3) generation length = 25 years, age at enrollment = 20 years

(a) matriculation register of University of Basel, 1871



(b) baptismal register, 1529-1600

Figure I: Original data

The figure shows the original data material of the main dataset. The first part in (a) is the matriculation register of the University of Basel whereas (b) shows the baptismal registers. sources: see Data Appendix
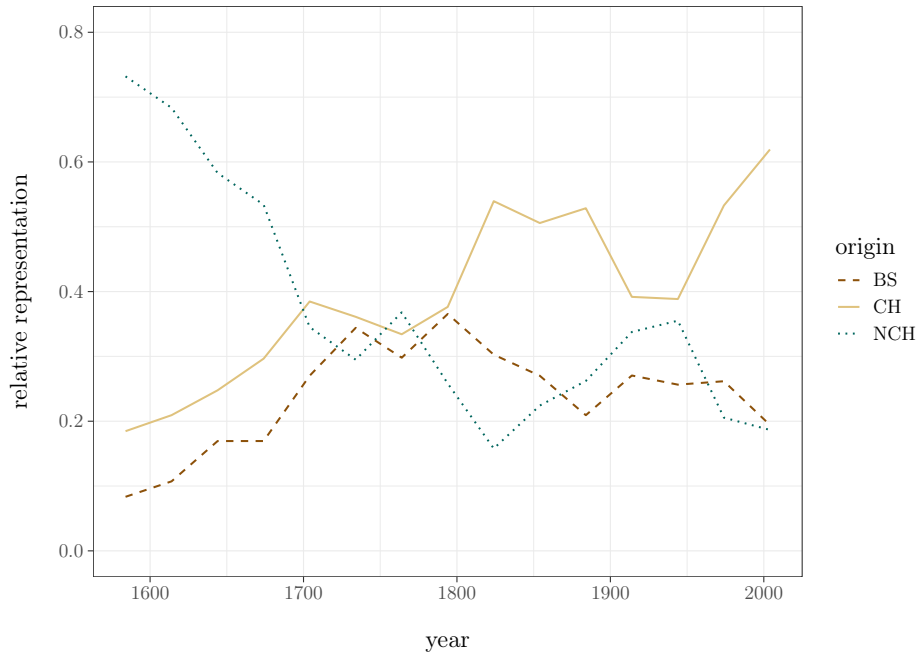
Figure II: Proportion of students by their origin

The figure shows the origin of the students enrolled at University of Basel since 1550. Students from Basel are designated as BS, the students from the rest of Switzerland are described as CH and NCH means that the students come from abroad. source: see Data Appendix
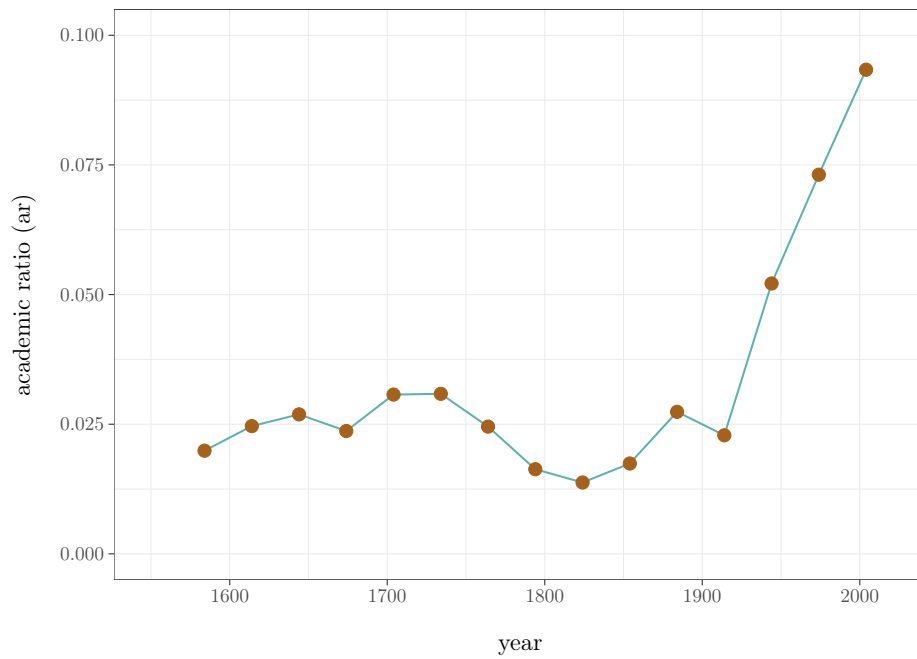
Figure III: Development of academic ratio ($ar$) over time

In this figure, the development of the academic ratio between 1550 and 2019 is shown. The academic ratio is a specific degree of academization, defined as the share of young adults born in Basel that are enrolled at the University of Basel. source: see Data Appendix
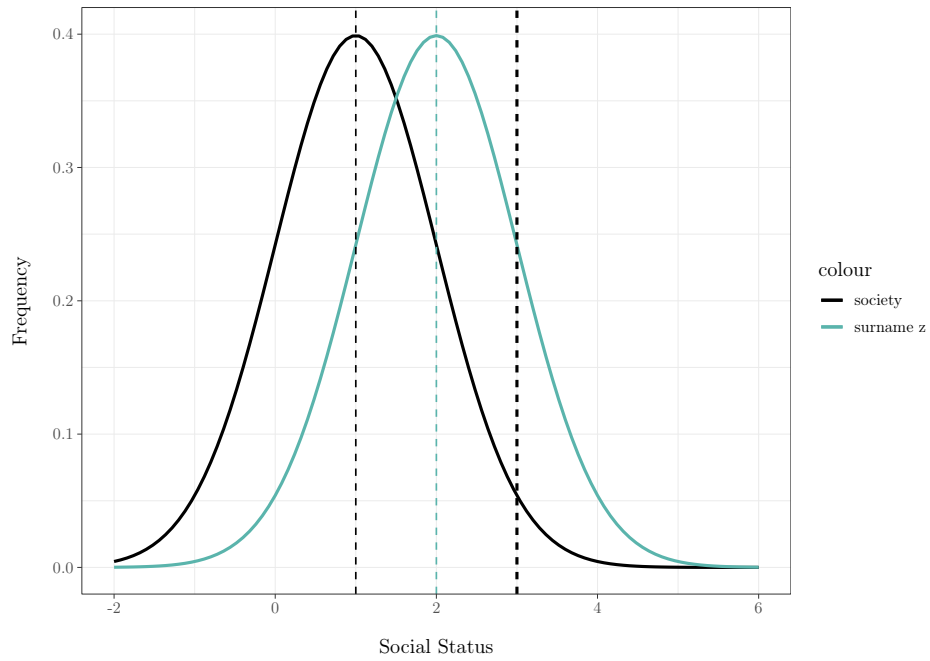
Figure IV: The distribution of social status in society and for a specific surname $z$

The figure illustrates the approach of determining the mean social status per surname and generation. The black curve shows the distribution of social status of the whole society. The green curve describes the distribution of social status for a particular family $z$. Its social status is shifted to the right, indicating a social status above the society's average. The bold black dashed line indicates the area under the black curve, which corresponds to the academic ratio in Basel's society. source: own graph based on Clark (2014)
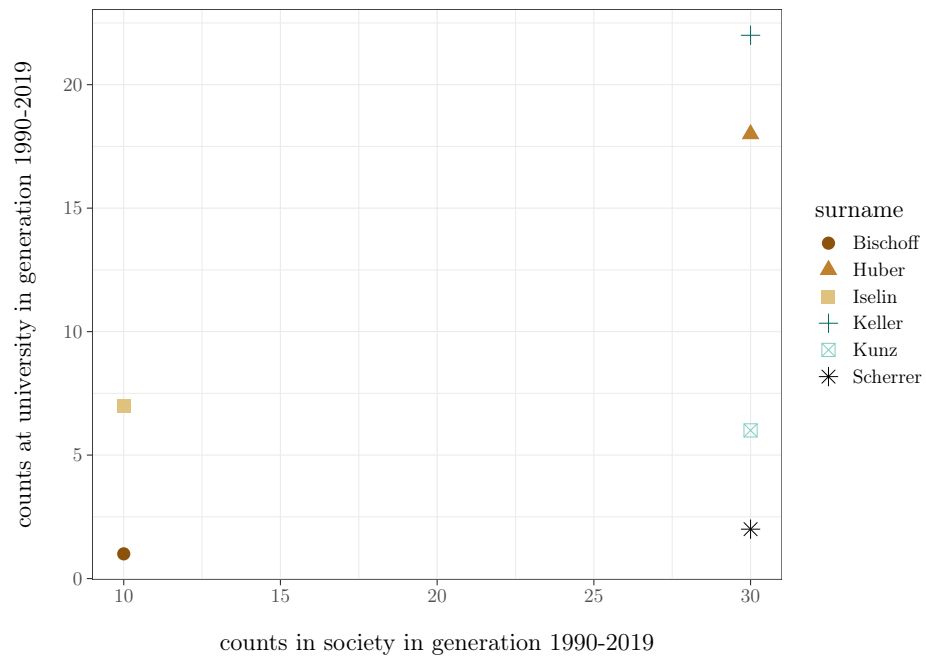
Figure V: What the surname's frequency tells us

In this figure, six surnames are compared with respect to their relative frequency at the University of Basel and their relative frequency in Basel's society. It is striking that surnames with the same expected representation at University of Basel (due to the same surname frequency in society) actually differ a lot in their actual representation at university. Our study exploits this variation. sources: see Data Appendix
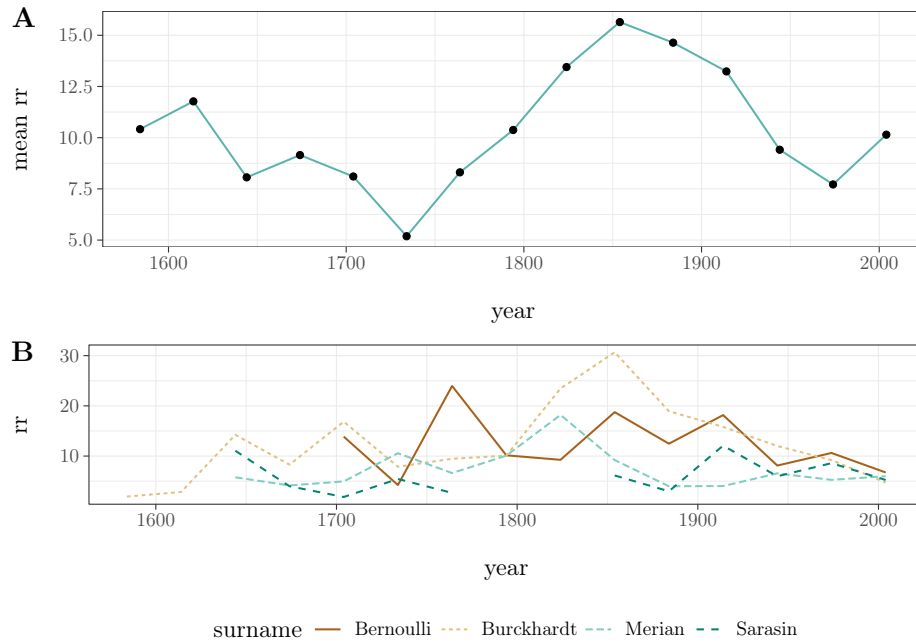
Figure VI: Development of relative representation of "Daig" families at University of Basel

Part A of the figure shows the mean relative representation (meanrr) of the so-called "Daig families": Bernoulli, Burckhardt, Christ, Faesch, Iselin, La Roche, Lichtenhahn, Merian, Oeri, Sarasin, Schlumberger, Socin, Staehelin, Vischer, Von der Mühll, Wackernagel. In Part B, the development of the relative representation (rr) is represented for four particular families. sources: see Data Appendix

## Family Burckhardt

C. Burckhardt (1490-1578)
silk merchant, guild "Safran"

J. Burckhardt (1558-1617)
silk merchant, guild "Safran"

T. Burckhardt (1596-1691)
silk merchant, guild "Safran"

T. Burckhardt (1624-1697)
salesman, guild "Safran"

## Family Bernoulli

J. Bernoulli (1667-1748)
Professor of Mathematics

J. Bernoulli (1710-1790)
Professor of Mathematics

D. Bernoulli (1751-1834)
Professor of Eloquence

C. Bernoulli (1782-1863)
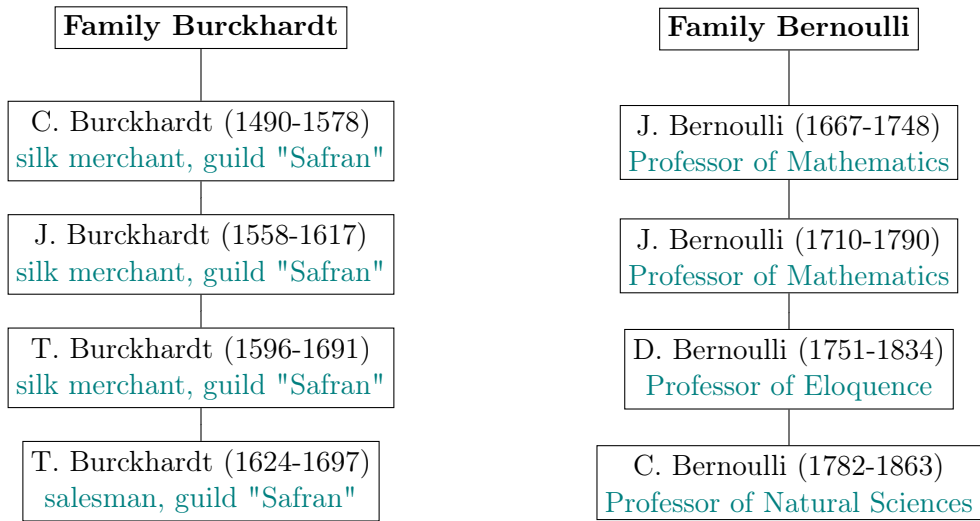Professor of Natural Sciences

Figure VII: Like father, like son in families Burckhardt and Bernoulli
Extracts from the family trees of the Burckhardt and Bernoulli families source: Webapplication "Historische Personen des Kantons Basel"
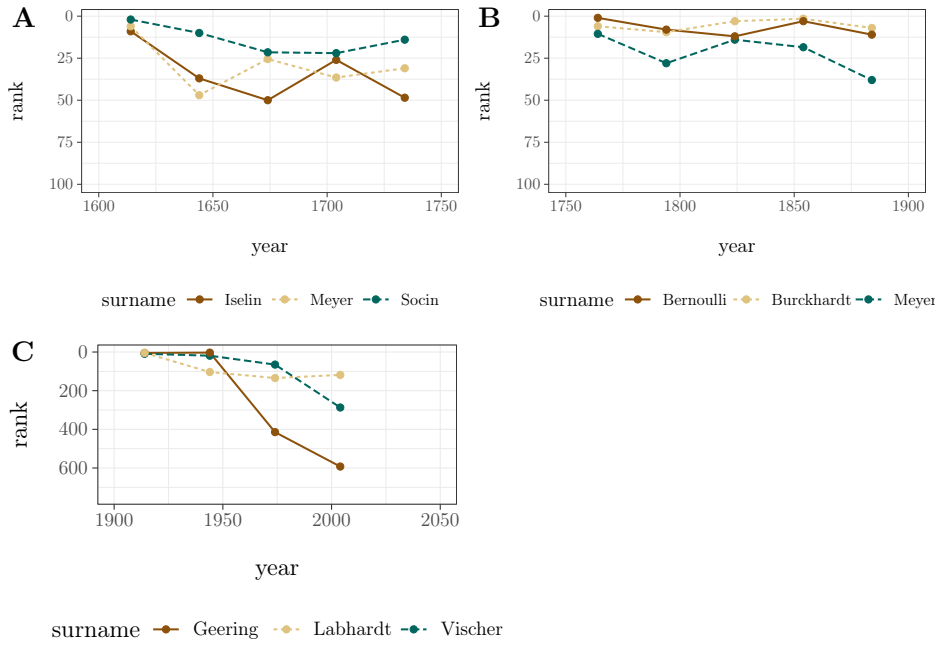
Figure VIII: Top-ranked families at University of Basel

This figure shows the development of ranks of top families at University of Basel over several succeeding generations. sources: see Data Appendix
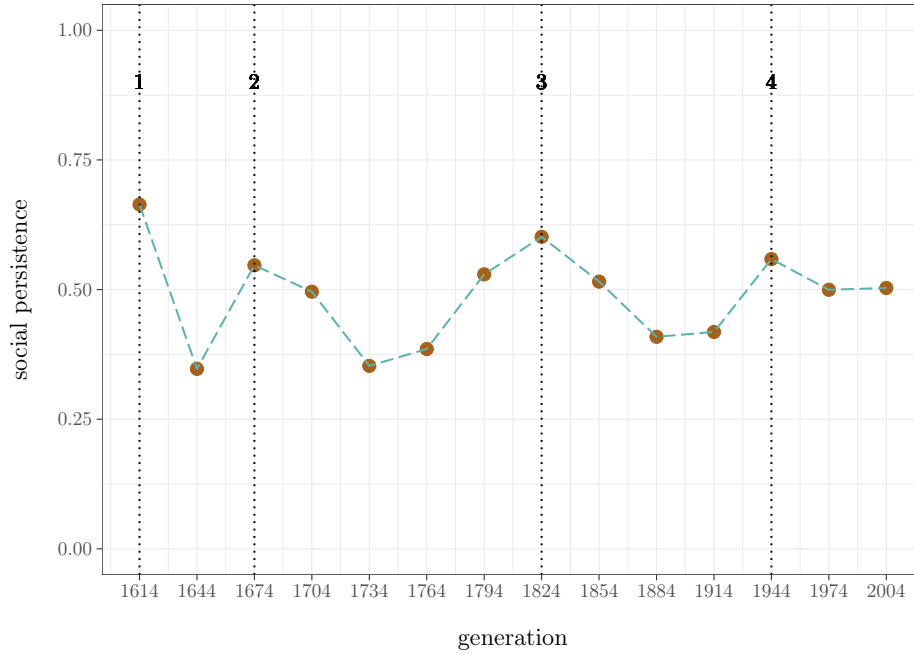
Figure IX: Social mobility and crises

sources: see Data Appendix

The figure displays the Spearman's rank correlation coefficients between two consecutive generations. As our newest data is from 2019, we designed the generations in a way that the last one ends in 2019. The measures are shown for the middle-year of each generation. We assumed an average generation length of 30 years (see S2 for method and S4 for robustness tests). The events illustrated are the following: 1: Thirty Years' War, 2: Revolutionary movement in Basel, 3: Civil war and cantonal separation, 4: World War II

# Appendix

In the following, the individual registers are listed separately, whereby the description contains a hyperlink to the distinct directories in case they are accessible and publicly available online.

## University data

1460-1529:

- edited matriculate register University of Basel, volume 1

1532/33-1600/01:

- edited matriculate register University of Basel, volume 2

1601/02-1665/66:

- edited matriculate register University of Basel, volume 3

1666/67-1725/26:

- edited matriculate register University of Basel, volume 4

1726/27-1817/18:

- edited matriculate register University of Basel, volume 5

1818/19-2000:

- original matriculates registers physically accessible at the Department of Manuscripts of the University Library Basel (special permit for data from 1960 onwards)

2002-2019:

- Data digitally available in the administration system of the University of Basel (special permit)

## Births data

1490-1528:

- baptismal registers of the Theodor's church in Basel, physically accessible at the state archives of the Canton Basel

1529-1869:

- baptismal registers digitalized by the state archives of the Canton Basel

1870-1875:

- baptismal registers physically accessible at the state archives of the Canton Basel

1876-1928:

- birth registers physically accessible at the state archives of the Canton Basel

1929-2004:

- birth registers physically accessible at the civil registry office in Basel (special permit)

## Inheritance tax data

1850 - 1907:

- individual years from the register of the control of inheritance fees physically accessible at the state archives of the Canton Basel

## Guild master data

1550 - 2019:

- guild "zur Safran"

- guild "zu Schmieden"

- guild "zu Hausgenossen"

- guild "zu Weinleuten"

- guild "zu Brotbecken"

- guild "zu Schiffleuten"

- guild "zu Metzgern"

- guild "zu Fischern"

- not published list of the guild "zu Schuhmachern"

- not published list of the guild "zu Gerbern"

- not published list of the guild "zu Schneidern"

- not published list of the guild "zu Kürschnern"

- not published list of the guild "zu Webern"

- not published list of the guild "akademische Zunft"

## Basel's (political) elite

1570-1600:

- supplementary material in Schüpbach-Guggenbühl (2002), see References

## Census data

1850:

- Civil research project Basel Hospital Cemetery

Table V: Professions of top 3 families

| Surname | First name | Profession | Occupation code |
|---|---|---|---|
| Burckhardt | Wilhlem | strip manufacturer | 6 |
| Burckhardt | August | president of the criminal court | 6 |
| Burckhardt | Johannes | bookkeeper | 6 |
| Burckhardt | Johannes Friedrich | merchant | 6 |
| Burckhardt | Johann Conrad | former strip manufacturer | 6 |
| Burckhardt | Hieronimus | man of private means | 7 |
| Burckhardt | Alfred | merchant | 6 |
| Burckhardt | Louis | merchant | 6 |
| Burckhardt | Abraham | master baker | 4 |
| Burckhardt | Hieronimus | merchant | 6 |
| Burckhardt | Carl | strip manufacturer | 6 |
| Burckhardt | Daniel | merchant | 6 |
| Burckhardt | Wilhlem | man of private means | 7 |
| Burckhardt | Rudolf | engraver | 3 |
| Burckhardt | Achilles | confectioner | 4 |
| Burckhardt | Sebastian | man of private means | 7 |
| Burckhardt | Franz | mechanic | 4 |
| Burckhardt | Samuel | shoemaker | 3 |
| Burckhardt | Rudolf | butcher | 4 |
| Burckhardt | Ludwig | painter | 3 |
| Stähelin | Balthasar | merchant | 6 |
| Stähelin | Benedict | strip manufacturer | 6 |
| Stähelin | Benedict | strip manufacturer | 6 |
| Stähelin | Johann Jakob | professor of theology | 6 |
| Stähelin | Salomon | man of private means | 7 |
| Stähelin | Peter | pastor | 6 |
| Stähelin | Christoph | man of private means | 7 |
| Stähelin | Hieronimus | man of private means | 7 |
| Stähelin | Christoph | private lecturer | 6 |
| Stähelin | Johann Heinrich | cook and restaurateur | 4 |
| Bernoulli | Heinrich | war commissioner | 6 |
| Bernoulli | Leonhard | man of private means | 7 |
| Bernoulli | Eduard | merchant | 6 |
| Bernoulli | Nicolaus | notary | 6 |
| Bernoulli | Friedrich | chemist | 6 |
| Bernoulli | Daniel | man of private means | 7 |
| Bernoulli | Daniel | merchant | 6 |
| Bernoulli | Emanuel | salesman | 4 |
| Bernoulli | Leonhard | merchant | 6 |
| Bernoulli | Johannes | merchant | 6 |
| Bernoulli | Johann Jakob | man of private means | 7 |
| Bernoulli | Christoph | professor | 6 |
| Bernoulli | August | manufacturer | 6 |

source: see Data Appendix